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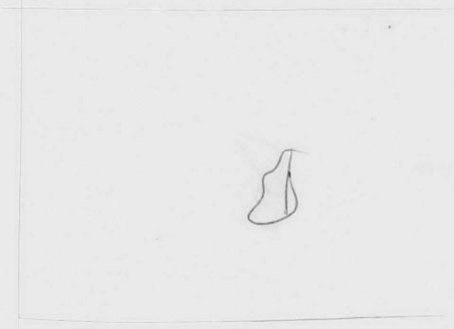

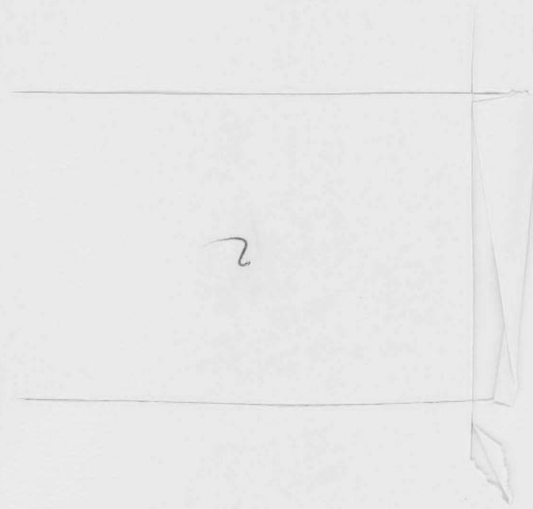

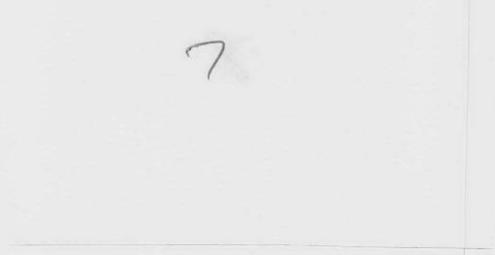

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SPECIAL ARTICLE

SHATTUCK LECTURE — HEALTH CARE IN THE DEVELOPING WORLD: PROBLEMS OF SCARCITY AND CHOICE

JOHN R. EVANS, M.D., KAREN LASHMAN HALL, M.P.A., AND JEREMY WARFORD, PH.D.

THE World Health Organization (WHO) and UNICEF, together with representatives of 134 member governments, launched a campaign in 1978 to achieve "Health for All by the Year 2000" through primary health care.[1,2] The objective of this campaign was to increase the political commitment of member countries to address the health needs of their people and particularly to improve the health status of the rural and urban poor in the Third World. Our presentation describes the difficulties of putting this objective into practice, and what may be possible on the very limited budget available for health in most developing countries.

WHO and UNICEF might well have found the text for their plan in the *Report of the Sanitary Commission of Massachusetts*, which Lemuel Shattuck presented to the Massachusetts state legislature in 1850.[3] The report was based on a careful survey of the health status of the population of Massachusetts, and its recommendations embodied the essential elements of primary health care: immunization and communicable-disease control; promotion of child health; improved housing for the poor; environmental sanitation; training of community-oriented health manpower; public-health education; promotion of individual responsibility for one's own health; mobilization of community participation through sanitary associations; and creation of multidisciplinary boards of health to assess health needs and plan programs in response to sound epidemiologic evidence. Recognizing the importance of political commitment, Shattuck built a strong public-health constituency by highlighting both the major differences in life expectancy between rural areas and Boston and the deterioration of health status over a decade in major cities in the United States.

The conditions described by Shattuck in the United States in 1850 prevail today in most countries of the developing world (Table 1).[4-6] In low-income countries, life expectancy at birth averages only 51 years, and in several it is less than 45 years. Mortality rates are 10 to 20 times higher for infants and for children aged one to four than in developed countries. Nearly half of all deaths occur in children under five years of age. The major causes are diarrheal diseases, respiratory infections, tetanus, and childhood infectious diseases such as diphtheria, measles, and whooping cough, all of which can be effectively and cheaply controlled by measures used in developed countries. Malnutrition is important as an associated — and even primary — cause of death in young children, and short birth intervals adversely affect the survival of infants. For those who reach the age of five, life expectancy is only eight to nine years less than in developed countries. The commonest causes of death are similar to those in industrialized countries: cancer, cerebrovascular disease, heart disease, respiratory disease, and trauma. However, in developing countries, tuberculosis ranks among the most common causes of death. These nations are also plagued with endemic diseases such as malaria, schistosomiasis, trypanosomiasis, onchocerciasis, and leprosy, which are major causes of serious morbidity and mortality in

Table 1. Health-Related Indicators in Countries with Different Income Levels.[6]

INDICATOR	YEAR	LOW-INCOME COUNTRIES *	MIDDLE-INCOME COUNTRIES †	INDUSTRIALIZED COUNTRIES ‡
Gross national product per capita ($)	1979	240	1420	9440
Crude birth rate (births/1000 population)	1979	42	34	15
Crude death rate (deaths/1000 population)	1979	16	10	10
Life expectancy at birth (yr)	1979	51	61	74
Infant mortality rate (deaths/1000 live births) §	1978	(49–237)	(12–157)	13
Child mortality rate (deaths/1000 children 1–4 yr old)	1979	18	10	1
Per cent of population with access to safe water	1975	25	58	¶
Daily per capita calorie supply (% of requirement) ‖	1977	96	109	131
Adult literacy rate (%)	1976	43	72	99

*Thirty-four low-income developing countries with a per capita income of $370 or less in 1979 (China and India are excluded from the low-income group in this table).

†Sixty middle-income developing countries with a per capita income of more than $370 in 1979.

‡Eighteen industrial-market economies.

§Weighted averages; figures in parentheses denote the sample range.

¶Data not available but assumed to be close to 100 per cent.

‖Requirements based on calories needed to sustain a person at normal levels of activity and health, taking into account age and sex distributions, average body weights, and environmental temperatures, as estimated by the United Nation. Food and Agriculture Organization.

From the Population, Health and Nutrition Department, World Bank, 1818 H St., N.W., Washington, DC 20433, where reprint requests should be addressed to Dr. Evans.

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adults and children, but for which effective control measures have not been available or have proved difficult to implement or maintain.

Even in middle-income countries, more favorable national statistics in the aggregate disguise wide disparities between the conditions, on the one hand, of the rural and peri-urban poor that are typical of low-income countries and the conditions, on the other hand, of more affluent urban dwellers who are better educated and have better access to health services and whose health status closely resembles the profile in industrialized countries. Table 2 contrasts the high mortality rates for infectious and parasitic diseases in the less developed northeastern and frontier regions of Brazil with the high rates for cancer and cardiovascular diseases in the more affluent southeastern region of the country. As economic development proceeds, the more prosperous regions of the country have the advantages of greater individual and collective wealth and greater political leverage. Consequently, national health policies give priority to their needs, and the limited resources of hospitals, equipment, drugs, physicians, and other health personnel are concentrated in the urban areas, widening the gap between urban and rural populations.[7]

In the push for development, particularly industrial and commercial development, protective measures for workers and the environment usually lag behind, as they did in the earlier stages of developed countries. These measures are often disregarded because they are initially expensive, and can generally be enforced only by firm legislation and inspection. Rapid development accelerates the appearance of new health problems such as traffic accidents, work accidents, accidental poisoning, and environmental pollution. Similarly, disruption of families and community, migration, and unemployment contribute to a variety of disorders of individual behavior — alcoholism, violence, promiscuity — each with attendant physical and mental risks, counterparts of those seen in industrialized countries.

Urban problems will increasingly dominate the health pattern of the developing world. According to United Nations projections, the urban population in developing countries will increase by 1.32 billion between 1975 and 2000; by 2000 it will average 43 per cent of the population of the less-developed regions overall, and 75 per cent of the population of countries in Latin America.[8] The primary-health-care approach for rural health problems may need to be modified to address different problems arising from life styles and diets in the urban setting. For example, recent analyses indicate that in several countries there are large numbers of malnourished urban dwellers, and that their numbers are increasing more rapidly than those of the rural malnourished.[9]

Table 2. Regional Variations in Cause-Specific Mortality in Brazil, 1970.*

Cause of Death	Region		
	Northeast	Frontier	Southeast
	per cent of all deaths		
Infectious and parasitic diseases	24.5	26.6	11.2
Neoplasms and cardiovascular diseases	21.1	19.1	42.1

*Adapted from de Carvalho AVW, de Moura Ribeiro E. Estudo da Mortalidade proporcional, segundo Grupos de Idade e Causas de Obito, em algunas Capitais Brasileiras, em 1970. Revista Brasileira de Estatistica. 1976; 37(148):475 (as reported in World Bank. *Brazil: Human Resources Special Report*. Washington, D.C., October 1979).

Stages in the Evolution of Health Systems

The pattern of diseases in northern Europe and the United States evolved in stages over the past two centuries, and with each stage distinctive control measures were introduced.

The first stage, dominated by major and minor infectious diseases linked to poverty, malnutrition, and poor personal hygiene, responded slowly to improved food supply, housing, and literacy made possible by greater prosperity, and to public-health measures, particularly safe water supply, sanitation, and immunization campaigns. The steady decline in infant mortality (Table 3) and the reduction in child mortality as a percentage of all deaths (Table 4) may be attributed to these changes. As scientific advances provided a wide array of immunologic and therapeutic techniques to control acute bacterial and viral infections, life expectancy increased, and heart disease, cancer, and stroke replaced respiratory and gastrointestinal infections as the principal causes of death. For example, in the United States in 1900, the three leading causes of death (influenza and pneumonia, tuberculosis, and gastroenteritis) accounted for over 30 per cent of all deaths, whereas heart disease, cancer, and strokes were responsible for 18 per cent of deaths. By 1975, only influenza and pneumonia (3 per cent) ranked in the top 10 causes of death, whereas heart diseases (38 per cent), cancer (20 per cent), and stroke (10 per cent) together accounted for over two thirds of all deaths.[10]

The second stage in the evolution has been dominated by chronic diseases, particularly cardiac and cerebrovascular diseases, cancer, diabetes, arthritis, and mental disorders. As the threat of infectious diseases receded, public-health measures were relegated to a regulatory role, and personal health services became the primary channel for prevention and treatment of health problems. The development of expensive and complicated technology for diagnosis and treatment has led to the transfer of care from doctors' offices to elaborate and expensive hospitals. Doctors and patients have looked to these curative techniques and facilities to provide striking improvements in health. Sadly, experience has shown that for many problems the benefits hoped for have not been realized. As Cochrane has noted, the massive public and private expenditures on health, now close to $1,000 per capita annually for capital and recurrent costs in

Table 3. Infant Mortality in Selected Countries, 1750-1975.*

Period	Country		
	Sweden	France	United States
	no. of deaths/1000 live births		
1751–1755	206	277	†
1851–1855	149	166	†
1901–1905	91	141	124
1971–1975	10	14	18

*Source — Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Démographie, Université Catholique de Louvain, Ordina Editions, 1980:147-9.

†Data not available.

the wealthier industrialized countries, have not produced commensurate improvement in the health status of the population.[11] Only a small proportion of the interventions used are of proved effectiveness, and the benefits to be gained from the intensive services for terminal illnesses are at best marginal.

A third stage of evolution can now be defined. It reflects a shift from preoccupation with intrinsic disorders of structure and function of the body, to an awareness of the health hazards arising from environmental exposure to an increasing number of chemicals, drugs, and other toxic substances and from changes in the social conditions of the family, community, and workplace that influence behavior and life style and are associated with absenteeism, violence and alcohol and drug abuse of epidemic proportions. The personal health-care system concentrates on the consequences of such processes. New approaches are needed to encourage the healthy to avoid patterns of behavior that lead to disease, and to identify and treat the social and environmental causes of disease that originate in the community. Industrialized countries have recently recognized the importance of this third stage and the need to adapt their health systems to give greater emphasis to health promotion and preventive measures at individual and community levels.[12,13] This stage is not new. These concerns provided much of the impetus for reform of industrial and other health practices for well over a hundred years. The meaning of the third stage is a return to the recognition that responsibility for health should not be exclusively the prerogative of the health professions — that protective and preventive measures have to be the responsibility of the individual and the society.

Industrialized countries have evolved through the three stages over the course of more than a century (Table 3). In contrast, developing countries face the challenge of coping with all three stages simultaneously: the rural and peri-urban poor who constitute a majority of the population are in the first stage; the influential, more affluent urban dwellers are at the second stage; and manifestations of the third stage are already apparent because of environmental deterioration and the social disruption associated with massive urban growth and unemployment. Furthermore, developing countries must cope with just a fraction of the financial and human resources available to their industrialized counterparts. In any circumstances, but particularly in these, the strategy to improve health must be selective. Success will depend heavily on correctly identifying the most important problems in each population group, selecting the most cost-effective interventions, and managing the services efficiently. Uncritical acceptance of new and expensive high technology will not serve the purposes of developing countries. But developed countries do have much to offer through scientific and technical cooperation. Already, developing countries, by taking advantage of the innovations in the industrialized world (vaccines, microbiologic techniques, and antibiotics, for example) have achieved much faster rates of improvement in health status than those achieved in northern Europe and the United States. However, there are signs that this rate of progress is not being sustained. As Gwatkin and Brandel pointed out (unpublished data), life expectancy in the less-developed regions of the world, which had been rising by 0.64 year annually between 1950 and 1960, slowed to 0.40 year annually 15 years later. Several factors stand out as impediments to progress.

Obstacles to Progress

Uneven Distribution of Health Services

Access to health services is very uneven, and large segments of the rural population are not reached. Health facilities and personnel are concentrated in urban areas, and within the urban population the services are oriented to the middle-income and upper-income groups, neglecting the peri-urban poor. Political considerations may override all other priorities, and little progress can be expected unless there is a political commitment to apply resources where the need is greatest.

There is a shortage of skilled health personnel, particularly in the poorer countries. National averages for physician:population ratios are reported to be 1:17,000 in the least developed countries and 1:2700 in other developing countries, as compared with 1:520 in developed countries. The nurse:population ratios are 1:6500, 1:1500, and 1:220, respectively.[5] These

Table 4. Child Mortality in Belgium, 1880-1970.*

Year	Age Group		Total (0–5 yr)
	<1 yr	1–5 yr	
	per cent of all deaths		
1880	27.7	13.3	41.0
1900	27.4	9.0	36.4
1920	17.7	4.1	21.8
1950	7.5	1.0	8.5
1970	2.5	0.04	2.6

*Adapted from: Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Démographie, Université Catholique de Louvain, Ordina Editions, 1980:127.

national averages disguise the fact that in some rural areas there may be only one doctor serving 40,000 to 200,000 people. Furthermore, the pyramid of health manpower is inverted, particularly in the least developed countries. Instead of a broad base of inexpensively trained, less skilled personnel working at the community level, priority has been given to expensive training programs for "conventional" doctors, who expect sophisticated facilities and equipment, gravitate to practice in the cities, and have a propensity to emigrate. To achieve effective coverage of the population, large numbers of less skilled personnel need to be trained, and these health workers need to be part of a system that will provide supervision, drugs and supplies, and the support services necessary for their practice. Otherwise dissatisfaction will lead to high turnover of health workers and low utilization of their services as patients bypass the first level of care in the community in favor of higher-level facilities, which properly should function as referral centers. Doctors are key participants in the referral and supervisory systems; if they operate as primary-care workers, their expensive training is wasted and the cost of their practice may outweigh the benefits. The supervisory and managerial role of the physician in the health system must be addressed more directly in the process of medical education and in the career development and rewards for the physician in practice.[14]

Lack of Appropriate Technology

A second obstacle to progress is the lack of appropriate technology to address Stage 2 and Stage 3 health problems and to cope with the serious endemic diseases prevalent in the developing world. For Stage 1 health problems, much of the technology needed is already available, and in the case of vaccines technologic advances that would reduce dependence on the cold chain are imminent. In contrast, for Stage 2 health problems, relatively few technologies for dealing with the serious diseases of the adult population are appropriate to the circumstances and financial resources of less developed countries. Most of the technologies that are being transferred from the developed world are expensive, and the equipment is often difficult to maintain. It is necessary to determine which interventions are effective and which yield large benefits at acceptable costs. The greater challenge is in the search for preventive measures to reduce the large burden of illness from cancer, hypertension, diabetes, respiratory, cardiac, and cerebrovascular disease. For Stage 3 health problems, we are still handicapped by inadequate understanding of behavior and the links between social and environmental hazards and specific diseases. We have much to learn about conveying health-education messages, motivating community participation, and using modern communications technology to circumvent the barrier of illiteracy.

The "tropical diseases" (e.g., malaria, schistosomiasis, filariasis, trypanosomiasis, and leprosy) are a particular problem for developing countries, in part because they generally have climates and ecologies conducive to disease vectors. Techniques for ecologic control of vectors or transmission routes are available but are expensive and require repeated application over wide areas. Treatment of patients is generally expensive, sometimes risky, and often delayed. Prophylactic measures such as vaccination are largely undeveloped. Knowledge of the biology of the diseases is far from complete. Research on these diseases has so far been largely neglected by the scientific community and the pharmaceutical industry, which have been preoccupied with cancer, cardiovascular disorders, and the other major diseases of the industrialized world. The Special Program for Research and Training in Tropical Diseases led by the WHO is an attempt to mobilize the health-science research community throughout the world to focus attention on these neglected tropical diseases in order to discover appropriate technologies for their control.

The scientific and development resources of the developing countries are limited, and their problems are difficult to solve. The most promising results will come from combining the scientific and technologic potential of the industrialized world with the local knowledge of scientists and professionals in developing countries who will have responsibility for applying the new technologies.

Pharmaceutical Policies

The most widely used technologies in health are drugs and vaccines. Shortages of supplies and failure to provide for the timely distribution of drugs and vaccines are serious problems that must be overcome for an effective health program. In looking to the future, however, the problems may be excessive and irrational use of drugs and unsustainable costs to the health system. Patients who consult health personnel expect to receive a prescription or, in some cultures, an injection. As access to health services broadens with the implementation of primary-health-care programs, a rapid increase in the consumption of drugs may be expected. Experience in less-developed countries supports this contention. In China, with nearly universal access to health care, curative medicine occupies 90 per cent of the time of "barefoot" doctors, and nearly all patients receive medication; there is evidence that drugs and traditional medicines account for two thirds of overall health expenditures. In countries with less complete coverage of the population, expenditures on drugs constitute about 40 to 60 per cent of the health budget (as compared with 15 to 20 per cent in developed countries[15]) and over half of private health expenditures. In most developing countries, the majority of drugs are imported, and these outlays are a considerable drain on foreign exchange.

The importance of drugs to the quality of health care, to the credibility of community health workers, to the development of iatrogenic disease (for exam-

ple, from toxicity or antibiotic-resistant microorganisms), and to the cost of health services makes it imperative that developing countries establish better mechanisms for assessing drug requirements and for purchasing, quality control, storage, and distribution of drugs. Experience in Tanzania and Ghana indicates that savings of up to 70 per cent of the budget for pharmaceuticals could be achieved by promoting generic alternatives and introduction of controls against overprescription.[16,17] The South Pacific Pharmaceutical Scheme projects cost savings of at least 25 per cent through limiting the availability of nonessential drugs and through bulk purchasing.[18] Without policies for national formularies, procurement, prescription, and pricing, this powerful and ubiquitous health technology could become more of a liability than an asset to the health system.

Management of Health Resources

One of the most difficult and pervasive problems to solve in the establishment of effective health services in developing countries will be deficiencies in management. The health sector presents a formidable organizational challenge. Some of its objectives can be achieved only with the cooperation of other sectors such as water supply and sanitation, education, agriculture, and community development. The delivery of health services involves widely dispersed facilities, numerous categories of personnel, general and specialized hospitals, vertically organized programs to control individual diseases such as malaria, tuberculosis, leprosy, or venereal disease — each with its own personnel and support services, community healthcare programs with multipurpose workers, and a system of indigenous medicine with traditional healers and birth attendants. The different elements need to be organized to reduce conflict and duplication between programs and to provide a coherent system to screen and treat patients according to the level of care required and to refer patients with difficult problems. Supervision and continuous in-service education of health workers, improved logistics and supply to maintain credible services, institution of personnel policies and rewards to maintain the quality, distribution, and morale of staff, and policies and financial arrangements that encourage rational use of the health resources by the public are essential corollaries to enhance sector performance.

The weakest links in the administrative chain of most developing countries are institutions at district and local levels, which are usually poorly staffed, have inadequate authority or control of resources, and are unable to provide the necessary support and supervision of field staff. The development of planning and administrative capability at the district level is of special importance, since this is normally the lowest tier of the health-services organization still communicating directly with central government but also in contact with the villages, aware of their needs, and in a position to encourage community participation. It is at this level that matching of health needs and resource allocation is most likely to occur.[19] Community-based non-governmental organizations active in health care may make an important contribution to the process of devolution of administrative responsibility.

The management of a system of health services is much more than the management of its facilities and support systems. It involves decisions about priorities and resource allocation that are based on the health needs of the population to be served. This epidemiologic perspective is missing from the training of many of those in positions of responsibility, and the information system on which to base such management decisions is typically inadequate. Management also involves gaining the cooperation and compliance of highly independent professionals and specialists who have their own constituencies and political support.

The medical profession is of special importance because of the profound steering effect of individual clinical decisions on the demand for expensive facilities and the consumption of resources for diagnosis and treatment. Most practicing physicians give relatively little weight to consideration of the efficacy of these procedures and almost no attention to the real cost and foregone opportunities in terms of resources used. Abel Smith (personal communication) has estimated that the consequential costs generated by the average medical specialist in Great Britain are on the order of £500,000 per year; if eliminating unnecessary procedures reduced expenditures by 10 per cent, the savings nationwide would be enormous. In developing countries, the secondary-health-system costs generated by physicians are smaller, largely because of the absence of much of the high-cost diagnosis and treatment modes, but the same problem exists as in developed countries, and the implications are more serious because of the much more limited resources available for health. To give priority to medical education and to a reward system for physicians is to place clinical decisions about the individual patient in the context of the health needs of the population and to promote more discriminating use of scarce resources for diagnosis and treatment based on evaluation of the effectiveness and the cost of these procedures. These decisions involve difficult ethical judgments. The concepts behind these decisions have only recently been introduced into medical education and health-services administration in developed countries.[14]

Poverty

Money alone will not ensure good health. However, in the opinion of most development specialists, the overriding constraint to improving health status in the least developed countries is the extreme poverty of most of the population and the low level of the gross national product per capita (below $400). Health must compete with other pressing developmental needs for extremely limited public resources.

The problem is made worse by the rapid growth in population, which averages 2.4 per cent per year among developing countries as a group and reaches nearly 4 per cent per year in Kenya; at this rate, the population of Kenya will double in 17 years. At current average annual growth rates, half the population will be under 15 years of age; and demands for employment, housing, and all basic services will increase rapidly. Public expenditures on health will have to increase commensurately just to "hold the line" on current levels of quality and coverage of services. Since population is the critical denominator of all development activities, with such limited resources reduction of fertility will be a decisive factor in attempts to improve services such as health care. At the same time, wider coverage of the population with effective services for maternal and child health and family planning is a necessary part of any strategy to reduce population growth.

Given the extremely limited resources and the rapid growth in population, several basic questions need to be addressed. First of all, what are the prospects for increased public expenditures on health, and to what extent are improvements in health dependent on economic progress? What other sources of financial support might be mobilized? Secondly, can existing resources be used more effectively? And thirdly, within these constraints is "Health for All" through primary health care feasible?

Financing of Health Services

Analysis of health expenditures in developing countries is hampered by a lack of satisfactory financial information on programs operated by different levels of government and the private sector. The available data indicate striking differences in the levels of current total public expenditures on health for capital and operating purposes, with average figures of $2.60 per capita per year in the poorest countries (1.1 per cent of the gross national product), $19 in middle-income developing countries (1.2 per cent of the gross national product), and $469 in industrialized countries (4.4 per cent of the gross national product). The combined public and private health expenditures in the United States and several northern European countries are close to $1,000 per capita per year — more than 100 times the level in the poorest group of countries. At the other extreme, a few of the poorest countries — Bangladesh, Ethiopia, Indonesia, and Zaire — have annual public expenditures on health of only $1 per capita. Since recurrent expenditures are concentrated in urban areas where hospitals and specialized manpower are located, it may be concluded that the resources available to operate health services for the rural population are very limited and in the poorest group of countries average substantially less than $1 per capita.

During the decade 1980-1990 the average annual growth in gross national product per capita is estimated to be 2.1 to 2.3 per cent in middle-income oil-importing countries, and 0.7 to 1.8 per cent in low-income countries.[6] Assuming that public expenditures for health remain at the same proportion of the gross national product as in 1977, the allocation for health in low-income countries may be expected to increase by only $0.40 to $0.80, to a level of $3 to $3.40 per capita per year by 1990; the increment will be only $0.20 to $0.50 in Asia and even lower in Africa, where a reduction in per capita income is possible in the sub-Saharan countries during the decade. Predictions for the year 2000 show little further improvement, particularly in the low-income countries, with the gap between rich and poor countries continuing to widen. A substantial increase in poor countries' public resources for health by 2000 is possible only if there is a shift in resources from other sectors. This seems unlikely, unless investing in health can be justified more convincingly to ministries of finance and planning, in terms of immediacy of benefit and return on investment.

To what extent are improvements in health dependent on economic progress? Preston's study of the contribution of economic factors to declines in mortality, which uses national income and mortality data from populations in 43 countries between 1938 and 1963, indicates that income is a critical but not major determinant of mortality level.[20] In the aggregate, income growth accounted for only 16 per cent of the improvement in life expectancy in the countries studied. In the subgroup of countries with incomes below $400 per capita, there appeared to be a stronger correlation of income and mortality trends. Nevertheless, Sri Lanka and the state of Kerala in India[21] and the People's Republic of China are examples of countries that have attained a life expectancy close to the level in the industrialized world, with income levels in the range of the least developed countries. The achievements may be explained in part by the public priority given to literacy, food, and health and by special features of social and political organization. Furthermore, as McDermott illustrated in the case of chemotherapy for tuberculosis in blacks in New York City and Maoris in New Zealand, advances in medical technology can be very effective in reducing mortality promptly without any preceding improvement in living standards.[22] These examples are of great importance for the least developed countries, which have such gloomy economic prospects for the next two decades.

In view of the continuing scarcity of public resources, what opportunities exist to supplement a central government's capacity to finance health services by mobilizing support from other sources? The possibility of revenue sharing by local government for local services warrants further exploration, although the capacity of local government to generate tax revenues is limited. In two regions of Senegal 8 per cent of general rural taxes are set aside for health, and in Colombia 35 per cent of the state beer tax is earmarked for hospitals. If these taxes generate new public revenue,

they could expand support for health; otherwise, the process is merely an exercise in allocation.

Social-security schemes based on contributions by employers, employees, and sometimes governments are an important financing mechanism in middle-income countries, particularly in Latin America. The services financed are predominantly curative, and since the benefits are restricted to employees, the schemes cannot be relied on to attain full coverage of low-income populations, many of whom are outside the wage economy. The equity of social-security systems has been questioned, since the public-sector contributions in effect serve to subsidize the better-off segment of the population, and employers may pass on their costs to consumers by raising prices. Private financing of health care has also been undertaken by productive sectors. One of the largest examples is the Colombia Coffee Growers' Association, which in 1978 alone contributed two fifths (41 per cent) of the total operating costs of the rural health-delivery system in that country.*

User fees and contributions in kind from the individual or the community are also important means to supplement financing from government. Many governments resist any form of user charges, for fear of excluding the poor or in the belief that users will not understand the value of the services. Paradoxically, imposition of user charges can have a positive impact on utilization of health services, by increasing the perceived value of services and therefore the demand for them over alternative "free" care. Mission clinics and hospitals have demonstrated the feasibility of recovering a considerable part of their operating costs for selected curative services when quality of care is acceptable. Institution of a pricing policy for selected curative health servcies has been attempted in several countries. The establishment of community pharmacies in the Philippines and of village drug cooperatives in Thailand and Senegal are examples of this approach. Traditional healers and birth attendants practice on a fee-for-service basis and enjoy a high level of community acceptance; with appropriate training, they could serve as a valuable extension of the health system financed by user fees. Village organizations and popular self-help movements such as Saemaul in Korea and Sarvodaya in Sri Lanka illustrate the value of community participation for mobilizing local labor and materials for health facilities and salary support of community health workers. However, local initiatives may lead to disillusionment if they are not supported by appropriate services within the public-health system. Multiple independent initiatives may complicate the evolution of a rational system unless they are developed within a general framework.

China, one of the few low-income countries with a broadly based health-care system, uses a variety of financing devices. In addition to central, provincial, and county-government appropriations and some user fees, health-insurance schemes are also employed. The "public-medical-expenses" scheme is similar to a social-security system covering government employees and students. The "labor-medical-insurance" scheme covers about 10 per cent of the population and is financed by 2 to 3 per cent of factory income before payment of salaries. The large rural population is covered by "cooperative medical services" financed by the participating communes through production "brigade revenue," individual premiums equivalent on average to 1.5 per cent of the family's disposable income, and user fees.[23] All expenditures for preventive health care are borne by the state.

Much work remains to be done in analyzing the effect of prices on the demand for health services in developing countries; the success of the private sector in this area is not necessarily a reliable guide to public-sector pricing policy. Even when a superior public service replaces a private one, the public cannot be assured of capability to collect the same level of charges, since it is less able to refuse services to those unwilling to pay, as has been shown in the case of public water supply. Nevertheless, since private spending is estimated to be three to four times greater than government expenditures on health in many developing countries,[24] it is clearly one of the most important sources of financing to explore.

Mobilization of resources for health from the widest spectrum of alternative sources should be actively pursued, ensuring that these resources are a net addition to public funding rather than a substitute for it. They have the added benefits of reducing the uncertainty associated with total dependence on public funding and of increasing the participation of the individual, community, cooperative, or local government in planning and managing the health services.

In many countries the principal alternative to government financing has been official development assistance from bilateral and multilateral agencies and extensive local contributions by foreign nongovernmental organizations. According to Howard, assistance for health from all external sources totalled $3 billion in 1978 — less than one quarter of the total estimated public and private expenditures on health in the 67 poorest developing countries (excluding China).[24] The largest component, $1,008 million, came from 18 bilateral donors; they allocated approximately 10 per cent of their total concessional assistance to the health sector — a share only exceeded by agriculture, public utilities, and education.[25] In view of the economic difficulties facing industrialized countries, it seems unrealistic for developing countries to rely on any appreciable increase in external assistance for health in real terms to compensate for a shortage in public expenditures. Furthermore, care must be taken to avoid capital expenditures financed by external assistance if the recurrent cost obligations that they create are not in keeping with the pri-

*Figures are based on assigned budget figures from the Colombia Ministry of Health for 1976 (*Financing for the Rural Health Plan from 1976-1980*. Bogota: World Bank Resident Mission [unpublished data]).

orities for use of the limited public funds available for health.

The tendency of governments to discriminate in budget allocations against programs with high recurrent costs in favor of capital-intensive projects is aggravated by the policy of many external donors not to support operating costs. In general, recurrent costs generated per dollar of capital investment are substantially higher for health than for other major public sectors, such as agriculture or transportation, and the ratios are particularly high for primary-health-care programs and rural health centers,[26,27] in which expenditures are mainly for manpower and drugs. This makes these programs very vulnerable to budget cutting by government. In addition, even when general operating expenditures have been met, neglect of maintenance expenses leads to further capital expenditures for rehabilitation or replacement of facilities and equipment — a much more costly approach to sector development. An important consideration in the success of primary health care will be the willingness of governments and external donors to place appropriate priority on the financing of recurrent costs.

Efficiency and Effectiveness of the Use of Resources

National capability to plan and implement strategies and programs that make the best use of scarce resources is seriously deficient in most developing countries. The coexistence of subpopulations with different health needs requires programs that are designed for these groups and not based on national averages. The need to select from among a broad range of possible interventions the most appropriate mix of personnel, facilities, and technologies requires information on relative cost effectiveness, trade-offs between capital investment and recurrent costs, and assessment of the political and administrative feasibility of implementation — for all of these, data are seriously deficient.

Health planning is under a cloud of skepticism because the substantial efforts to date have had little effect on resource-allocation decisions for the health sector in most countries. Much of the planning has been normative, based on international estimates of the number of personnel and hospital beds needed to establish or extend coverage of services rather than on the nature of the health problems of a given population and the most cost-effective methods of solving them. Almost all planning and management have been central, with inadequate understanding of the real constraints on implementation at the operating level.

Matching programs more closely with needs will depend on strengthening planning in several areas. Some initial definition of priorities for the sector is essential. This may be achieved by a review of estimates or epidemiologic measures of the disease profile of representative population groups, clarification of explicit health-sector objectives, and assessment of the technical, political, and administrative feasibility of dealing with the most important problems. From this general framework it should be possible to define population-specific objectives for health investments and to establish targets for reductions in critical sector-development indicators such as infant mortality, malnutrition, fertility, or disease prevalence. Setting targets provides a mechanism not only to assess the value of use of scarce resources but also to monitor and evaluate program performance. Alternative approaches to achieve the targets should be reviewed, and the most cost-effective solution selected, weighing not only technical and financial considerations but also cultural acceptability and feasibility of implementation. This exercise will raise difficult questions about trade-offs: whether to pursue inexpensive short-term symptomatic therapy or more expensive long-term measures to eliminate the cause of disease; the relative merits of interventions in health and in other sectors such as water supply and sanitation; and the choice between disease-specific, vertically organized health services and the multi-purpose, horizontal primary-health-care approach. Walsh and Warren reviewed published reports of infectious and parasitic diseases endemic in tropical countries and concluded that the strategy of intervention should be selective — based on evidence of the contribution of each disease to mortality and morbidity, the efficacy and cost of currently available control measures, and the feasibility of applying these measures.[28] The extensive studies of Morrow and his co-workers in Ghana[29] illustrate the potential value of cost-benefit analysis in sorting out priorities within the health sector and in justifying to the government the investments in health vis-à-vis other sectors. Application of this technique is limited by the difficulty in quantifying benefits in health, the inadequacy of the human-capital approach to life valuation, and the lack of suitable data for analysis in most developing countries.[30,31] In the absence of cost-benefit analysis, unit costs of specific health improvements may be compared in order to identify the least-cost solution. To apply these epidemiologic and economic measurements when planning health programs requires much information and takes time. In many cases, detailed measurements cannot be made, but more vigorous review of available evidence on the health needs of different population groups and the consideration of cost effectiveness in selecting interventions offer the best hope for stretching limited resources to achieve maximum impact on health. In addition to encouraging better policies and practices in the health sector, this should enhance the acceptability of proposals by ministries of health to ministries of planning and finance.

The development of measurement capability for both planning and managing health services has a high priority for health administrators, physicians, and others with leadership responsibility in the health system. This can be best achieved by strengthening existing institutions through mid-career training of

the staff, improving management information systems, and undertaking operational research on health services at central and peripheral levels of the health system.

Financial Feasibility of Primary Health Care

Primary health care has been accepted by the member governments of the WHO as the key to achievement of universal access to health care by 2000. Assuming that the low-income countries will have no more than $3 to $4 per capita per year in public resources to devote to health by 2000, is it possible to achieve the goals envisaged in the primary-health-care approach with this financial constraint?

Evidence from six primary-health projects undertaken in the late 1960s and 1970s in developing countries indicates that marked health improvements can be demonstrated within five years through provision of basic services with annual operating costs ranging from about $0.50 to $3.50 per capita (Table 5).[32,33] When corrected for inflation, these figures would be $1 to $7 per capita in 1981 prices. The results must be interpreted with caution since five of the projects were of a pilot nature; most involved very small populations; the cost data varied greatly. As a rule, they did not include capital investment, training, expenditures beyond the primary level of health care, or the value of expatriate and volunteer labor. The contribution of voluntary health workers is of special importance because they provide a large share of rural health services and because volunteerism may be difficult to sustain over the long term.[34] Although there should be economies in scaling-up to national programs, in fact higher marginal costs would be expected with expansion of primary health care to more widely dispersed populations. Furthermore, political and administrative problems involved in scaling-up would add costs for management, supervision, and support systems. Nevertheless, the results of the pilot projects, adjusted for inflation, are of the same order as the estimates of $1 to $3 by Joseph and Russell[35] and $5 by Patel (unpublished data) for per capita recurrent costs of primary-health-care programs.

An alternative approach to estimating the cost of primary health care is to price the individual components of a model program designed to treat the principal causes of mortality in children in low-income countries, as outlined in a recent WHO discussion paper.[36] The model for a total population of 100,000 would try to provide basic care for children under five years of age (about 17,000), tetanus toxoid, iron and folic acid for pregnant women (about 4000), and contraceptive advice and supplies for fertile women (about 5100 at a 30 per cent level of coverage). On the basis of estimates of the need for immunization against common infectious diseases and for treatment of diarrhea, acute respiratory infections, malaria, and intestinal parasites, and assuming that all patients in need will be treated with the least expensive, effective treatment available, it is possible to calculate the annual cost of drugs and supplies for each condition. For example, to immunize the 4000 children under one year of age against measles, 3200 doses would be required to achieve 80 per cent coverage (recognized as sufficient to halt transmission), which at $0.17 a dose would cost $544 each year. The annual cost of all the drugs, vaccines, and supplies for the model program was $35,000, or $0.35 per capita, for the population as a whole to cover the selected target groups.

The cost of commodities is, of course, only one component. It is necessary to add the cost of salaries of health workers, training, transportation, and maintenance. If these additional costs are in the same proportion to total primary-health-care costs as drugs are in national health budgets (drugs account for 25 per cent according to a conservative estimate[6]), then the total annual recurrent costs for primary health care may be in the range of $1.40. Since annuitized capital costs for primary care are about one third of recur-

Table 5. Impact and Cost of Selected Primary-Health-Care Projects.*

Project	Period Monitored	Estimated Population Covered	Infant Mortality Rate			Child Mortality Rate			Project Cost per Capita
			Base of Study Period	End of Study Period	Per Cent Reduction	Base of Study Period	End of Study Period	Per Cent Reduction	
			deaths/1000 live births			*deaths/1000 children 1–4 yr*			$
Miraj, India	1974–77	230,000	68	23	66	†	†	†	0.50
Jamkhed, India	1971–76	80,000	97	39	60	†	†	†	1.25–1.50
Narangwal, India	1968–73	10,500	128 ‡	70 ‡	45	19 ‡	11 ‡	42	0.80–2.00
Hanover, Jamaica	1973–75	65,000	36	11	69	13–15 §	5–6 §	60	0.40
Deschapelles, Haiti	1968–72	9,600	55	34	38	11	6	45	1.60
Rural Guatemala	1969–72	3,000	150	55	63	28	6	79	3.50

*Sources — Faruqee R, Johnson E. Health, nutrition and family planning: a survey of experiments and special project in India (unpublished data). World Bank Discussion Paper No. 81-14. Population and Human Resources Division); Gwatkin DR, Wilcox JR, Wray JD. Can health and nutrition interventions make a difference? (Monograph No. 13.) Washington, D.C.: Overseas Development Council, 1980; and Berggren WL, Ewbank DC, Berggren GG. Reduction of mortality in rural Haiti through a primary-health-care program. N Engl J Med. 1981; 304:1324-30.

†Data not available.

‡Comparison of average rates for 1970-73 in medical-care intervention and control areas. Child mortality reflects deaths in children 12 to 36 months of age per thousand children in that age group.

§Child mortality reflects deaths in children 1 to 48 months of age per thousand children in that age group.

rent costs,[26,27] $0.45 to $0.50 may be added to cover capital investments. The combined capital and recurrent costs of the primary-health-care program would be under $2 per capita per year, well within the financial reach of low-income countries.

The fragility of the assumptions involved in multiplying the commodity costs is acknowledged. The model itself is relatively insensitive to changes in the assumptions about the commodities with the exception of the contraceptive prevalence rate. (Increasing contraceptive prevalence to half the women at risk would increase per capita costs of commodities from $0.35 to $0.43.) A more important factor is the assumption that the primary-health-care worker will provide early diagnosis and treatment. For example, if treatment of diarrhea were delayed so that 50 per cent of children rather than 10 per cent required intravenous fluids and antibiotics, the cost of commodities would be increased from $0.35 to $0.62 per capita. The model also assumes encouragement of breast-feeding and nutrition education of mothers and children at nominal cost, but if food supplements are added, the cost of the package of commodities would be substantially increased. Using data from Project Poshak in India[37] on the cost of the basic food supplements, adjusted for inflation and an assumed 30 per cent prevalence of malnutrition, as reported in several national nutrition surveys, the added cost would be $0.71 per capita — twice the cost of supplies for the basic health and nutrition interventions. Provision of rural water supply, which might be proposed in addition to or as an alternative to primary health services, is estimated to cost $5 per capita, of which approximately half would be annuitized capital cost.[38] (This estimate is based on a reported capital cost of $26 per capita in 1977[38] annuitized at a 10 per cent discount rate and including complementary operation, maintenance, and support costs.)

The value of the modeling exercise is limited by the pyramid of assumptions on which the calculations are based. More important than the results, however, is the process involved in developing the model, which illustrates the trade-offs that countries must consider in determining the balance of services to be provided to their population. The process of choosing the most cost-effective approaches to meeting health needs is the essence of the planning and decision-making process outlined above.

Conclusions

Developing countries face the challenge of coping with a heavy burden of illness that differs markedly in subgroups of the population at different stages of development. The greatest improvement in life expectancy from health investments can be expected in the rural and peri-urban poor through a program that provides maternal and child health services, including control of the major infectious and parasitic diseases of children under five. Effective technology for such a program is now available and affordable even within the financial constraints of the least developed countries. Two major problems remain: the first is the political will to allocate the necessary resources for the program, and the second is the management capability to organize and operate a system of services for the rural and peri-urban populations that use multi-purpose community-health workers.

No satisfactory strategy has been developed to meet the health needs of older children and adults within the financial means of most developing countries. There are relatively few simple, effective interventions to control the metabolic, vascular, degenerative, and malignant diseases of the adult population, and there is little understanding of the behavioral disorders. Without new technologies for control and prevention, it is unlikely that the poorer developing countries will be able to provide more than symptomatic care for most patients with these health problems. Furthermore, adoption of the expensive technologies now used for the diagnosis and treatment of these diseases in the industrialized world will divert the limited resources available for programs for the rural and peri-urban poor to sophisticated, hospital-based, urban services, which will have, at best, a marginal impact on health.

The search for health technology appropriate to the financial and organizational circumstances of developing countries must be seen as a high priority for the research and development community of the entire world. Existing technology must be critically evaluated, and new, simpler techniques developed for the control and prevention of common chronic diseases. Greater attention should be given to research and development on the "tropical" diseases, which are a major component of the disease burden of developing countries but have been largely neglected by the world's scientific community. Pharmaceuticals are of special importance since the timely supply of essential drugs is critical to the quality of health care and the credibility of community health workers. The dangers of excessive use or inappropriate choice of drugs necessitate the introduction of policies on procurement, prescription, pricing, and quality control to avoid health hazards and excessive costs.

Financial constraints will be an overriding consideration in the development of the health sector for the foreseeable future, particularly in the least developed countries. The poorest countries that now have public expenditures on health averaging only $2.60 per capita per year also have the least favorable economic prospects for the next decade. Greater efforts are required to mobilize resources for health from other sources, particularly the private sector, and to ensure that the limited resources available from all sources are used in the most cost-effective manner. Few developing countries have the institutional capability to select health interventions on the basis of expected health impact, least cost, and feasibility of implementation, and to integrate independent facilities, practitioners, and disease-specific programs into a

more coherent, economical, multipurpose system. A high priority should be given to strengthening the capability of administrators, physicians, and other personnel in positions of leadership in the health system at central and local levels in order to develop a population perspective in the analysis of health problems, a cost-effectiveness attitude toward the use of resources, and management skills appropriate for a human-services organization. More efficient management of health services is only one aspect of the problem. It is equally important to mobilize communities and individuals to take a more active role in promoting health and in financing health services, rather than to rely passively on a government system.

Scarcity of money for health is a critical limitation on progress toward the goal of "Health for All by the Year 2000." More money alone, however, will not produce the desired outcome unless there is a political commitment to programs for those in greatest need, as well as the managerial capability to implement them. This is first and foremost a challenge for developing countries, but it is also a consideration in the investment policies of donor agencies. Progress toward the goal of "Health for All" can be accelerated if more external assistance can be provided for the areas of greatest need and if the unique scientific and technologic resources of the industrialized world can be made available to developing countries, to strengthen their institutions and to collaborate in the development of appropriate technology to meet their needs.

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SPECIAL ARTICLE

SHATTUCK LECTURE — HEALTH CARE IN THE DEVELOPING WORLD: PROBLEMS OF SCARCITY AND CHOICE

JOHN R. EVANS, M.D., KAREN LASHMAN HALL, M.P.A., AND JEREMY WARFORD, PH.D.

THE World Health Organization (WHO) and UNICEF, together with representatives of 134 member governments, launched a campaign in 1978 to achieve "Health for All by the Year 2000" through primary health care.[1,2] The objective of this campaign was to increase the political commitment of member countries to address the health needs of their people and particularly to improve the health status of the rural and urban poor in the Third World. Our presentation describes the difficulties of putting this objective into practice, and what may be possible on the very limited budget available for health in most developing countries.

WHO and UNICEF might well have found the text for their plan in the *Report of the Sanitary Commission of Massachusetts,* which Lemuel Shattuck presented to the Massachusetts state legislature in 1850.[3] The report was based on a careful survey of the health status of the population of Massachusetts, and its recommendations embodied the essential elements of primary health care: immunization and communicable-disease control; promotion of child health; improved housing for the poor; environmental sanitation; training of community-oriented health manpower; public-health education; promotion of individual responsibility for one's own health; mobilization of community participation through sanitary associations; and creation of multidisciplinary boards of health to assess health needs and plan programs in response to sound epidemiologic evidence. Recognizing the importance of political commitment, Shattuck built a strong public-health constituency by highlighting both the major differences in life expectancy between rural areas and Boston and the deterioration of health status over a decade in major cities in the United States.

The conditions described by Shattuck in the United States in 1850 prevail today in most countries of the developing world (Table 1).[4-6] In low-income countries, life expectancy at birth averages only 51 years, and in several it is less than 45 years. Mortality rates are 10 to 20 times higher for infants and for children aged one to four than in developed countries. Nearly half of all deaths occur in children under five years of age. The major causes are diarrheal diseases, respiratory infections, tetanus, and childhood infectious diseases such as diphtheria, measles, and whooping cough, all of which can be effectively and cheaply controlled by measures used in developed countries. Malnutrition is important as an associated — and even primary — cause of death in young children, and short birth intervals adversely affect the survival of infants. For those who reach the age of five, life expectancy is only eight to nine years less than in developed countries. The commonest causes of death are similar to those in industrialized countries: cancer, cerebrovascular disease, heart disease, respiratory disease, and trauma. However, in developing countries, tuberculosis ranks among the most common causes of death. These nations are also plagued with endemic diseases such as malaria, schistosomiasis, trypanosomiasis, onchocerciasis, and leprosy, which are major causes of serious morbidity and mortality in

Table 1. Health-Related Indicators in Countries with Different Income Levels.[6]

INDICATOR	YEAR	LOW-INCOME COUNTRIES *	MIDDLE-INCOME COUNTRIES †	INDUSTRIALIZED COUNTRIES ‡
Gross national product per capita ($)	1979	240	1420	9440
Crude birth rate (births/1000 population)	1979	42	34	15
Crude death rate (deaths/1000 population)	1979	16	10	10
Life expectancy at birth (yr)	1979	51	61	74
Infant mortality rate (deaths/1000 live births) §	1978	(49–237)	(12–157)	13
Child mortality rate (deaths/1000 children 1–4 yr old)	1979	18	10	1
Per cent of population with access to safe water	1975	25	58	¶
Daily per capita calorie supply (% of requirement) ‖	1977	96	109	131
Adult literacy rate (%)	1976	43	72	99

*Thirty-four low-income developing countries with a per capita income of $370 or less in 1979 (China and India are excluded from the low-income group in this table).

†Sixty middle-income developing countries with a per capita income of more than $370 in 1979.

‡Eighteen industrial-market economies.

§Weighted averages; figures in parentheses denote the sample range.

¶Data not available but assumed to be close to 100 per cent.

‖Requirements based on calories needed to sustain a person at normal levels of activity and health, taking into account age and sex distributions, average body weights, and environmental temperatures, as estimated by the United Nations Food and Agriculture Organization.

From the Population, Health and Nutrition Department, World Bank, 1818 H St., N.W., Washington, DC 20433, where reprint requests should be addressed to Dr. Evans.

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adults and children, but for which effective control measures have not been available or have proved difficult to implement or maintain.

Even in middle-income countries, more favorable national statistics in the aggregate disguise wide disparities between the conditions, on the one hand, of the rural and peri-urban poor that are typical of low-income countries and the conditions, on the other hand, of more affluent urban dwellers who are better educated and have better access to health services and whose health status closely resembles the profile in industrialized countries. Table 2 contrasts the high mortality rates for infectious and parasitic diseases in the less developed northeastern and frontier regions of Brazil with the high rates for cancer and cardiovascular diseases in the more affluent southeastern region of the country. As economic development proceeds, the more prosperous regions of the country have the advantages of greater individual and collective wealth and greater political leverage. Consequently, national health policies give priority to their needs, and the limited resources of hospitals, equipment, drugs, physicians, and other health personnel are concentrated in the urban areas, widening the gap between urban and rural populations.[7]

In the push for development, particularly industrial and commercial development, protective measures for workers and the environment usually lag behind, as they did in the earlier stages of developed countries. These measures are often disregarded because they are initially expensive, and can generally be enforced only by firm legislation and inspection. Rapid development accelerates the appearance of new health problems such as traffic accidents, work accidents, accidental poisoning, and environmental pollution. Similarly, disruption of families and community, migration, and unemployment contribute to a variety of disorders of individual behavior — alcoholism, violence, promiscuity — each with attendant physical and mental risks, counterparts of those seen in industrialized countries.

Urban problems will increasingly dominate the health pattern of the developing world. According to United Nations projections, the urban population in developing countries will increase by 1.32 billion between 1975 and 2000; by 2000 it will average 43 per cent of the population of the less-developed regions overall, and 75 per cent of the population of countries in Latin America.[8] The primary-health-care approach for rural health problems may need to be modified to address different problems arising from life styles and diets in the urban setting. For example, recent analyses indicate that in several countries there are large numbers of malnourished urban dwellers, and that their numbers are increasing more rapidly than those of the rural malnourished.[9]

Table 2. Regional Variations in Cause-Specific Mortality in Brazil, 1970.*

Cause of Death	Region		
	Northeast	Frontier	Southeast
	per cent of all deaths		
Infectious and parasitic diseases	24.5	26.6	11.2
Neoplasms and cardiovascular diseases	21.1	19.1	42.1

*Adapted from de Carvalho AVW, de Moura Ribeiro E. Estudo da Mortalidade proporcional, segundo Grupos de Idade e Causas de Obito, em algunas Capitais Brasileiras, em 1970. Revista Brasileira de Estatistica. 1976; 37(148):475 (as reported in World Bank. *Brazil: Human Resources Special Report*. Washington, D.C., October 1979).

Stages in the Evolution of Health Systems

The pattern of diseases in northern Europe and the United States evolved in stages over the past two centuries, and with each stage distinctive control measures were introduced.

The first stage, dominated by major and minor infectious diseases linked to poverty, malnutrition, and poor personal hygiene, responded slowly to improved food supply, housing, and literacy made possible by greater prosperity, and to public-health measures, particularly safe water supply, sanitation, and immunization campaigns. The steady decline in infant mortality (Table 3) and the reduction in child mortality as a percentage of all deaths (Table 4) may be attributed to these changes. As scientific advances provided a wide array of immunologic and therapeutic techniques to control acute bacterial and viral infections, life expectancy increased, and heart disease, cancer, and stroke replaced respiratory and gastrointestinal infections as the principal causes of death. For example, in the United States in 1900, the three leading causes of death (influenza and pneumonia, tuberculosis, and gastroenteritis) accounted for over 30 per cent of all deaths, whereas heart disease, cancer, and strokes were responsible for 18 per cent of deaths. By 1975, only influenza and pneumonia (3 per cent) ranked in the top 10 causes of death, whereas heart diseases (38 per cent), cancer (20 per cent), and stroke (10 per cent) together accounted for over two thirds of all deaths.[10]

The second stage in the evolution has been dominated by chronic diseases, particularly cardiac and cerebrovascular diseases, cancer, diabetes, arthritis, and mental disorders. As the threat of infectious diseases receded, public-health measures were relegated to a regulatory role, and personal health services became the primary channel for prevention and treatment of health problems. The development of expensive and complicated technology for diagnosis and treatment has led to the transfer of care from doctors' offices to elaborate and expensive hospitals. Doctors and patients have looked to these curative techniques and facilities to provide striking improvements in health. Sadly, experience has shown that for many problems the benefits hoped for have not been realized. As Cochrane has noted, the massive public and private expenditures on health, now close to $1,000 per capita annually for capital and recurrent costs in

Table 3. Infant Mortality in Selected Countries, 1750-1975.*

Period	Country		
	Sweden	France	United States
	no. of deaths/1000 live births		
1751–1755	206	277	†
1851–1855	149	166	†
1901–1905	91	141	124
1971–1975	10	14	18

*Source — Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Démographie, Université Catholique de Louvain, Ordina Editions, 1980:147-9.

†Data not available.

the wealthier industrialized countries, have not produced commensurate improvement in the health status of the population.[11] Only a small proportion of the interventions used are of proved effectiveness, and the benefits to be gained from the intensive services for terminal illnesses are at best marginal.

A third stage of evolution can now be defined. It reflects a shift from preoccupation with intrinsic disorders of structure and function of the body, to an awareness of the health hazards arising from environmental exposure to an increasing number of chemicals, drugs, and other toxic substances and from changes in the social conditions of the family, community, and workplace that influence behavior and life style and are associated with absenteeism, violence and alcohol and drug abuse of epidemic proportions. The personal health-care system concentrates on the consequences of such processes. New approaches are needed to encourage the healthy to avoid patterns of behavior that lead to disease, and to identify and treat the social and environmental causes of disease that originate in the community. Industrialized countries have recently recognized the importance of this third stage and the need to adapt their health systems to give greater emphasis to health promotion and preventive measures at individual and community levels.[12,13] This stage is not new. These concerns provided much of the impetus for reform of industrial and other health practices for well over a hundred years. The meaning of the third stage is a return to the recognition that responsibility for health should not be exclusively the prerogative of the health professions — that protective and preventive measures have to be the responsibility of the individual and the society.

Industrialized countries have evolved through the three stages over the course of more than a century (Table 3). In contrast, developing countries face the challenge of coping with all three stages simultaneously: the rural and peri-urban poor who constitute a majority of the population are in the first stage; the influential, more affluent urban dwellers are at the second stage; and manifestations of the third stage are already apparent because of environmental deterioration and the social disruption associated with massive urban growth and unemployment. Furthermore, developing countries must cope with just a fraction of the financial and human resources available to their industrialized counterparts. In any circumstances, but particularly in these, the strategy to improve health must be selective. Success will depend heavily on correctly identifying the most important problems in each population group, selecting the most cost-effective interventions, and managing the services efficiently. Uncritical acceptance of new and expensive high technology will not serve the purposes of developing countries. But developed countries do have much to offer through scientific and technical cooperation. Already, developing countries, by taking advantage of the innovations in the industrialized world (vaccines, microbiologic techniques, and antibiotics, for example) have achieved much faster rates of improvement in health status than those achieved in northern Europe and the United States. However, there are signs that this rate of progress is not being sustained. As Gwatkin and Brandel pointed out (unpublished data), life expectancy in the less-developed regions of the world, which had been rising by 0.64 year annually between 1950 and 1960, slowed to 0.40 year annually 15 years later. Several factors stand out as impediments to progress.

Obstacles to Progress

Uneven Distribution of Health Services

Access to health services is very uneven, and large segments of the rural population are not reached. Health facilities and personnel are concentrated in urban areas, and within the urban population the services are oriented to the middle-income and upper-income groups, neglecting the peri-urban poor. Political considerations may override all other priorities, and little progress can be expected unless there is a political commitment to apply resources where the need is greatest.

There is a shortage of skilled health personnel, particularly in the poorer countries. National averages for physician:population ratios are reported to be 1:17,000 in the least developed countries and 1:2700 in other developing countries, as compared with 1:520 in developed countries. The nurse:population ratios are 1:6500, 1:1500, and 1:220, respectively.[5] These

Table 4. Child Mortality in Belgium, 1880-1970.*

Year	Age Group		Total (0–5 yr)
	<1 yr	1–5 yr	
	per cent of all deaths		
1880	27.7	13.3	41.0
1900	27.4	9.0	36.4
1920	17.7	4.1	21.8
1950	7.5	1.0	8.5
1970	2.5	0.04	2.6

*Adapted from Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Demographie, Université Catholique de Louvain, Ordina Editions, 1980:127.

national averages disguise the fact that in some rural areas there may be only one doctor serving 40,000 to 200,000 people. Furthermore, the pyramid of health manpower is inverted, particularly in the least developed countries. Instead of a broad base of inexpensively trained, less skilled personnel working at the community level, priority has been given to expensive training programs for "conventional" doctors, who expect sophisticated facilities and equipment, gravitate to practice in the cities, and have a propensity to emigrate. To achieve effective coverage of the population, large numbers of less skilled personnel need to be trained, and these health workers need to be part of a system that will provide supervision, drugs and supplies, and the support services necessary for their practice. Otherwise dissatisfaction will lead to high turnover of health workers and low utilization of their services as patients bypass the first level of care in the community in favor of higher-level facilities, which properly should function as referral centers. Doctors are key participants in the referral and supervisory systems; if they operate as primary-care workers, their expensive training is wasted and the cost of their practice may outweigh the benefits. The supervisory and managerial role of the physician in the health system must be addressed more directly in the process of medical education and in the career development and rewards for the physician in practice.[14]

Lack of Appropriate Technology

A second obstacle to progress is the lack of appropriate technology to address Stage 2 and Stage 3 health problems and to cope with the serious endemic diseases prevalent in the developing world. For Stage 1 health problems, much of the technology needed is already available, and in the case of vaccines technologic advances that would reduce dependence on the cold chain are imminent. In contrast, for Stage 2 health problems, relatively few technologies for dealing with the serious diseases of the adult population are appropriate to the circumstances and financial resources of less developed countries. Most of the technologies that are being transferred from the developed world are expensive, and the equipment is often difficult to maintain. It is necessary to determine which interventions are effective and which yield large benefits at acceptable costs. The greater challenge is in the search for preventive measures to reduce the large burden of illness from cancer, hypertension, diabetes, respiratory, cardiac, and cerebrovascular disease. For Stage 3 health problems, we are still handicapped by inadequate understanding of behavior and the links between social and environmental hazards and specific diseases. We have much to learn about conveying health-education messages, motivating community participation, and using modern communications technology to circumvent the barrier of illiteracy.

The "tropical diseases" (e.g., malaria, schistosomiasis, filariasis, trypanosomiasis, and leprosy) are a particular problem for developing countries, in part because they generally have climates and ecologies conducive to disease vectors. Techniques for ecologic control of vectors or transmission routes are available but are expensive and require repeated application over wide areas. Treatment of patients is generally expensive, sometimes risky, and often delayed. Prophylactic measures such as vaccination are largely undeveloped. Knowledge of the biology of the diseases is far from complete. Research on these diseases has so far been largely neglected by the scientific community and the pharmaceutical industry, which have been preoccupied with cancer, cardiovascular disorders, and the other major diseases of the industrialized world. The Special Program for Research and Training in Tropical Diseases led by the WHO is an attempt to mobilize the health-science research community throughout the world to focus attention on these neglected tropical diseases in order to discover appropriate technologies for their control.

The scientific and development resources of the developing countries are limited, and their problems are difficult to solve. The most promising results will come from combining the scientific and technologic potential of the industrialized world with the local knowledge of scientists and professionals in developing countries who will have responsibility for applying the new technologies.

Pharmaceutical Policies

The most widely used technologies in health are drugs and vaccines. Shortages of supplies and failure to provide for the timely distribution of drugs and vaccines are serious problems that must be overcome for an effective health program. In looking to the future, however, the problems may be excessive and irrational use of drugs and unsustainable costs to the health system. Patients who consult health personnel expect to receive a prescription or, in some cultures, an injection. As access to health services broadens with the implementation of primary-health-care programs, a rapid increase in the consumption of drugs may be expected. Experience in less-developed countries supports this contention. In China, with nearly universal access to health care, curative medicine occupies 90 per cent of the time of "barefoot" doctors, and nearly all patients receive medication; there is evidence that drugs and traditional medicines account for two thirds of overall health expenditures. In countries with less complete coverage of the population, expenditures on drugs constitute about 40 to 60 per cent of the health budget (as compared with 15 to 20 per cent in developed countries[15]) and over half of private health expenditures. In most developing countries, the majority of drugs are imported, and these outlays are a considerable drain on foreign exchange.

The importance of drugs to the quality of health care, to the credibility of community health workers, to the development of iatrogenic disease (for exam-

ple, from toxicity or antibiotic-resistant microorganisms), and to the cost of health services makes it imperative that developing countries establish better mechanisms for assessing drug requirements and for purchasing, quality control, storage, and distribution of drugs. Experience in Tanzania and Ghana indicates that savings of up to 70 per cent of the budget for pharmaceuticals could be achieved by promoting generic alternatives and introduction of controls against overprescription.[16,17] The South Pacific Pharmaceutical Scheme projects cost savings of at least 25 per cent through limiting the availability of nonessential drugs and through bulk purchasing.[18] Without policies for national formularies, procurement, prescription, and pricing, this powerful and ubiquitous health technology could become more of a liability than an asset to the health system.

Management of Health Resources

One of the most difficult and pervasive problems to solve in the establishment of effective health services in developing countries will be deficiencies in management. The health sector presents a formidable organizational challenge. Some of its objectives can be achieved only with the cooperation of other sectors such as water supply and sanitation, education, agriculture, and community development. The delivery of health services involves widely dispersed facilities, numerous categories of personnel, general and specialized hospitals, vertically organized programs to control individual diseases such as malaria, tuberculosis, leprosy, or venereal disease — each with its own personnel and support services, community health-care programs with multipurpose workers, and a system of indigenous medicine with traditional healers and birth attendants. The different elements need to be organized to reduce conflict and duplication between programs and to provide a coherent system to screen and treat patients according to the level of care required and to refer patients with difficult problems. Supervision and continuous in-service education of health workers, improved logistics and supply to maintain credible services, institution of personnel policies and rewards to maintain the quality, distribution, and morale of staff, and policies and financial arrangements that encourage rational use of the health resources by the public are essential corollaries to enhance sector performance.

The weakest links in the administrative chain of most developing countries are institutions at district and local levels, which are usually poorly staffed, have inadequate authority or control of resources, and are unable to provide the necessary support and supervision of field staff. The development of planning and administrative capability at the district level is of special importance, since this is normally the lowest tier of the health-services organization still communicating directly with central government but also in contact with the villages, aware of their needs, and in a position to encourage community participation. It is at this level that matching of health needs and resource allocation is most likely to occur.[19] Community-based non-governmental organizations active in health care may make an important contribution to the process of devolution of administrative responsibility.

The management of a system of health services is much more than the management of its facilities and support systems. It involves decisions about priorities and resource allocation that are based on the health needs of the population to be served. This epidemiologic perspective is missing from the training of many of those in positions of responsibility, and the information system on which to base such management decisions is typically inadequate. Management also involves gaining the cooperation and compliance of highly independent professionals and specialists who have their own constituencies and political support.

The medical profession is of special importance because of the profound steering effect of individual clinical decisions on the demand for expensive facilities and the consumption of resources for diagnosis and treatment. Most practicing physicians give relatively little weight to consideration of the efficacy of these procedures and almost no attention to the real cost and foregone opportunities in terms of resources used. Abel Smith (personal communication) has estimated that the consequential costs generated by the average medical specialist in Great Britain are on the order of £500,000 per year; if eliminating unnecessary procedures reduced expenditures by 10 per cent, the savings nationwide would be enormous. In developing countries, the secondary-health-system costs generated by physicians are smaller, largely because of the absence of much of the high-cost diagnosis and treatment modes, but the same problem exists as in developed countries, and the implications are more serious because of the much more limited resources available for health. To give priority to medical education and to a reward system for physicians is to place clinical decisions about the individual patient in the context of the health needs of the population and to promote more discriminating use of scarce resources for diagnosis and treatment based on evaluation of the effectiveness and the cost of these procedures. These decisions involve difficult ethical judgments. The concepts behind these decisions have only recently been introduced into medical education and health-services administration in developed countries.[14]

Poverty

Money alone will not ensure good health. However, in the opinion of most development specialists, the overriding constraint to improving health status in the least developed countries is the extreme poverty of most of the population and the low level of the gross national product per capita (below $400). Health must compete with other pressing developmental needs for extremely limited public resources.

The problem is made worse by the rapid growth in population, which averages 2.4 per cent per year among developing countries as a group and reaches nearly 4 per cent per year in Kenya; at this rate, the population of Kenya will double in 17 years. At current average annual growth rates, half the population will be under 15 years of age; and demands for employment, housing, and all basic services will increase rapidly. Public expenditures on health will have to increase commensurately just to "hold the line" on current levels of quality and coverage of services. Since population is the critical denominator of all development activities, with such limited resources reduction of fertility will be a decisive factor in attempts to improve services such as health care. At the same time, wider coverage of the population with effective services for maternal and child health and family planning is a necessary part of any strategy to reduce population growth.

Given the extremely limited resources and the rapid growth in population, several basic questions need to be addressed. First of all, what are the prospects for increased public expenditures on health, and to what extent are improvements in health dependent on economic progress? What other sources of financial support might be mobilized? Secondly, can existing resources be used more effectively? And thirdly, within these constraints is "Health for All" through primary health care feasible?

Financing of Health Services

Analysis of health expenditures in developing countries is hampered by a lack of satisfactory financial information on programs operated by different levels of government and the private sector. The available data indicate striking differences in the levels of current total public expenditures on health for capital and operating purposes, with average figures of $2.60 per capita per year in the poorest countries (1.1 per cent of the gross national product), $19 in middle-income developing countries (1.2 per cent of the gross national product), and $469 in industrialized countries (4.4 per cent of the gross national product). The combined public and private health expenditures in the United States and several northern European countries are close to $1,000 per capita per year — more than 100 times the level in the poorest group of countries. At the other extreme, a few of the poorest countries — Bangladesh, Ethiopia, Indonesia, and Zaire — have annual public expenditures on health of only $1 per capita. Since recurrent expenditures are concentrated in urban areas where hospitals and specialized manpower are located, it may be concluded that the resources available to operate health services for the rural population are very limited and in the poorest group of countries average substantially less than $1 per capita.

During the decade 1980-1990 the average annual growth in gross national product per capita is estimated to be 2.1 to 2.3 per cent in middle-income oil-importing countries, and 0.7 to 1.8 per cent in low-income countries.[6] Assuming that public expenditures for health remain at the same proportion of the gross national product as in 1977, the allocation for health in low-income countries may be expected to increase by only $0.40 to $0.80, to a level of $3 to $3.40 per capita per year by 1990; the increment will be only $0.20 to $0.50 in Asia and even lower in Africa, where a reduction in per capita income is possible in the sub-Saharan countries during the decade. Predictions for the year 2000 show little further improvement, particularly in the low-income countries, with the gap between rich and poor countries continuing to widen. A substantial increase in poor countries' public resources for health by 2000 is possible only if there is a shift in resources from other sectors. This seems unlikely, unless investing in health can be justified more convincingly to ministries of finance and planning, in terms of immediacy of benefit and return on investment.

To what extent are improvements in health dependent on economic progress? Preston's study of the contribution of economic factors to declines in mortality, which uses national income and mortality data from populations in 43 countries between 1938 and 1963, indicates that income is a critical but not major determinant of mortality level.[20] In the aggregate, income growth accounted for only 16 per cent of the improvement in life expectancy in the countries studied. In the subgroup of countries with incomes below $400 per capita, there appeared to be a stronger correlation of income and mortality trends. Nevertheless, Sri Lanka and the state of Kerala in India[21] and the People's Republic of China are examples of countries that have attained a life expectancy close to the level in the industrialized world, with income levels in the range of the least developed countries. The achievements may be explained in part by the public priority given to literacy, food, and health and by special features of social and political organization. Furthermore, as McDermott illustrated in the case of chemotherapy for tuberculosis in blacks in New York City and Maoris in New Zealand, advances in medical technology can be very effective in reducing mortality promptly without any preceding improvement in living standards.[22] These examples are of great importance for the least developed countries, which have such gloomy economic prospects for the next two decades.

In view of the continuing scarcity of public resources, what opportunities exist to supplement a central government's capacity to finance health services by mobilizing support from other sources? The possibility of revenue sharing by local government for local services warrants further exploration, although the capacity of local government to generate tax revenues is limited. In two regions of Senegal 8 per cent of general rural taxes are set aside for health, and in Colombia 35 per cent of the state beer tax is earmarked for hospitals. If these taxes generate new public revenue,

they could expand support for health; otherwise, the process is merely an exercise in allocation.

Social-security schemes based on contributions by employers, employees, and sometimes governments are an important financing mechanism in middle-income countries, particularly in Latin America. The services financed are predominantly curative, and since the benefits are restricted to employees, the schemes cannot be relied on to attain full coverage of low-income populations, many of whom are outside the wage economy. The equity of social-security systems has been questioned, since the public-sector contributions in effect serve to subsidize the better-off segment of the population, and employers may pass on their costs to consumers by raising prices. Private financing of health care has also been undertaken by productive sectors. One of the largest examples is the Colombia Coffee Growers' Association, which in 1978 alone contributed two fifths (41 per cent) of the total operating costs of the rural health-delivery system in that country.*

User fees and contributions in kind from the individual or the community are also important means to supplement financing from government. Many governments resist any form of user charges, for fear of excluding the poor or in the belief that users will not understand the value of the services. Paradoxically, imposition of user charges can have a positive impact on utilization of health services, by increasing the perceived value of services and therefore the demand for them over alternative "free" care. Mission clinics and hospitals have demonstrated the feasibility of recovering a considerable part of their operating costs for selected curative services when quality of care is acceptable. Institution of a pricing policy for selected curative health servcies has been attempted in several countries. The establishment of community pharmacies in the Philippines and of village drug cooperatives in Thailand and Senegal are examples of this approach. Traditional healers and birth attendants practice on a fee-for-service basis and enjoy a high level of community acceptance; with appropriate training, they could serve as a valuable extension of the health system financed by user fees. Village organizations and popular self-help movements such as Saemaul in Korea and Sarvodaya in Sri Lanka illustrate the value of community participation for mobilizing local labor and materials for health facilities and salary support of community health workers. However, local initiatives may lead to disillusionment if they are not supported by appropriate services within the public-health system. Multiple independent initiatives may complicate the evolution of a rational system unless they are developed within a general framework.

China, one of the few low-income countries with a broadly based health-care system, uses a variety of financing devices. In addition to central, provincial, and county-government appropriations and some user fees, health-insurance schemes are also employed. The "public-medical-expenses" scheme is similar to a social-security system covering government employees and students. The "labor-medical-insurance" scheme covers about 10 per cent of the population and is financed by 2 to 3 per cent of factory income before payment of salaries. The large rural population is covered by "cooperative medical services" financed by the participating communes through production "brigade revenue," individual premiums equivalent on average to 1.5 per cent of the family's disposable income, and user fees.[23] All expenditures for preventive health care are borne by the state.

Much work remains to be done in analyzing the effect of prices on the demand for health services in developing countries; the success of the private sector in this area is not necessarily a reliable guide to public-sector pricing policy. Even when a superior public service replaces a private one, the public cannot be assured of capability to collect the same level of charges, since it is less able to refuse services to those unwilling to pay, as has been shown in the case of public water supply. Nevertheless, since private spending is estimated to be three to four times greater than government expenditures on health in many developing countries,[24] it is clearly one of the most important sources of financing to explore.

Mobilization of resources for health from the widest spectrum of alternative sources should be actively pursued, ensuring that these resources are a net addition to public funding rather than a substitute for it. They have the added benefits of reducing the uncertainty associated with total dependence on public funding and of increasing the participation of the individual, community, cooperative, or local government in planning and managing the health services.

In many countries the principal alternative to government financing has been official development assistance from bilateral and multilateral agencies and extensive local contributions by foreign nongovernmental organizations. According to Howard, assistance for health from all external sources totalled $3 billion in 1978 — less than one quarter of the total estimated public and private expenditures on health in the 67 poorest developing countries (excluding China).[24] The largest component, $1,008 million, came from 18 bilateral donors; they allocated approximately 10 per cent of their total concessional assistance to the health sector — a share only exceeded by agriculture, public utilities, and education.[25] In view of the economic difficulties facing industrialized countries, it seems unrealistic for developing countries to rely on any appreciable increase in external assistance for health in real terms to compensate for a shortage in public expenditures. Furthermore, care must be taken to avoid capital expenditures financed by external assistance if the recurrent cost obligations that they create are not in keeping with the pri-

*Figures are based on assigned budget figures from the Colombia Ministry of Health for 1976 (*Financing for the Rural Health Plan from 1976-1980.* Bogota: World Bank Resident Mission [unpublished data]).

orities for use of the limited public funds available for health.

The tendency of governments to discriminate in budget allocations against programs with high recurrent costs in favor of capital-intensive projects is aggravated by the policy of many external donors not to support operating costs. In general, recurrent costs generated per dollar of capital investment are substantially higher for health than for other major public sectors, such as agriculture or transportation, and the ratios are particularly high for primary-health-care programs and rural health centers,[26,27] in which expenditures are mainly for manpower and drugs. This makes these programs very vulnerable to budget cutting by government. In addition, even when general operating expenditures have been met, neglect of maintenance expenses leads to further capital expenditures for rehabilitation or replacement of facilities and equipment — a much more costly approach to sector development. An important consideration in the success of primary health care will be the willingness of governments and external donors to place appropriate priority on the financing of recurrent costs.

Efficiency and Effectiveness of the Use of Resources

National capability to plan and implement strategies and programs that make the best use of scarce resources is seriously deficient in most developing countries. The coexistence of subpopulations with different health needs requires programs that are designed for these groups and not based on national averages. The need to select from among a broad range of possible interventions the most appropriate mix of personnel, facilities, and technologies requires information on relative cost effectiveness, trade-offs between capital investment and recurrent costs, and assessment of the political and administrative feasibility of implementation — for all of these, data are seriously deficient.

Health planning is under a cloud of skepticism because the substantial efforts to date have had little effect on resource-allocation decisions for the health sector in most countries. Much of the planning has been normative, based on international estimates of the number of personnel and hospital beds needed to establish or extend coverage of services rather than on the nature of the health problems of a given population and the most cost-effective methods of solving them. Almost all planning and management have been central, with inadequate understanding of the real constraints on implementation at the operating level.

Matching programs more closely with needs will depend on strengthening planning in several areas. Some initial definition of priorities for the sector is essential. This may be achieved by a review of estimates or epidemiologic measures of the disease profile of representative population groups, clarification of explicit health-sector objectives, and assessment of the technical, political, and administrative feasibility of dealing with the most important problems. From this general framework it should be possible to define population-specific objectives for health investments and to establish targets for reductions in critical sector-development indicators such as infant mortality, malnutrition, fertility, or disease prevalence. Setting targets provides a mechanism not only to assess the value of use of scarce resources but also to monitor and evaluate program performance. Alternative approaches to achieve the targets should be reviewed, and the most cost-effective solution selected, weighing not only technical and financial considerations but also cultural acceptability and feasibility of implementation. This exercise will raise difficult questions about trade-offs: whether to pursue inexpensive short-term symptomatic therapy or more expensive long-term measures to eliminate the cause of disease; the relative merits of interventions in health and in other sectors such as water supply and sanitation; and the choice between disease-specific, vertically organized health services and the multi-purpose, horizontal primary-health-care approach. Walsh and Warren reviewed published reports of infectious and parasitic diseases endemic in tropical countries and concluded that the strategy of intervention should be selective — based on evidence of the contribution of each disease to mortality and morbidity, the efficacy and cost of currently available control measures, and the feasibility of applying these measures.[28] The extensive studies of Morrow and his co-workers in Ghana[29] illustrate the potential value of cost-benefit analysis in sorting out priorities within the health sector and in justifying to the government the investments in health vis-à-vis other sectors. Application of this technique is limited by the difficulty in quantifying benefits in health, the inadequacy of the human-capital approach to life valuation, and the lack of suitable data for analysis in most developing countries.[30,31] In the absence of cost-benefit analysis, unit costs of specific health improvements may be compared in order to identify the least-cost solution. To apply these epidemiologic and economic measurements when planning health programs requires much information and takes time. In many cases, detailed measurements cannot be made, but more vigorous review of available evidence on the health needs of different population groups and the consideration of cost effectiveness in selecting interventions offer the best hope for stretching limited resources to achieve maximum impact on health. In addition to encouraging better policies and practices in the health sector, this should enhance the acceptability of proposals by ministries of health to ministries of planning and finance.

The development of measurement capability for both planning and managing health services has a high priority for health administrators, physicians, and others with leadership responsibility in the health system. This can be best achieved by strengthening existing institutions through mid-career training of

the staff, improving management information systems, and undertaking operational research on health services at central and peripheral levels of the health system.

Financial Feasibility of Primary Health Care

Primary health care has been accepted by the member governments of the WHO as the key to achievement of universal access to health care by 2000. Assuming that the low-income countries will have no more than $3 to $4 per capita per year in public resources to devote to health by 2000, is it possible to achieve the goals envisaged in the primary-health-care approach with this financial constraint?

Evidence from six primary-health projects undertaken in the late 1960s and 1970s in developing countries indicates that marked health improvements can be demonstrated within five years through provision of basic services with annual operating costs ranging from about $0.50 to $3.50 per capita (Table 5).[32,33] When corrected for inflation, these figures would be $1 to $7 per capita in 1981 prices. The results must be interpreted with caution since five of the projects were of a pilot nature; most involved very small populations; the cost data varied greatly. As a rule, they did not include capital investment, training, expenditures beyond the primary level of health care, or the value of expatriate and volunteer labor. The contribution of voluntary health workers is of special importance because they provide a large share of rural health services and because volunteerism may be difficult to sustain over the long term.[34] Although there should be economies in scaling-up to national programs, in fact higher marginal costs would be expected with expansion of primary health care to more widely dispersed populations. Furthermore, political and administrative problems involved in scaling-up would add costs for management, supervision, and support systems. Nevertheless, the results of the pilot projects, adjusted for inflation, are of the same order as the estimates of $1 to $3 by Joseph and Russell[35] and $5 by Patel (unpublished data) for per capita recurrent costs of primary-health-care programs.

An alternative approach to estimating the cost of primary health care is to price the individual components of a model program designed to treat the principal causes of mortality in children in low-income countries, as outlined in a recent WHO discussion paper.[36] The model for a total population of 100,000 would try to provide basic care for children under five years of age (about 17,000), tetanus toxoid, iron and folic acid for pregnant women (about 4000), and contraceptive advice and supplies for fertile women (about 5100 at a 30 per cent level of coverage). On the basis of estimates of the need for immunization against common infectious diseases and for treatment of diarrhea, acute respiratory infections, malaria, and intestinal parasites, and assuming that all patients in need will be treated with the least expensive, effective treatment available, it is possible to calculate the annual cost of drugs and supplies for each condition. For example, to immunize the 4000 children under one year of age against measles, 3200 doses would be required to achieve 80 per cent coverage (recognized as sufficient to halt transmission), which at $0.17 a dose would cost $544 each year. The annual cost of all the drugs, vaccines, and supplies for the model program was $35,000, or $0.35 per capita, for the population as a whole to cover the selected target groups.

The cost of commodities is, of course, only one component. It is necessary to add the cost of salaries of health workers, training, transportation, and maintenance. If these additional costs are in the same proportion to total primary-health-care costs as drugs are in national health budgets (drugs account for 25 per cent according to a conservative estimate[6]), then the total annual recurrent costs for primary health care may be in the range of $1.40. Since annuitized capital costs for primary care are about one third of recur-

Table 5. Impact and Cost of Selected Primary-Health-Care Projects.*

Project	Period Monitored	Estimated Population Covered	Infant Mortality Rate			Child Mortality Rate			Project Cost per Capita
			Base of Study Period	End of Study Period	Per Cent Reduction	Base of Study Period	End of Study Period	Per Cent Reduction	
			deaths/1000 live births			*deaths/1000 children 1–4 yr*			$
Miraj, India	1974–77	230,000	68	23	66	†	†	†	0.50
Jamkhed, India	1971–76	80,000	97	39	60	†	†	†	1.25–1.50
Narangwal, India	1968–73	10,500	128 ‡	70 ‡	45	19 ‡	11 ‡	42	0.80–2.00
Hanover, Jamaica	1973–75	65,000	36	11	69	13–15 §	5–6 §	60	0.40
Deschapelles, Haiti	1968–72	9,600	55	34	38	11	6	45	1.60
Rural Guatemala	1969–72	3,000	150	55	63	28	6	79	3.50

*Sources — Faruqee R, Johnson E. Health, nutrition and family planning: a survey of experiments and special project in India.(unpublished data); World Bank Discussion Paper No. 81-14, Population and Human Resources Division); Gwatkin DR, Wilcox JR, Wray JD. Can health and nutrition interventions make a difference? (Monograph No. 13.) Washington, D.C.: Overseas Development Council, 1980; and Berggren WL, Ewbank DC, Berggren GG. Reduction of mortality in rural Haiti through a primary-health-care program. N Engl J Med. 1981; 304:1324-30.

†Data not available.

‡Comparison of average rates for 1970-73 in medical-care intervention and control areas. Child mortality reflects deaths in children 12 to 36 months of age per thousand children in that age group.

§Child mortality reflects deaths in children 1 to 48 months of age per thousand children in that age group.

rent costs,[26,27] $0.45 to $0.50 may be added to cover capital investments. The combined capital and recurrent costs of the primary-health-care program would be under $2 per capita per year, well within the financial reach of low-income countries.

The fragility of the assumptions involved in multiplying the commodity costs is acknowledged. The model itself is relatively insensitive to changes in the assumptions about the commodities with the exception of the contraceptive prevalence rate. (Increasing contraceptive prevalence to half the women at risk would increase per capita costs of commodities from $0.35 to $0.43.) A more important factor is the assumption that the primary-health-care worker will provide early diagnosis and treatment. For example, if treatment of diarrhea were delayed so that 50 per cent of children rather than 10 per cent required intravenous fluids and antibiotics, the cost of commodities would be increased from $0.35 to $0.62 per capita. The model also assumes encouragement of breast-feeding and nutrition education of mothers and children at nominal cost, but if food supplements are added, the cost of the package of commodities would be substantially increased. Using data from Project Poshak in India[37] on the cost of the basic food supplements, adjusted for inflation and an assumed 30 per cent prevalence of malnutrition, as reported in several national nutrition surveys, the added cost would be $0.71 per capita — twice the cost of supplies for the basic health and nutrition interventions. Provision of rural water supply, which might be proposed in addition to or as an alternative to primary health services, is estimated to cost $5 per capita, of which approximately half would be annuitized capital cost.[38] (This estimate is based on a reported capital cost of $26 per capita in 1977[38] annuitized at a 10 per cent discount rate and including complementary operation, maintenance, and support costs.)

The value of the modeling exercise is limited by the pyramid of assumptions on which the calculations are based. More important than the results, however, is the process involved in developing the model, which illustrates the trade-offs that countries must consider in determining the balance of services to be provided to their population. The process of choosing the most cost-effective approaches to meeting health needs is the essence of the planning and decision-making process outlined above.

Conclusions

Developing countries face the challenge of coping with a heavy burden of illness that differs markedly in subgroups of the population at different stages of development. The greatest improvement in life expectancy from health investments can be expected in the rural and peri-urban poor through a program that provides maternal and child health services, including control of the major infectious and parasitic diseases of children under five. Effective technology for such a program is now available and affordable even within the financial constraints of the least developed countries. Two major problems remain: the first is the political will to allocate the necessary resources for the program, and the second is the management capability to organize and operate a system of services for the rural and peri-urban populations that use multi-purpose community-health workers.

No satisfactory strategy has been developed to meet the health needs of older children and adults within the financial means of most developing countries. There are relatively few simple, effective interventions to control the metabolic, vascular, degenerative, and malignant diseases of the adult population, and there is little understanding of the behavioral disorders. Without new technologies for control and prevention, it is unlikely that the poorer developing countries will be able to provide more than symptomatic care for most patients with these health problems. Furthermore, adoption of the expensive technologies now used for the diagnosis and treatment of these diseases in the industrialized world will divert the limited resources available for programs for the rural and peri-urban poor to sophisticated, hospital-based, urban services, which will have, at best, a marginal impact on health.

The search for health technology appropriate to the financial and organizational circumstances of developing countries must be seen as a high priority for the research and development community of the entire world. Existing technology must be critically evaluated, and new, simpler techniques developed for the control and prevention of common chronic diseases. Greater attention should be given to research and development on the "tropical" diseases, which are a major component of the disease burden of developing countries but have been largely neglected by the world's scientific community. Pharmaceuticals are of special importance since the timely supply of essential drugs is critical to the quality of health care and the credibility of community health workers. The dangers of excessive use or inappropriate choice of drugs necessitate the introduction of policies on procurement, prescription, pricing, and quality control to avoid health hazards and excessive costs.

Financial constraints will be an overriding consideration in the development of the health sector for the foreseeable future, particularly in the least developed countries. The poorest countries that now have public expenditures on health averaging only $2.60 per capita per year also have the least favorable economic prospects for the next decade. Greater efforts are required to mobilize resources for health from other sources, particularly the private sector, and to ensure that the limited resources available from all sources are used in the most cost-effective manner. Few developing countries have the institutional capability to select health interventions on the basis of expected health impact, least cost, and feasibility of implementation, and to integrate independent facilities, practitioners, and disease-specific programs into a

more coherent, economical, multipurpose system. A high priority should be given to strengthening the capability of administrators, physicians, and other personnel in positions of leadership in the health system at central and local levels in order to develop a population perspective in the analysis of health problems, a cost-effectiveness attitude toward the use of resources, and management skills appropriate for a human-services organization. More efficient management of health services is only one aspect of the problem. It is equally important to mobilize communities and individuals to take a more active role in promoting health and in financing health services, rather than to rely passively on a government system.

Scarcity of money for health is a critical limitation on progress toward the goal of "Health for All by the Year 2000." More money alone, however, will not produce the desired outcome unless there is a political commitment to programs for those in greatest need, as well as the managerial capability to implement them. This is first and foremost a challenge for developing countries, but it is also a consideration in the investment policies of donor agencies. Progress toward the goal of "Health for All" can be accelerated if more external assistance can be provided for the areas of greatest need and if the unique scientific and technologic resources of the industrialized world can be made available to developing countries, to strengthen their institutions and to collaborate in the development of appropriate technology to meet their needs.

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SPECIAL ARTICLE

SHATTUCK LECTURE — HEALTH CARE IN THE DEVELOPING WORLD: PROBLEMS OF SCARCITY AND CHOICE

JOHN R. EVANS, M.D., KAREN LASHMAN HALL, M.P.A., AND JEREMY WARFORD, PH.D.

THE World Health Organization (WHO) and UNICEF, together with representatives of 134 member governments, launched a campaign in 1978 to achieve "Health for All by the Year 2000" through primary health care.[1,2] The objective of this campaign was to increase the political commitment of member countries to address the health needs of their people and particularly to improve the health status of the rural and urban poor in the Third World. Our presentation describes the difficulties of putting this objective into practice, and what may be possible on the very limited budget available for health in most developing countries.

WHO and UNICEF might well have found the text for their plan in the *Report of the Sanitary Commission of Massachusetts,* which Lemuel Shattuck presented to the Massachusetts state legislature in 1850.[3] The report was based on a careful survey of the health status of the population of Massachusetts, and its recommendations embodied the essential elements of primary health care: immunization and communicable-disease control; promotion of child health; improved housing for the poor; environmental sanitation; training of community-oriented health manpower; public-health education; promotion of individual responsibility for one's own health; mobilization of community participation through sanitary associations; and creation of multidisciplinary boards of health to assess health needs and plan programs in response to sound epidemiologic evidence. Recognizing the importance of political commitment, Shattuck built a strong public-health constituency by highlighting both the major differences in life expectancy between rural areas and Boston and the deterioration of health status over a decade in major cities in the United States.

The conditions described by Shattuck in the United States in 1850 prevail today in most countries of the developing world (Table 1).[4-6] In low-income countries, life expectancy at birth averages only 51 years, and in several it is less than 45 years. Mortality rates are 10 to 20 times higher for infants and for children aged one to four than in developed countries. Nearly half of all deaths occur in children under five years of age. The major causes are diarrheal diseases, respiratory infections, tetanus, and childhood infectious diseases such as diphtheria, measles, and whooping cough, all of which can be effectively and cheaply controlled by measures used in developed countries. Malnutrition is important as an associated — and even primary — cause of death in young children, and short birth intervals adversely affect the survival of infants. For those who reach the age of five, life expectancy is only eight to nine years less than in developed countries. The commonest causes of death are similar to those in industrialized countries: cancer, cerebrovascular disease, heart disease, respiratory disease, and trauma. However, in developing countries, tuberculosis ranks among the most common causes of death. These nations are also plagued with endemic diseases such as malaria, schistosomiasis, trypanosomiasis, onchocerciasis, and leprosy, which are major causes of serious morbidity and mortality in

Table 1. Health-Related Indicators in Countries with Different Income Levels.[6]

INDICATOR	YEAR	LOW-INCOME COUNTRIES *	MIDDLE-INCOME COUNTRIES †	INDUSTRIALIZED COUNTRIES ‡
Gross national product per capita ($)	1979	240	1420	9440
Crude birth rate (births/1000 population)	1979	42	34	15
Crude death rate (deaths/1000 population)	1979	16	10	10
Life expectancy at birth (yr)	1979	51	61	74
Infant mortality rate (deaths/1000 live births) §	1978	(49–237)	(12–157)	13
Child mortality rate (deaths/1000 children 1–4 yr old)	1979	18	10	1
Per cent of population with access to safe water	1975	25	58	¶
Daily per capita calorie supply (% of requirement) ‖	1977	96	109	131
Adult literacy rate (%)	1976	43	72	99

*Thirty-four low-income developing countries with a per capita income of $370 or less in 1979 (China and India are excluded from the low-income group in this table).

†Sixty middle-income developing countries with a per capita income of more than $370 in 1979.

‡Eighteen industrial-market economies.

§Weighted averages; figures in parentheses denote the sample range.

¶Data not available but assumed to be close to 100 per cent.

‖Requirements based on calories needed to sustain a person at normal levels of activity and health, taking into account age and sex distributions, average body weights, and environmental temperatures, as estimated by the United Nations Food and Agriculture Organization.

From the Population, Health and Nutrition Department, World Bank, 1818 H St., N.W., Washington, DC 20433, where reprint requests should be addressed to Dr. Evans.

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adults and children, but for which effective control measures have not been available or have proved difficult to implement or maintain.

Even in middle-income countries, more favorable national statistics in the aggregate disguise wide disparities between the conditions, on the one hand, of the rural and peri-urban poor that are typical of low-income countries and the conditions, on the other hand, of more affluent urban dwellers who are better educated and have better access to health services and whose health status closely resembles the profile in industrialized countries. Table 2 contrasts the high mortality rates for infectious and parasitic diseases in the less developed northeastern and frontier regions of Brazil with the high rates for cancer and cardiovascular diseases in the more affluent southeastern region of the country. As economic development proceeds, the more prosperous regions of the country have the advantages of greater individual and collective wealth and greater political leverage. Consequently, national health policies give priority to their needs, and the limited resources of hospitals, equipment, drugs, physicians, and other health personnel are concentrated in the urban areas, widening the gap between urban and rural populations.[7]

In the push for development, particularly industrial and commercial development, protective measures for workers and the environment usually lag behind, as they did in the earlier stages of developed countries. These measures are often disregarded because they are initially expensive, and can generally be enforced only by firm legislation and inspection. Rapid development accelerates the appearance of new health problems such as traffic accidents, work accidents, accidental poisoning, and environmental pollution. Similarly, disruption of families and community, migration, and unemployment contribute to a variety of disorders of individual behavior — alcoholism, violence, promiscuity — each with attendant physical and mental risks, counterparts of those seen in industrialized countries.

Urban problems will increasingly dominate the health pattern of the developing world. According to United Nations projections, the urban population in developing countries will increase by 1.32 billion between 1975 and 2000; by 2000 it will average 43 per cent of the population of the less-developed regions overall, and 75 per cent of the population of countries in Latin America.[8] The primary-health-care approach for rural health problems may need to be modified to address different problems arising from life styles and diets in the urban setting. For example, recent analyses indicate that in several countries there are large numbers of malnourished urban dwellers, and that their numbers are increasing more rapidly than those of the rural malnourished.[9]

Table 2. Regional Variations in Cause-Specific Mortality in Brazil, 1970.*

Cause of Death	Region		
	Northeast	Frontier	Southeast
	per cent of all deaths		
Infectious and parasitic diseases	24.5	26.6	11.2
Neoplasms and cardiovascular diseases	21.1	19.1	42.1

*Adapted from de Carvalho AVW, de Moura Ribeiro E. Estudo da Mortalidade proporcional, segundo Grupos de Idade e Causas de Obito, em algunas Capitais Brasileiras, em 1970. Revista Brasileira de Estatistica. 1976; 37(148):475 (as reported in World Bank. *Brazil: Human Resources Special Report.* Washington, D.C., October 1979).

Stages in the Evolution of Health Systems

The pattern of diseases in northern Europe and the United States evolved in stages over the past two centuries, and with each stage distinctive control measures were introduced.

The first stage, dominated by major and minor infectious diseases linked to poverty, malnutrition, and poor personal hygiene, responded slowly to improved food supply, housing, and literacy made possible by greater prosperity, and to public-health measures, particularly safe water supply, sanitation, and immunization campaigns. The steady decline in infant mortality (Table 3) and the reduction in child mortality as a percentage of all deaths (Table 4) may be attributed to these changes. As scientific advances provided a wide array of immunologic and therapeutic techniques to control acute bacterial and viral infections, life expectancy increased, and heart disease, cancer, and stroke replaced respiratory and gastrointestinal infections as the principal causes of death. For example, in the United States in 1900, the three leading causes of death (influenza and pneumonia, tuberculosis, and gastroenteritis) accounted for over 30 per cent of all deaths, whereas heart disease, cancer, and strokes were responsible for 18 per cent of deaths. By 1975, only influenza and pneumonia (3 per cent) ranked in the top 10 causes of death, whereas heart diseases (38 per cent), cancer (20 per cent), and stroke (10 per cent) together accounted for over two thirds of all deaths.[10]

The second stage in the evolution has been dominated by chronic diseases, particularly cardiac and cerebrovascular diseases, cancer, diabetes, arthritis, and mental disorders. As the threat of infectious diseases receded, public-health measures were relegated to a regulatory role, and personal health services became the primary channel for prevention and treatment of health problems. The development of expensive and complicated technology for diagnosis and treatment has led to the transfer of care from doctors' offices to elaborate and expensive hospitals. Doctors and patients have looked to these curative techniques and facilities to provide striking improvements in health. Sadly, experience has shown that for many problems the benefits hoped for have not been realized. As Cochrane has noted, the massive public and private expenditures on health, now close to $1,000 per capita annually for capital and recurrent costs in

Table 3. Infant Mortality in Selected Countries, 1750-1975.*

Period	Country		
	Sweden	France	United States
	no. of deaths/1000 live births		
1751–1755	206	277	†
1851–1855	149	166	†
1901–1905	91	141	124
1971–1975	10	14	18

*Source — Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Démographie, Université Catholique de Louvain, Ordina Editions, 1980:147-9.

†Data not available.

the wealthier industrialized countries, have not produced commensurate improvement in the health status of the population.[11] Only a small proportion of the interventions used are of proved effectiveness, and the benefits to be gained from the intensive services for terminal illnesses are at best marginal.

A third stage of evolution can now be defined. It reflects a shift from preoccupation with intrinsic disorders of structure and function of the body, to an awareness of the health hazards arising from environmental exposure to an increasing number of chemicals, drugs, and other toxic substances and from changes in the social conditions of the family, community, and workplace that influence behavior and life style and are associated with absenteeism, violence and alcohol and drug abuse of epidemic proportions. The personal health-care system concentrates on the consequences of such processes. New approaches are needed to encourage the healthy to avoid patterns of behavior that lead to disease, and to identify and treat the social and environmental causes of disease that originate in the community. Industrialized countries have recently recognized the importance of this third stage and the need to adapt their health systems to give greater emphasis to health promotion and preventive measures at individual and community levels.[12,13] This stage is not new. These concerns provided much of the impetus for reform of industrial and other health practices for well over a hundred years. The meaning of the third stage is a return to the recognition that responsibility for health should not be exclusively the prerogative of the health professions — that protective and preventive measures have to be the responsibility of the individual and the society.

Industrialized countries have evolved through the three stages over the course of more than a century (Table 3). In contrast, developing countries face the challenge of coping with all three stages simultaneously: the rural and peri-urban poor who constitute a majority of the population are in the first stage; the influential, more affluent urban dwellers are at the second stage; and manifestations of the third stage are already apparent because of environmental deterioration and the social disruption associated with massive urban growth and unemployment. Furthermore, developing countries must cope with just a fraction of the financial and human resources available to their industrialized counterparts. In any circumstances, but particularly in these, the strategy to improve health must be selective. Success will depend heavily on correctly identifying the most important problems in each population group, selecting the most cost-effective interventions, and managing the services efficiently. Uncritical acceptance of new and expensive high technology will not serve the purposes of developing countries. But developed countries do have much to offer through scientific and technical cooperation. Already, developing countries, by taking advantage of the innovations in the industrialized world (vaccines, microbiologic techniques, and antibiotics, for example) have achieved much faster rates of improvement in health status than those achieved in northern Europe and the United States. However, there are signs that this rate of progress is not being sustained. As Gwatkin and Brandel pointed out (unpublished data), life expectancy in the less-developed regions of the world, which had been rising by 0.64 year annually between 1950 and 1960, slowed to 0.40 year annually 15 years later. Several factors stand out as impediments to progress.

Obstacles to Progress

Uneven Distribution of Health Services

Access to health services is very uneven, and large segments of the rural population are not reached. Health facilities and personnel are concentrated in urban areas, and within the urban population the services are oriented to the middle-income and upper-income groups, neglecting the peri-urban poor. Political considerations may override all other priorities, and little progress can be expected unless there is a political commitment to apply resources where the need is greatest.

There is a shortage of skilled health personnel, particularly in the poorer countries. National averages for physician:population ratios are reported to be 1:17,000 in the least developed countries and 1:2700 in other developing countries, as compared with 1:520 in developed countries. The nurse:population ratios are 1:6500, 1:1500, and 1:220, respectively.[5] These

Table 4. Child Mortality in Belgium, 1880-1970.*

Year	Age Group		Total (0–5 yr)
	<1 yr	1–5 yr	
	per cent of all deaths		
1880	27.7	13.3	41.0
1900	27.4	9.0	36.4
1920	17.7	4.1	21.8
1950	7.5	1.0	8.5
1970	2.5	0.04	2.6

*Adapted from Arriaga E, Boulanger PM, Bourgeois-Pichat J, et al. La Mortalité des Enfants dans le Monde et dans l'Histoire. Liege, Belgium: Departement de Demographie, Université Catholique de Louvain, Ordina Editions, 1980:127.

national averages disguise the fact that in some rural areas there may be only one doctor serving 40,000 to 200,000 people. Furthermore, the pyramid of health manpower is inverted, particularly in the least developed countries. Instead of a broad base of inexpensively trained, less skilled personnel working at the community level, priority has been given to expensive training programs for "conventional" doctors, who expect sophisticated facilities and equipment, gravitate to practice in the cities, and have a propensity to emigrate. To achieve effective coverage of the population, large numbers of less skilled personnel need to be trained, and these health workers need to be part of a system that will provide supervision, drugs and supplies, and the support services necessary for their practice. Otherwise dissatisfaction will lead to high turnover of health workers and low utilization of their services as patients bypass the first level of care in the community in favor of higher-level facilities, which properly should function as referral centers. Doctors are key participants in the referral and supervisory systems; if they operate as primary-care workers, their expensive training is wasted and the cost of their practice may outweigh the benefits. The supervisory and managerial role of the physician in the health system must be addressed more directly in the process of medical education and in the career development and rewards for the physician in practice.[14]

Lack of Appropriate Technology

A second obstacle to progress is the lack of appropriate technology to address Stage 2 and Stage 3 health problems and to cope with the serious endemic diseases prevalent in the developing world. For Stage 1 health problems, much of the technology needed is already available, and in the case of vaccines technologic advances that would reduce dependence on the cold chain are imminent. In contrast, for Stage 2 health problems, relatively few technologies for dealing with the serious diseases of the adult population are appropriate to the circumstances and financial resources of less developed countries. Most of the technologies that are being transferred from the developed world are expensive, and the equipment is often difficult to maintain. It is necessary to determine which interventions are effective and which yield large benefits at acceptable costs. The greater challenge is in the search for preventive measures to reduce the large burden of illness from cancer, hypertension, diabetes, respiratory, cardiac, and cerebrovascular disease. For Stage 3 health problems, we are still handicapped by inadequate understanding of behavior and the links between social and environmental hazards and specific diseases. We have much to learn about conveying health-education messages, motivating community participation, and using modern communications technology to circumvent the barrier of illiteracy.

The "tropical diseases" (e.g., malaria, schistosomiasis, filariasis, trypanosomiasis, and leprosy) are a particular problem for developing countries, in part because they generally have climates and ecologies conducive to disease vectors. Techniques for ecologic control of vectors or transmission routes are available but are expensive and require repeated application over wide areas. Treatment of patients is generally expensive, sometimes risky, and often delayed. Prophylactic measures such as vaccination are largely undeveloped. Knowledge of the biology of the diseases is far from complete. Research on these diseases has so far been largely neglected by the scientific community and the pharmaceutical industry, which have been preoccupied with cancer, cardiovascular disorders, and the other major diseases of the industrialized world. The Special Program for Research and Training in Tropical Diseases led by the WHO is an attempt to mobilize the health-science research community throughout the world to focus attention on these neglected tropical diseases in order to discover appropriate technologies for their control.

The scientific and development resources of the developing countries are limited, and their problems are difficult to solve. The most promising results will come from combining the scientific and technologic potential of the industrialized world with the local knowledge of scientists and professionals in developing countries who will have responsibility for applying the new technologies.

Pharmaceutical Policies

The most widely used technologies in health are drugs and vaccines. Shortages of supplies and failure to provide for the timely distribution of drugs and vaccines are serious problems that must be overcome for an effective health program. In looking to the future, however, the problems may be excessive and irrational use of drugs and unsustainable costs to the health system. Patients who consult health personnel expect to receive a prescription or, in some cultures, an injection. As access to health services broadens with the implementation of primary-health-care programs, a rapid increase in the consumption of drugs may be expected. Experience in less-developed countries supports this contention. In China, with nearly universal access to health care, curative medicine occupies 90 per cent of the time of "barefoot" doctors, and nearly all patients receive medication; there is evidence that drugs and traditional medicines account for two thirds of overall health expenditures. In countries with less complete coverage of the population, expenditures on drugs constitute about 40 to 60 per cent of the health budget (as compared with 15 to 20 per cent in developed countries[15]) and over half of private health expenditures. In most developing countries, the majority of drugs are imported, and these outlays are a considerable drain on foreign exchange.

The importance of drugs to the quality of health care, to the credibility of community health workers, to the development of iatrogenic disease (for exam-

ple, from toxicity or antibiotic-resistant microorganisms), and to the cost of health services makes it imperative that developing countries establish better mechanisms for assessing drug requirements and for purchasing, quality control, storage, and distribution of drugs. Experience in Tanzania and Ghana indicates that savings of up to 70 per cent of the budget for pharmaceuticals could be achieved by promoting generic alternatives and introduction of controls against overprescription.[16,17] The South Pacific Pharmaceutical Scheme projects cost savings of at least 25 per cent through limiting the availability of nonessential drugs and through bulk purchasing.[18] Without policies for national formularies, procurement, prescription, and pricing, this powerful and ubiquitous health technology could become more of a liability than an asset to the health system.

Management of Health Resources

One of the most difficult and pervasive problems to solve in the establishment of effective health services in developing countries will be deficiencies in management. The health sector presents a formidable organizational challenge. Some of its objectives can be achieved only with the cooperation of other sectors such as water supply and sanitation, education, agriculture, and community development. The delivery of health services involves widely dispersed facilities, numerous categories of personnel, general and specialized hospitals, vertically organized programs to control individual diseases such as malaria, tuberculosis, leprosy, or venereal disease — each with its own personnel and support services, community health-care programs with multipurpose workers, and a system of indigenous medicine with traditional healers and birth attendants. The different elements need to be organized to reduce conflict and duplication between programs and to provide a coherent system to screen and treat patients according to the level of care required and to refer patients with difficult problems. Supervision and continuous in-service education of health workers, improved logistics and supply to maintain credible services, institution of personnel policies and rewards to maintain the quality, distribution, and morale of staff, and policies and financial arrangements that encourage rational use of the health resources by the public are essential corollaries to enhance sector performance.

The weakest links in the administrative chain of most developing countries are institutions at district and local levels, which are usually poorly staffed, have inadequate authority or control of resources, and are unable to provide the necessary support and supervision of field staff. The development of planning and administrative capability at the district level is of special importance, since this is normally the lowest tier of the health-services organization still communicating directly with central government but also in contact with the villages, aware of their needs, and in a position to encourage community participation. It is at this level that matching of health needs and resource allocation is most likely to occur.[19] Community-based non-governmental organizations active in health care may make an important contribution to the process of devolution of administrative responsibility.

The management of a system of health services is much more than the management of its facilities and support systems. It involves decisions about priorities and resource allocation that are based on the health needs of the population to be served. This epidemiologic perspective is missing from the training of many of those in positions of responsibility, and the information system on which to base such management decisions is typically inadequate. Management also involves gaining the cooperation and compliance of highly independent professionals and specialists who have their own constituencies and political support.

The medical profession is of special importance because of the profound steering effect of individual clinical decisions on the demand for expensive facilities and the consumption of resources for diagnosis and treatment. Most practicing physicians give relatively little weight to consideration of the efficacy of these procedures and almost no attention to the real cost and foregone opportunities in terms of resources used. Abel Smith (personal communication) has estimated that the consequential costs generated by the average medical specialist in Great Britain are on the order of £500,000 per year; if eliminating unnecessary procedures reduced expenditures by 10 per cent, the savings nationwide would be enormous. In developing countries, the secondary-health-system costs generated by physicians are smaller, largely because of the absence of much of the high-cost diagnosis and treatment modes, but the same problem exists as in developed countries, and the implications are more serious because of the much more limited resources available for health. To give priority to medical education and to a reward system for physicians is to place clinical decisions about the individual patient in the context of the health needs of the population and to promote more discriminating use of scarce resources for diagnosis and treatment based on evaluation of the effectiveness and the cost of these procedures. These decisions involve difficult ethical judgments. The concepts behind these decisions have only recently been introduced into medical education and health-services administration in developed countries.[14]

Poverty

Money alone will not ensure good health. However, in the opinion of most development specialists, the overriding constraint to improving health status in the least developed countries is the extreme poverty of most of the population and the low level of the gross national product per capita (below $400). Health must compete with other pressing developmental needs for extremely limited public resources.

The problem is made worse by the rapid growth in population, which averages 2.4 per cent per year among developing countries as a group and reaches nearly 4 per cent per year in Kenya; at this rate, the population of Kenya will double in 17 years. At current average annual growth rates, half the population will be under 15 years of age; and demands for employment, housing, and all basic services will increase rapidly. Public expenditures on health will have to increase commensurately just to "hold the line" on current levels of quality and coverage of services. Since population is the critical denominator of all development activities, with such limited resources reduction of fertility will be a decisive factor in attempts to improve services such as health care. At the same time, wider coverage of the population with effective services for maternal and child health and family planning is a necessary part of any strategy to reduce population growth.

Given the extremely limited resources and the rapid growth in population, several basic questions need to be addressed. First of all, what are the prospects for increased public expenditures on health, and to what extent are improvements in health dependent on economic progress? What other sources of financial support might be mobilized? Secondly, can existing resources be used more effectively? And thirdly, within these constraints is "Health for All" through primary health care feasible?

Financing of Health Services

Analysis of health expenditures in developing countries is hampered by a lack of satisfactory financial information on programs operated by different levels of government and the private sector. The available data indicate striking differences in the levels of current total public expenditures on health for capital and operating purposes, with average figures of $2.60 per capita per year in the poorest countries (1.1 per cent of the gross national product), $19 in middle-income developing countries (1.2 per cent of the gross national product), and $469 in industrialized countries (4.4 per cent of the gross national product). The combined public and private health expenditures in the United States and several northern European countries are close to $1,000 per capita per year — more than 100 times the level in the poorest group of countries. At the other extreme, a few of the poorest countries — Bangladesh, Ethiopia, Indonesia, and Zaire — have annual public expenditures on health of only $1 per capita. Since recurrent expenditures are concentrated in urban areas where hospitals and specialized manpower are located, it may be concluded that the resources available to operate health services for the rural population are very limited and in the poorest group of countries average substantially less than $1 per capita.

During the decade 1980-1990 the average annual growth in gross national product per capita is estimated to be 2.1 to 2.3 per cent in middle-income oil-importing countries, and 0.7 to 1.8 per cent in low-income countries.[6] Assuming that public expenditures for health remain at the same proportion of the gross national product as in 1977, the allocation for health in low-income countries may be expected to increase by only $0.40 to $0.80, to a level of $3 to $3.40 per capita per year by 1990; the increment will be only $0.20 to $0.50 in Asia and even lower in Africa, where a reduction in per capita income is possible in the sub-Saharan countries during the decade. Predictions for the year 2000 show little further improvement, particularly in the low-income countries, with the gap between rich and poor countries continuing to widen. A substantial increase in poor countries' public resources for health by 2000 is possible only if there is a shift in resources from other sectors. This seems unlikely, unless investing in health can be justified more convincingly to ministries of finance and planning, in terms of immediacy of benefit and return on investment.

To what extent are improvements in health dependent on economic progress? Preston's study of the contribution of economic factors to declines in mortality, which uses national income and mortality data from populations in 43 countries between 1938 and 1963, indicates that income is a critical but not major determinant of mortality level.[20] In the aggregate, income growth accounted for only 16 per cent of the improvement in life expectancy in the countries studied. In the subgroup of countries with incomes below $400 per capita, there appeared to be a stronger correlation of income and mortality trends. Nevertheless, Sri Lanka and the state of Kerala in India[21] and the People's Republic of China are examples of countries that have attained a life expectancy close to the level in the industrialized world, with income levels in the range of the least developed countries. The achievements may be explained in part by the public priority given to literacy, food, and health and by special features of social and political organization. Furthermore, as McDermott illustrated in the case of chemotherapy for tuberculosis in blacks in New York City and Maoris in New Zealand, advances in medical technology can be very effective in reducing mortality promptly without any preceding improvement in living standards.[22] These examples are of great importance for the least developed countries, which have such gloomy economic prospects for the next two decades.

In view of the continuing scarcity of public resources, what opportunities exist to supplement a central government's capacity to finance health services by mobilizing support from other sources? The possibility of revenue sharing by local government for local services warrants further exploration, although the capacity of local government to generate tax revenues is limited. In two regions of Senegal 8 per cent of general rural taxes are set aside for health, and in Colombia 35 per cent of the state beer tax is earmarked for hospitals. If these taxes generate new public revenue,

they could expand support for health; otherwise, the process is merely an exercise in allocation.

Social-security schemes based on contributions by employers, employees, and sometimes governments are an important financing mechanism in middle-income countries, particularly in Latin America. The services financed are predominantly curative, and since the benefits are restricted to employees, the schemes cannot be relied on to attain full coverage of low-income populations, many of whom are outside the wage economy. The equity of social-security systems has been questioned, since the public-sector contributions in effect serve to subsidize the better-off segment of the population, and employers may pass on their costs to consumers by raising prices. Private financing of health care has also been undertaken by productive sectors. One of the largest examples is the Colombia Coffee Growers' Association, which in 1978 alone contributed two fifths (41 per cent) of the total operating costs of the rural health-delivery system in that country.*

User fees and contributions in kind from the individual or the community are also important means to supplement financing from government. Many governments resist any form of user charges, for fear of excluding the poor or in the belief that users will not understand the value of the services. Paradoxically, imposition of user charges can have a positive impact on utilization of health services, by increasing the perceived value of services and therefore the demand for them over alternative "free" care. Mission clinics and hospitals have demonstrated the feasibility of recovering a considerable part of their operating costs for selected curative services when quality of care is acceptable. Institution of a pricing policy for selected curative health servcies has been attempted in several countries. The establishment of community pharmacies in the Philippines and of village drug cooperatives in Thailand and Senegal are examples of this approach. Traditional healers and birth attendants practice on a fee-for-service basis and enjoy a high level of community acceptance; with appropriate training, they could serve as a valuable extension of the health system financed by user fees. Village organizations and popular self-help movements such as Saemaul in Korea and Sarvodaya in Sri Lanka illustrate the value of community participation for mobilizing local labor and materials for health facilities and salary support of community health workers. However, local initiatives may lead to disillusionment if they are not supported by appropriate services within the public-health system. Multiple independent initiatives may complicate the evolution of a rational system unless they are developed within a general framework.

China, one of the few low-income countries with a broadly based health-care system, uses a variety of financing devices. In addition to central, provincial, and county-government appropriations and some user fees, health-insurance schemes are also employed. The "public-medical-expenses" scheme is similar to a social-security system covering government employees and students. The "labor-medical-insurance" scheme covers about 10 per cent of the population and is financed by 2 to 3 per cent of factory income before payment of salaries. The large rural population is covered by "cooperative medical services" financed by the participating communes through production "brigade revenue," individual premiums equivalent on average to 1.5 per cent of the family's disposable income, and user fees.[23] All expenditures for preventive health care are borne by the state.

Much work remains to be done in analyzing the effect of prices on the demand for health services in developing countries; the success of the private sector in this area is not necessarily a reliable guide to public-sector pricing policy. Even when a superior public service replaces a private one, the public cannot be assured of capability to collect the same level of charges, since it is less able to refuse services to those unwilling to pay, as has been shown in the case of public water supply. Nevertheless, since private spending is estimated to be three to four times greater than government expenditures on health in many developing countries,[24] it is clearly one of the most important sources of financing to explore.

Mobilization of resources for health from the widest spectrum of alternative sources should be actively pursued, ensuring that these resources are a net addition to public funding rather than a substitute for it. They have the added benefits of reducing the uncertainty associated with total dependence on public funding and of increasing the participation of the individual, community, cooperative, or local government in planning and managing the health services.

In many countries the principal alternative to government financing has been official development assistance from bilateral and multilateral agencies and extensive local contributions by foreign nongovernmental organizations. According to Howard, assistance for health from all external sources totalled $3 billion in 1978 — less than one quarter of the total estimated public and private expenditures on health in the 67 poorest developing countries (excluding China).[24] The largest component, $1,008 million, came from 18 bilateral donors; they allocated approximately 10 per cent of their total concessional assistance to the health sector — a share only exceeded by agriculture, public utilities, and education.[25] In view of the economic difficulties facing industrialized countries, it seems unrealistic for developing countries to rely on any appreciable increase in external assistance for health in real terms to compensate for a shortage in public expenditures. Furthermore, care must be taken to avoid capital expenditures financed by external assistance if the recurrent cost obligations that they create are not in keeping with the pri-

*Figures are based on assigned budget figures from the Colombia Ministry of Health for 1976 (*Financing for the Rural Health Plan from 1976-1980.* Bogota: World Bank Resident Mission [unpublished data]).

orities for use of the limited public funds available for health.

The tendency of governments to discriminate in budget allocations against programs with high recurrent costs in favor of capital-intensive projects is aggravated by the policy of many external donors not to support operating costs. In general, recurrent costs generated per dollar of capital investment are substantially higher for health than for other major public sectors, such as agriculture or transportation, and the ratios are particularly high for primary-health-care programs and rural health centers,[26,27] in which expenditures are mainly for manpower and drugs. This makes these programs very vulnerable to budget cutting by government. In addition, even when general operating expenditures have been met, neglect of maintenance expenses leads to further capital expenditures for rehabilitation or replacement of facilities and equipment — a much more costly approach to sector development. An important consideration in the success of primary health care will be the willingness of governments and external donors to place appropriate priority on the financing of recurrent costs.

Efficiency and Effectiveness of the Use of Resources

National capability to plan and implement strategies and programs that make the best use of scarce resources is seriously deficient in most developing countries. The coexistence of subpopulations with different health needs requires programs that are designed for these groups and not based on national averages. The need to select from among a broad range of possible interventions the most appropriate mix of personnel, facilities, and technologies requires information on relative cost effectiveness, trade-offs between capital investment and recurrent costs, and assessment of the political and administrative feasibility of implementation — for all of these, data are seriously deficient.

Health planning is under a cloud of skepticism because the substantial efforts to date have had little effect on resource-allocation decisions for the health sector in most countries. Much of the planning has been normative, based on international estimates of the number of personnel and hospital beds needed to establish or extend coverage of services rather than on the nature of the health problems of a given population and the most cost-effective methods of solving them. Almost all planning and management have been central, with inadequate understanding of the real constraints on implementation at the operating level.

Matching programs more closely with needs will depend on strengthening planning in several areas. Some initial definition of priorities for the sector is essential. This may be achieved by a review of estimates or epidemiologic measures of the disease profile of representative population groups, clarification of explicit health-sector objectives, and assessment of the technical, political, and administrative feasibility of dealing with the most important problems. From this general framework it should be possible to define population-specific objectives for health investments and to establish targets for reductions in critical sector-development indicators such as infant mortality, malnutrition, fertility, or disease prevalence. Setting targets provides a mechanism not only to assess the value of use of scarce resources but also to monitor and evaluate program performance. Alternative approaches to achieve the targets should be reviewed, and the most cost-effective solution selected, weighing not only technical and financial considerations but also cultural acceptability and feasibility of implementation. This exercise will raise difficult questions about trade-offs: whether to pursue inexpensive short-term symptomatic therapy or more expensive long-term measures to eliminate the cause of disease; the relative merits of interventions in health and in other sectors such as water supply and sanitation; and the choice between disease-specific, vertically organized health services and the multi-purpose, horizontal primary-health-care approach. Walsh and Warren reviewed published reports of infectious and parasitic diseases endemic in tropical countries and concluded that the strategy of intervention should be selective — based on evidence of the contribution of each disease to mortality and morbidity, the efficacy and cost of currently available control measures, and the feasibility of applying these measures.[28] The extensive studies of Morrow and his co-workers in Ghana[29] illustrate the potential value of cost-benefit analysis in sorting out priorities within the health sector and in justifying to the government the investments in health vis-à-vis other sectors. Application of this technique is limited by the difficulty in quantifying benefits in health, the inadequacy of the human-capital approach to life valuation, and the lack of suitable data for analysis in most developing countries.[30,31] In the absence of cost-benefit analysis, unit costs of specific health improvements may be compared in order to identify the least-cost solution. To apply these epidemiologic and economic measurements when planning health programs requires much information and takes time. In many cases, detailed measurements cannot be made, but more vigorous review of available evidence on the health needs of different population groups and the consideration of cost effectiveness in selecting interventions offer the best hope for stretching limited resources to achieve maximum impact on health. In addition to encouraging better policies and practices in the health sector, this should enhance the acceptability of proposals by ministries of health to ministries of planning and finance.

The development of measurement capability for both planning and managing health services has a high priority for health administrators, physicians, and others with leadership responsibility in the health system. This can be best achieved by strengthening existing institutions through mid-career training of

the staff, improving management information systems, and undertaking operational research on health services at central and peripheral levels of the health system.

Financial Feasibility of Primary Health Care

Primary health care has been accepted by the member governments of the WHO as the key to achievement of universal access to health care by 2000. Assuming that the low-income countries will have no more than $3 to $4 per capita per year in public resources to devote to health by 2000, is it possible to achieve the goals envisaged in the primary-health-care approach with this financial constraint?

Evidence from six primary-health projects undertaken in the late 1960s and 1970s in developing countries indicates that marked health improvements can be demonstrated within five years through provision of basic services with annual operating costs ranging from about $0.50 to $3.50 per capita (Table 5).[32,33] When corrected for inflation, these figures would be $1 to $7 per capita in 1981 prices. The results must be interpreted with caution since five of the projects were of a pilot nature; most involved very small populations; the cost data varied greatly. As a rule, they did not include capital investment, training, expenditures beyond the primary level of health care, or the value of expatriate and volunteer labor. The contribution of voluntary health workers is of special importance because they provide a large share of rural health services and because volunteerism may be difficult to sustain over the long term.[34] Although there should be economies in scaling-up to national programs, in fact higher marginal costs would be expected with expansion of primary health care to more widely dispersed populations. Furthermore, political and administrative problems involved in scaling-up would add costs for management, supervision, and support systems. Nevertheless, the results of the pilot projects, adjusted for inflation, are of the same order as the estimates of $1 to $3 by Joseph and Russell[35] and $5 by Patel (unpublished data) for per capita recurrent costs of primary-health-care programs.

An alternative approach to estimating the cost of primary health care is to price the individual components of a model program designed to treat the principal causes of mortality in children in low-income countries, as outlined in a recent WHO discussion paper.[36] The model for a total population of 100,000 would try to provide basic care for children under five years of age (about 17,000), tetanus toxoid, iron and folic acid for pregnant women (about 4000), and contraceptive advice and supplies for fertile women (about 5100 at a 30 per cent level of coverage). On the basis of estimates of the need for immunization against common infectious diseases and for treatment of diarrhea, acute respiratory infections, malaria, and intestinal parasites, and assuming that all patients in need will be treated with the least expensive, effective treatment available, it is possible to calculate the annual cost of drugs and supplies for each condition. For example, to immunize the 4000 children under one year of age against measles, 3200 doses would be required to achieve 80 per cent coverage (recognized as sufficient to halt transmission), which at $0.17 a dose would cost $544 each year. The annual cost of all the drugs, vaccines, and supplies for the model program was $35,000, or $0.35 per capita, for the population as a whole to cover the selected target groups.

The cost of commodities is, of course, only one component. It is necessary to add the cost of salaries of health workers, training, transportation, and maintenance. If these additional costs are in the same proportion to total primary-health-care costs as drugs are in national health budgets (drugs account for 25 per cent according to a conservative estimate[6]), then the total annual recurrent costs for primary health care may be in the range of $1.40. Since annuitized capital costs for primary care are about one third of recur-

Table 5. Impact and Cost of Selected Primary-Health-Care Projects.*

Project	Period Monitored	Estimated Population Covered	Infant Mortality Rate			Child Mortality Rate			Project Cost per Capita
			Base of Study Period	End of Study Period	Per Cent Reduction	Base of Study Period	End of Study Period	Per Cent Reduction	
			deaths/1000 live births			*deaths/1000 children 1–4 yr*			$
Miraj, India	1974–77	230,000	68	23	66	†	†	†	0.50
Jamkhed, India	1971–76	80,000	97	39	60	†	†	†	1.25–1.50
Narangwal, India	1968–73	10,500	128 ‡	70 ‡	45	19 ‡	11 ‡	42	0.80–2.00
Hanover, Jamaica	1973–75	65,000	36	11	69	13–15 §	5–6 §	60	0.40
Deschapelles, Haiti	1968–72	9,600	55	34	38	11	6	45	1.60
Rural Guatemala	1969–72	3,000	150	55	63	28	6	79	3.50

*Sources — Faruqee R, Johnson E. Health, nutrition and family planning: a survey of experiments and special project in India.(unpublished data); World Bank Discussion Paper No. 81-14, Population and Human Resources Division); Gwatkin DR, Wilcox JR, Wray JD. Can health and nutrition interventions make a difference? (Monograph No. 13.) Washington, D.C.: Overseas Development Council, 1980; and Berggren WL, Ewbank DC, Berggren GG. Reduction of mortality in rural Haiti through a primary-health-care program. N Engl J Med. 1981; 304:1324-30.

†Data not available.

‡Comparison of average rates for 1970-73 in medical-care intervention and control areas. Child mortality reflects deaths in children 12 to 36 months of age per thousand children in that age group.

§Child mortality reflects deaths in children 1 to 48 months of age per thousand children in that age group.

rent costs,[26,27] $0.45 to $0.50 may be added to cover capital investments. The combined capital and recurrent costs of the primary-health-care program would be under $2 per capita per year, well within the financial reach of low-income countries.

The fragility of the assumptions involved in multiplying the commodity costs is acknowledged. The model itself is relatively insensitive to changes in the assumptions about the commodities with the exception of the contraceptive prevalence rate. (Increasing contraceptive prevalence to half the women at risk would increase per capita costs of commodities from $0.35 to $0.43.) A more important factor is the assumption that the primary-health-care worker will provide early diagnosis and treatment. For example, if treatment of diarrhea were delayed so that 50 per cent of children rather than 10 per cent required intravenous fluids and antibiotics, the cost of commodities would be increased from $0.35 to $0.62 per capita. The model also assumes encouragement of breast-feeding and nutrition education of mothers and children at nominal cost, but if food supplements are added, the cost of the package of commodities would be substantially increased. Using data from Project Poshak in India[37] on the cost of the basic food supplements, adjusted for inflation and an assumed 30 per cent prevalence of malnutrition, as reported in several national nutrition surveys, the added cost would be $0.71 per capita — twice the cost of supplies for the basic health and nutrition interventions. Provision of rural water supply, which might be proposed in addition to or as an alternative to primary health services, is estimated to cost $5 per capita, of which approximately half would be annuitized capital cost.[38] (This estimate is based on a reported capital cost of $26 per capita in 1977[38] annuitized at a 10 per cent discount rate and including complementary operation, maintenance, and support costs.)

The value of the modeling exercise is limited by the pyramid of assumptions on which the calculations are based. More important than the results, however, is the process involved in developing the model, which illustrates the trade-offs that countries must consider in determining the balance of services to be provided to their population. The process of choosing the most cost-effective approaches to meeting health needs is the essence of the planning and decision-making process outlined above.

Conclusions

Developing countries face the challenge of coping with a heavy burden of illness that differs markedly in subgroups of the population at different stages of development. The greatest improvement in life expectancy from health investments can be expected in the rural and peri-urban poor through a program that provides maternal and child health services, including control of the major infectious and parasitic diseases of children under five. Effective technology for such a program is now available and affordable even within the financial constraints of the least developed countries. Two major problems remain: the first is the political will to allocate the necessary resources for the program, and the second is the management capability to organize and operate a system of services for the rural and peri-urban populations that use multi-purpose community-health workers.

No satisfactory strategy has been developed to meet the health needs of older children and adults within the financial means of most developing countries. There are relatively few simple, effective interventions to control the metabolic, vascular, degenerative, and malignant diseases of the adult population, and there is little understanding of the behavioral disorders. Without new technologies for control and prevention, it is unlikely that the poorer developing countries will be able to provide more than symptomatic care for most patients with these health problems. Furthermore, adoption of the expensive technologies now used for the diagnosis and treatment of these diseases in the industrialized world will divert the limited resources available for programs for the rural and peri-urban poor to sophisticated, hospital-based, urban services, which will have, at best, a marginal impact on health.

The search for health technology appropriate to the financial and organizational circumstances of developing countries must be seen as a high priority for the research and development community of the entire world. Existing technology must be critically evaluated, and new, simpler techniques developed for the control and prevention of common chronic diseases. Greater attention should be given to research and development on the "tropical" diseases, which are a major component of the disease burden of developing countries but have been largely neglected by the world's scientific community. Pharmaceuticals are of special importance since the timely supply of essential drugs is critical to the quality of health care and the credibility of community health workers. The dangers of excessive use or inappropriate choice of drugs necessitate the introduction of policies on procurement, prescription, pricing, and quality control to avoid health hazards and excessive costs.

Financial constraints will be an overriding consideration in the development of the health sector for the foreseeable future, particularly in the least developed countries. The poorest countries that now have public expenditures on health averaging only $2.60 per capita per year also have the least favorable economic prospects for the next decade. Greater efforts are required to mobilize resources for health from other sources, particularly the private sector, and to ensure that the limited resources available from all sources are used in the most cost-effective manner. Few developing countries have the institutional capability to select health interventions on the basis of expected health impact, least cost, and feasibility of implementation, and to integrate independent facilities, practitioners, and disease-specific programs into a

more coherent, economical, multipurpose system. A high priority should be given to strengthening the capability of administrators, physicians, and other personnel in positions of leadership in the health system at central and local levels in order to develop a population perspective in the analysis of health problems, a cost-effectiveness attitude toward the use of resources, and management skills appropriate for a human-services organization. More efficient management of health services is only one aspect of the problem. It is equally important to mobilize communities and individuals to take a more active role in promoting health and in financing health services, rather than to rely passively on a government system.

Scarcity of money for health is a critical limitation on progress toward the goal of "Health for All by the Year 2000." More money alone, however, will not produce the desired outcome unless there is a political commitment to programs for those in greatest need, as well as the managerial capability to implement them. This is first and foremost a challenge for developing countries, but it is also a consideration in the investment policies of donor agencies. Progress toward the goal of "Health for All" can be accelerated if more external assistance can be provided for the areas of greatest need and if the unique scientific and technologic resources of the industrialized world can be made available to developing countries, to strengthen their institutions and to collaborate in the development of appropriate technology to meet their needs.

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May 25, 1982

Dear Ms. Fettner:

Thank you very much for taking the time to write further on the issue of health education and to give me a clear picture of what you had in mind.

I share your view that an effort to mobilize the interest and influence of teachers in health is a highly desirable goal, would likely have a useful impact and is at the present time largely neglected due to the separation of sectoral ministries. In rural communities in particular, teachers are often community leaders as well as talented professionals in education. The educational approach may be extremely important in blending useful information derived primarily from western medicine with the reality of cultural traditions.

In your letter you also note the frailty of a health system built on community health volunteers. I am sure that you are aware that recent studies of primary health care projects bear out your comments.

Once again, thank you for elaborating on these issues.

Yours sincerely,

John R. Evans
Director
Population, Health and Nutrition Department

Ms. Ann Giudici Fettner
4144 Flintlock Road, N.W.
Atlanta, Georgia 30327

Dr

John R. Evans, M.D.
The World Bank
Washington, D.C. 20433

Dear Dr. Evans:

In my short letter to the New England Journal of Medicine I had hoped to communicate my appreciation of your and the other authors' overview of the health care problems of developing countries but appear to not have made clear that what I refer to is not part of the "delivery" of health care, but rather to the delivery of an instrument with which school teachers can pass to their students basic knowledge of such as the germ theory of disease, personal hygeine and simple interventions on a non-medical basis.

I do not agree that such a book would require a new or changed structure within the education system. While such is to be desired and will come in its own time, the book I want to see produced (and on which I steadily work in hope that--) is a self-contained unit developed in response to the perceived needs of teachers. This need was expressed to me again and again by school personnel in every part of Kenya.

Delivering curative services certainly enhances our credibility and is both humane and needed. However, it has been my experience that such care has a net effect of teaching rural people that they will be acted <u>on</u> by medicine and they can count on it to solve their ills. There is virtually no mechanism by which the concept of personal responsibility for health is promulgated.

A health book would fill in a part of that lack. It does not pretend to supplant any other program, nor to impose yet another burden on the ministeries of Health or Education; rather it could help fill a great gap in teacher knowledge and present education. Such a book could serve as the fulcrum around which a comprehensive program was gradually installed in teachers' curriculum, but before such a change is made, it would provide a badly needed resource.

I do not believe such a plan would disappoint; it would do just the opposite by its physical presence and immediate usefulness. Literate persons could put such a book to use without any further formal training.

It bothers me that literate teachers are largely ignored by the health planning system while plans for developing primary care workers are seen as a large part of the answer to LDC health. Having participated in the Ministery of Health's PHC planning process, this concept, for me, has taken on a coloration of confusion, expense and bureaucratic tangles of enormous proportion. The identification, selection, training and reimbursement of this cadre, as you know, is by no means a simple issue. Who is to be

/...more

selected, how and where trained, supervised? Are these mythical people to dispense medicines and, if so, which and how do they get them? Who will pay these people: the community, the government, or is volunteerism to be encouraged? The questions are endless and involve constraints far beyond any attached to the delivery of a health resource book. In any event, the two are not mutually exclusive.

Also, in general, health care in these countries satisfies a number of human requirements beyond the boundaries of medicine. The entire social millieu is reflected in a village health center. To place a cost benefit on what you refer to as "the problems of scarcity and choice" could easily result in what I know you want to avoid--the imposition of a delivery system by outside interests on a complex of cultural, economic, political and social realities of which we have faint grasp. If the Third World opts for a cost benefit approach then it is our responsibility to point out these interrelationships in terms similar to those we use to convince western industry that alcololism, for example, loses money.

The problems of teaching health in the Third World is far greater than modification on the behavioral level. The cultural modifications that must take place before health as we think of it is possible depend on a sociatal evolution which appreciates the causes of disease (as opposed to the Will of Allah, or God willed it). While it may be true that we learn health at our mothers' knees, we have a comparatively well informed public and an infrastructure by which to desiminate such knowledge. Quite the reverse is true, at least in Kenya, where 90 percent of the population has never had access to any but tribal knowledge of health. If we want to create an environment in which the family influences health in a positive way, we have to embark on a massive public information program, the infrastructure for which does not presently exist.

It was, however, interesting to me that among educated Kenyans, the birth rate was usually comparable to that of Western countries. One has to guess that training in linear thought processes such as required for literacy brings with it an appreciation of "tomorrow", a side effect of education and the most effective argument for birth control

More than any other argument, I see a crying need for a non-existant resource, the production and distribution of which could only add to the skimpy resources now available to men and women who do have a present impact on health knowledge and who are ill equipped to fulfil such a role.

Sincerely,

Ann Giudici Fettner

January 8, 1982

Edwin W. Salzman, M.D.
Deputy Editor
The New England Journal
of Medicine
10 Shattuck Street
Boston, Mass. 02115

Gentlemen:

Ms. Fettner draws attention in her letter to an important aspect of the promotion of health which medical personnel frequently overlook. The formal education system provides a unique opportunity to develop an understanding of hygiene, nutrition, family planning and public health measures. The children in turn may be a vehicle for influencing their families. In communities in many developing countries, teachers are important leaders in gaining acceptance of programs to modify human behavior. In general, however, studies in Europe and America have indicated that environment is a more important determinant of behavior than school. Furthermore, the success of school health education often falls short of its promise since it requires special training of teachers, curriculum revision and teaching materials such as the handbook suggested by Ms. Fettner, all of which strain an already overburdened system.

The approach to health education may reach beyond the formal educational system in its attempt to modify the patterns of behavior of adults. Although this presents a more difficult challenge, significant progress has been made particularly in programs which involve the leadership of members of the community rather than relying exclusively on the advice of technical specialists. The approach beyond formal education is also important since in some countries only a small proportion of students are in regular attendance at school and the interval before results can be demonstrated is substantially longer if it is necessary to wait for the impact from modifying the habits of children alone.

I believe Ms. Fettner has misinterpreted the intent of the article if she concludes that we believe dealing with the health problems of the adult population in low income developing countries is fruitless. The health problems of adults are as real as the health problems of children and to neglect them undermines the credibility of the system. Furthermore, there is not a vacuum at the present time. Adults are receiving health care from a variety of sources including traditional healers and are spending substantially more of their income on health than does the government on the public health system on a per capita

basis. It is important to improve the impact on health of the services which are being used to make them more cost-effective and more satisfying to the clientele. In this context of "problems of scarcity and choice" it will be useful to analyze in detail the contribution that education can make to health work. Countries will choose their options on this basis. This aspect of the concept of health for all by the year 2000 through primary health care has received very much less attention than the care of infants and children under five years of age and their mothers.

Yours truly,

John R. Evans
Director
Population, Health and Nutrition Department

JREvans/rmf

The New England Journal of Medicine

10 SHATTUCK STREET, BOSTON, MASSACHUSETTS 02115—TELEPHONE 617/734-9800

OFFICIAL PUBLICATION OF THE MASSACHUSETTS MEDICAL SOCIETY

D1

OFFICE OF THE EDITOR

December 23, 1981

John R. Evans, M.D.
Director of Population,
Health & Nutrition
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

Dear Dr. Evans:

The enclosed correspondence about your recent article in the Journal will be published in the correspondence section of a forthcoming issue. It is our policy to give you the opportunity to reply in print, with the stipulations that the total length of your comments does not exceed 1½ double-spaced typed pages (exclusive of illustrations and references), and that we receive your letter within three weeks. If we have not received any comments from you by JAN 13 1982, the letter(s) will be printed without a reply.

Sincerely yours,

Edwin W. Salzman/klp

Edwin W. Salzman, M.D.
Deputy Editor

EWS:klp

Enc.

ist

ce Evans 11/5

4144 Flintlock Road, NW
Atlanta, Georgia 30327

NOV 20 1981

To the Editor
The New England Journal of Medicine
10 Shattuck Street
Boston, Mass. 02115

Health care in the developing world

Gentlemen:

Your publication of the Shattuck Lecture on health realities in developing countries was a genuine service to all concerned. The authors were able to dispassionately evaluate the massive stumbling blocks to the delivery of even the most modest public health interventions.

As a health education specialist who has experienced (in Kenya) each constraint described by the authors, I offer a suggestion in an area which seemed a little ignored in an otherwise excellent article.

No 1

As the authors stated, trying to deal with the health problems of the adult populations of low income developing countries LDC's is fruitless. It is the children who must be educated toward understanding and accepting public health measures in the future. To that end, the lack of health input into the usually free, often universal public school systems is a major oversight of planners.

Primary school teachers are literate, are looked upon as leaders in their rural areas, in fact serve in many places as in-place primary health care workers. However, they have virtually no education or materials with which to teach even the most basic prevention measures to their students.

3490

It was and is my hope that a comprehensive book on health be put into the hands of each school teacher. Other materials could follow as resources become available and re-structuring of the education system allows. This delivery of a health book would by-pass the bureaucratic tangles and provide a sorely needed resource for these men and women, and for the children to whom their teachers represent the hope of another kind of future.

Ann Giudici Fettner

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Dr. John R. Evans, Director, PHNDR

DATE: January 4, 1982

FROM: Margaret Valdivia, PHND3

SUBJECT: Letter to the Editor of the New England Journal of Medicine

1. It appears from the letter that the writer is a health education specialist who retains the traditional assumption that information relayed by a teacher is retained by children and that attitudes, practices and behaviour recommended by teachers are necessarily respected and acted upon outside school by children; their families and the community at large. A large body of sociological research in Europe and America has established that environment is a more potent conditioner of behaviour than school. Numerous school education and health education programmes in developing countries have been conducted by MOH health educators, teachers trained in health education and by teachers incorporating health-themes in other topics. Evaluation of such programmes has not established with absolute validity, a causal link between health-related behavioural innovation or change and classroom education. Experience in health education in USA has been more encouraging, perhaps because the environment is more favorable; the topics closer to the felt needs of the students; or the teaching environment are more positive.

2. School health education in most underdeveloped countries is conducted in pilot projects funded by bilateral or small aid agencies, including missions; by school health nurses, inspectors or specially trained teachers as an element among other responsibilities; by MOH mobile health education teams who visit schools as part of a wider campaign. Objectives of such programmes vary from hygiene promotion to a developed curriculum on illness, disease, nutrition and child care. The appropriateness of such programmes require some reexamination as does their effectiveness.

3. The Shattuck lecture identifies problems of scarcity and choice as constraints affecting the evolution of health care systems for developing countries. School health education in developing countries reaches from 10-60% of the child population in the age group 6-12 years. In many countries both primary and secondary education are available to a privileged minority and those who attend school for the first two years and then drop out are the majority among those. Since these are the future parents and possibly future opinion leaders of their community, appropriate health education is clearly important; supported by well-trained and supervised teachers, a curriculum and classroom materials relevant to the age group, cultural and social environment and, possibly a parallel educational effort in the community. A developing country will weigh the costs and expected impact associated with developing and supporting this kind of health education against the costs of out of school education for the same age group; parent education, non-formal education for adults or regional mass media campaigns on health topics. Considerations will be: the size of the target audience, the nature of the health problems to be addressed, and the estimated impact, appeal and relevance of the programme. These decisions

will be taken in relation to the alternative available solutions to health problems.

4. The Shattuck lecture, for example, identifies diarrheal diseases, respiratory infections, tetanus childhood infection diseases, such as diptheria, measles and whooping cough as major causes of infant and child death in particular when associated with malnutrition. While school-based health education could achieve little in these areas, mass media information and motivation campaigns together with vaccination teams would be an appropriate progamme response to the problem of infectious diseases. Prevention of diarrheal diseases and respiratory infection, the care of children and self-care of adults suffering from these conditions and the treatment of the conditions define specific tasks for the health worker and the health educator. School-based health education can sensitise children to the concepts of sanitation, hygiene, germ theory and personal behaviour related to health care. Only education of mothers, community motivation and education, water, sanitation and health services can combat the environmental disease continuum within the spectrum of preventative activities, child care, environmental sanitation and treatment. The same selectivity of approach can be applied to the problem of malnutrition. Children can learn and understand a large number of nutrition concepts and facts. In communities where malnutrition is result of traditional feeding patterns, seasonal or permanent shortage, poverty or the dislocation of traditional standards due to the shift from village to peri-urban or squatter communities, individual and community education is required in addition to medical and other interventions.

5. Both child education and adult education will contribute to the attitudinal and behavioural change. The dimension of learning and attitude change is fundamental to health education and health behaviour. Home care of patients, use of medicines, aspects of hygiene and sanitation, nutrition habits and child care can be learned. Concepts of family size, dietary laws, illness and health, debility and strength derive from cultural values. Behaviour connected with water use, feeding, solid waste disposal, use of medical facilities may require modification .

6. Ministries of Health in developing countries will decide what strategy to adopt and what funds to allocate to school education, non-formal education, community mobilization and mass media information and motivation activities on the basis of defined health goals, appropriate target groups and reasonable assumptions on impact.

cc: Mr.Pearce, PHND3
Mr. Radel, PHND2

MValdivia/hs
HEALTH/PHN

TO: Dr. Evans

7 January 1982

FROM: Dave Radel

SUBJECT: Proposed Insert Paragraph for Your Reply to Ms. Fettner's Letter to the Editor of the New-England Journal of Medicine

John:

Due to the Division II workshop, I've been slow in getting to this. I've read Margaret's memo to you. I basically agree with what she says there. In many ways, however, your draft already makes these points. Hence my own contribution is in the way of some specific remarks on Ms. Fettner's suggestions, which, if you think they are worth adding to the letter, might constitute an insert between the present first and second paras. A minor change in the first sentence of the next para. would then be required for a smoother transition.

School health education, while theoretically presenting some attractive opportunities, appears in those cases where its effectiveness has been measured frequently to fall short of its promise, however. Its content has often been irrelevant to the needs and interests of pupils, and teachers have frequently been ill-prepared to handle the topic. Ms. Fettner's proposal to provide teachers with special handbooks, if well prepared and tested, might represent a partial answer. We have observed, however, that considerable thought and experimentation is still required to determine the appropriate role and content for school health education (e.g., is it more effective if it becomes part of a continuum with community health education as is being tested in Indonesia); that ad hoc material that is not examinable is unlikely to be taught in highly structured, examination-oriented systems; and that, even when content has been included in the curriculum, the average, poorly trained teacher generally teaches just what is in the basic required textbooks. Hence we conclude that the introduction of appropriate content on health, nutrition, and population into schools can be done most effectively by working with education authorities at critical stages in the education development cycle, e.g., during development and revision of new curricula for the schools or for teacher training institutions and subsequent preparation of new or revised textbooks.

1781 ~ 1981
Two Hundredth Anniversary

THE MASSACHUSETTS
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Executive Offices

December 1, 1981

Mr. James P. Grant
Director of UNICEF
866 United Nations Plaza
New York, New York 10017

Dear Mr. Grant:

Your presentation at the dinner, October 31, 1981, honoring the Bicentennial of the Massachusetts Medical Society, was well received by those in attendance. We are appreciative of the assistance of the World Affairs Council of Boston in arranging for your presence at the affair.

It gives me great pleasure to provide a check for $700.00 to UNICEF. John R. Evans, M.D. of World Bank who was our distinguished Shattuck Lecturer for 1981, requested that most of the honorarium offered to him by the Massachusetts Medical Society be forwarded to you to support the good activities of UNICEF.

Thank you again for your appropriate message in your presentation on the occasion of the 200th anniversary of the Massachusetts Medical Society.

Sincerely yours,

S. M. Wyman

Stanley M. Wyman, M.D.
President

SMW/vm
Enclosure
cc: John R. Evans, M.D.
James F. McDonough, M.D.
Arnold S. Relman, M.D.
John J. Byrne, M.D.
Charles G. Shedd, M.D.
Robert Nichols
William B. Munier, M.D.
Charles S. Amorosino, Jr.

There is evidence that the Society's original seal, accepted by the Society on April 9, 1783, was engraved by Paul Revere, Silversmith. The silver seal, mounted on a hardwood handle, is on loan to the Boston Museum of Fine Arts. The original seal depicts Aesculapius in his proper habit, pointing to a wounded hart nipping the herb proper for his cure. The motto is Natura Duce – "With Nature as our Guide." The embossed seal above is an exact replica of the original.

TELEPHONE PLAZA 4-1234

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UNITED NATIONS CHILDREN'S FUND • FONDS DES NATIONS UNIES POUR L'ENFANCE

UNITED NATIONS, NEW YORK

30 November 1981

Dear John,

Thank you for your letter of 18 November with its enclosures on Dr. Ofosu-Amaah and Zak Sabry. I value your recommendations - as I do your writings as evidenced by your article in the recent issue of the New England Journal of Medicine.

With best wishes for the holiday season.

Sincerely yours,

James P. Grant
Executive Director

Mr. John R. Evans
Director
Population, Health and
Nutrition Department
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

WAKE FOREST UNIVERSITY

BOWMAN GRAY SCHOOL OF MEDICINE

300 South Hawthorne Road • Winston-Salem, North Carolina 27103

Department of Surgery

November 27, 1981

Dr. John R. Evans
Department of Population, Health & Nutrition
World Bank
1818 H Street, NW
Washington, DC 20433

Dear Dr. Evans:

Congratulations on your very fine special article in the November 5 issue of the New England Medical Journal. This was masterfully accumulated and put together, and your concepts are very thought prevoking. By virtue of rather extensive, yet strange involvement in third world health care and delivery, while at the same time being an academically based institutional surgeon-type-person, I feel I do have some expertise on which to interpret and judge this fine article.

Keep up the good work and I hope that our paths will cross in the future.

Respectfully,

Timothy C. Pennell, M. D.
Professor

jm

social welfare, social planning/policy & social development

Dr. John R. Evans
Population, Health & Nutrition Dept.
World Bank, 1818 H St. NW
Washington, DC 20433

An International Data Base

P.O. Box 22206, San Diego, California 92122 (714) 565-6603

Dear Colleague,

One of your recent publications has been selected for referencing in *Social Welfare, Social Planning/Policy, and Social Development* and/or *Sociological Abstracts*. Please send an abstract or summary of your article (or book review) to the address above within two weeks of the date you receive this letter. This will insure that the abstract we publish accurately reflects the contents of your article, that appropriate emphasis is accorded to important themes in the article, and, most importantly, that the time lag between the publication of your article and the appearance of its abstract in the hands of other scholars in 55 countries is minimized.

A form containing instructions is attached for your convenience in preparing this abstract. The abstract may be submitted in any language, although English is preferred. We would also greatly appreciate it if you would provide us with a reprint of your article.

Thank you for your cooperation in the international, non-profit dissemination of information about sociology and planning, policy and development.

Chère Collègue/Cher Collègue,

l'une de vos publications récentes a été sélectionée comme référence à paraître dans *Social Welfare, Social Planning/Policy, and Social Development* et/ou *Sociological Abstracts*. Nous vous prions donc de bien vouloir nous envoyer, à l'adresse ci-dessus un résumé analytique de votre article (ou compte-rendu) dans les deux semaines suivant la réception de cette lettre. Ceci pour nous permettre de publier un résumé fidèle du contenu de votre étude, mettant l'accent sur les révélations importantes, et de réduire au minimum le délai entre la publication originale de votre article et la parution de son résumé à l'usage de nos confrères chercheurs dans 55 pays du monde.

Nous vous joignons un formulaire contenant des instructions qui vous facilitera la rédaction de ce résumé dans la langue qui vous conviendra, en anglais de préférence. Nous vous serions également très obligés s'il vous était possible de nous adresser un tiré-à-part de votre article.

Avec nos remerciements pour votre collaboration à la diffusion internationale d'information sur la sociologie et planification, l'intérêt public et développement nous prions d'agréer l'expression de nos sentiments les meilleurs.

cn lc 6160; dt tp

al Evans, John R.;Hall, Karen Lashman;Warford, Jeremy;

fi World Bank, 1818 H Street NW Washington DC 20433

Title of article
ti Shattuck Lecture - Health Care in the Developing World: Problems of Scarcity and Choice

English translation of title (if appropriate)
tt

Name of journal
New England Journal of Medicine

sc NEJMA si 1981, 305, 19, Nov 5, 1117-1127
Year Volume Issue Month/Season Pagination

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(Date) (Signature) Name (Please print)

Abstract (Please type *DOUBLE SPACED*)
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Page ____ of ____ pages *Please use additional pages if necessary*

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COUNCIL OF ABSTRACTING SERVICES
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sociological abstracts inc

ABSTRACTING INSTRUCTIONS

General Instructions--An abstract either summarizes or describes an article. The abstract should be intelligible as an independent statement and should echo the style and reflect the emphases of the original study. Informative abstracts will enable the researcher to distinguish between one article on a given subject and others on the same subject.

Informative Abstract--An informative abstract will include information about data collection, analysis, evaluation, and results. From each of these aspects, the crucial information representing the skeletal structure of the study must be selected and reported. To make this selection well, the abstractor must ask three basic questions:

(1) What did the author do? What ideas, notions, hypotheses, concepts, theories, thoughts or hunches are investigated?

(2) How did the author do it? What data are used? What is their origin? What method(s) of gathering data are used? Are the data qualitatively or quantitatively manipulated? How many subjects, if any, are involved? What tests, scales, indexes, or summary measures are used? What classification scheme is provided? How, in other words, is analysis and/or synthesis accomplished?

(3) What did the author conclude? Is support provided for the hypotheses or are they rejected? What conclusions are drawn? Briefly, what are the significant findings?

The skeletal structure thus achieved should be succinct, should incorporate terms and concepts prevalent in the field, and should not omit relevant information. It is insufficient to state that a questionnaire was used. The type of questions (open-end, multiple-choice, etc.) and the manner of administration should be indicated. Important characteristics of the subjects involved, studied, or described should be specified. Scales and tests should be identified by name.

Descriptive (Indicative) Abstract--Certain studies (e.g., bibliographies, book reviews, reports, etc.) cannot readily be summarized and require descriptive abstracts. This type of abstract tells what an article or book or study is about, what significant subject matter it includes, and what its scope is. This type of abstract is not suitable for the report of an experimental study.

Style--The names and addresses of all authors should be complete. Author initials are not adequate unless the author never uses his or her first and/or middle name(s). The author to whom requests for reprints should be addressed should be specified. The abstract should be typed, if possible, and it should be typed double spaced, using additional pages, if necessary. Complete sentences should be used, not telegraphic phrases. Information in the title should not be repeated. Please do not use abbreviations; your article is of potential interest to scholars working in other fields who may be ignorant of abbreviations or acronyms common to your discipline. Please enclose a reprint with your abstract if you have one; however, do not delay sending the abstract until reprints are available. The reprint may be forwarded later.

COMMENT REDIGER UN RESUME ANALYTIQUE

Instructions générales--Un résumé analytique ("abstract") a pour fonction soit de résumer, soit de décrire un article. Il doit être compréhensible par lui-même; son style doit être celui de l'étude originelle et il doit mettre en relief les points essentiels de celle-ci. Les résumés d'information doivent permettre au spécialiste de différencier les articles traitant d'un même sujet.

Résumé d'information--Un résumé d'information doit renseigner sur l'acquisition, l'analyse et l'évaluation des données, et sur les résultats obtenus. Dans chacun de ces domaines, l'essentiel de l'information qui est la charpente de l'étude doit être relevé. Pour que la sélection soit bonne, elle doit permettre de répondre aux trois questions suivantes:

(1) Que fait l'auteur? Sur quoi--sur quelles idées, quelles notions, quelles hypothèses, quels concepts, quelles théories, quelles pensées, quelles impressions--portent les recherches?

(2) Comment le fait-il? Quelles sont la nature et l'origine des données? Par quelle(s) méthode(s) ont-elles été acquises? Les données sont-elles traitées qualitativement ou quantitativement? Le cas échéant, combien y a-t-il de sujets? Quels sont les tests, les échelles, les indices ou les mesures sommaires utilisés? Quelle classification propose-t-on? En bref, comment l'analyse et/ou la synthèse sont-elles faites?

(3) Que conclut l'auteur? Les hypothèses sont-elles vérifiées ou rejetées? Quelles sont les conclusions? Quels sont les résultats significatifs?

La charpente ainsi obtenue doit être succincte. Elle doit inclure les termes et concepts en vigueur dans ce domaine. Elle ne doit omettre aucune des informations essentielles. Il n'est pas suffisant, par exemple, de mentionner qu'on a utilisé un questionnaire, il faut encore préciser le type de questions posées (réponses libres, choix multiples, etc.) et la facon dont le questionnaire a été rempli. Il faut aussi mentionner les caractéristiques importantes des sujets inclus dans la recherche, observés ou décrits. Les échelles ou les tests doivent toujours être identifiés.

Résumé (indicateur) descriptif--Certains types d'étude (bibliographies, comptes-rendus, rapports, etc.) ne peuvent pas se résumer facilement et exigent donc un résumé descriptif. Ce type de résumé indique ce dont traite un article, un livre ou une étude, ce qui en est le sujet et quelle en est la portée. Ce modèle ne convient pas pour la relation d'une étude expérimentale.

Le style--Les noms et l'adresse de tous les auteurs doivent être indiqués dans leur entier. Il ne faut mentionner les initiales d'un auteur que s'il ou elle ne fait jamais usage de son (ou de ses) prénom(s). Mention spéciale doit être faite de l'auteur chargé(e) des tirés-à-part. Dans la mesure du possible, il est préférable que le résumé soit tapé à la machine, avec double interligne, en utilisant des feuilles supplémentaires au besoin. Le style télégraphique est à éviter. Les renseignements contenus dans le titre ne doivent pas être répétés. Les abréviations ou acronymes sont à éviter, car ils peuvent être incompréhensibles pour un chercheur d'une autre spécialité s'intéressant à l'article. Si vous avez un tiré-à-part de votre article disponible, ayez l'obligeance de le joindre au résumé, sinon faites-nous parvenir le résumé sans délai, et une copie de l'article quand cela vous sera possible.

Nov 18/8

Karen:

I don't know whether this is worth doing. I know that I will not find the time.

Thanks

11/24/81

JRE –

Discussed with JW and Nancy Wynn, our library consultant, who concur that existing referencing for N England Journal of Medicine plus incorporation in Bank Reprint Series should facilitate sufficient dissemination.

KLH

Absence of Indicators of the Influence of Its Physicians on a Society's Health

Impact of Physician Care on Society

WALSH McDERMOTT, M.D.
Princeton, New Jersey

Reprinted from the April issue

The American Journal of Medicine

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Absence of Indicators of the Influence of Its Physicians on a Society's Health

Impact of Physician Care on Society

WALSH McDERMOTT, M.D.
Princeton, New Jersey

There are no established indicators for measuring the influence of its private physicians on a society's health. For a brief period the age-adjusted death rate, an important indicator of the public health effort, also served to reflect a portion of the influence of the personal physician system. Particular medical interventions could be linked to specific sites in the pathogenesis of microbial disease in a way not yet permitted by the available knowledge of the common nonmicrobial diseases.

Our national allocations for health cannot be made rationally until we develop indicators for measuring incremental investments in either system, but especially for the personal physician system. For death rates per se fail to accurately reflect the workings of this system which is concerned primarily with prolonging effective life by preserving or restoring function in an individual person.

A dangerous misconception, often repeated today, is that the influence of its personal physicians on a society's health can be measured by the mortality statistics of that society. In reality, such statistics are almost wholly unrevealing as to what it is the physician does or seeks to do. The fact is that there are no established indicators by which to measure the influence of the personal physician* system [1,2]. This is unlike the situation that in the past has obtained for the effects of the public health system, but even that is changing. Consequently, incredible as it may seem, there is no certain way to measure the health benefits of most of our society's multibillion dollar expenditure for health.

Our lifetime pattern of health or illness is affected not only by the health potential with which each of us is initially endowed, but also by the following three external forces: (1) Biomedical knowledge applied to our community through the public health system; (2) similar knowledge applied to ourselves through the personal service system; and (3) the living patterns permitted or featured by our material culture.

There are conflicting opinions as to which force is capable of exerting the greatest influence today. The issue is important, because it largely determines the direction of our major social investments in

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* Hereinafter this is also called "the personal service system." Use of the word "physician" without mention of the other valued professionals and trained helpers is an editorial convenience and should not be taken as a lack of recognition of their important roles in delivering personal health care. It is true, however, that the physician is generally the one who has the comprehensive training needed for choosing which elements from the vast body of biomedical science and technology are to be applied.

health. The causes of the argument become clear when the specific roles of the two health care systems, public and personal, are analyzed in relation to demographic patterns; material cultures; prevalent diseases and the illnesses they may cause; and their specific vulnerabilities to biomedical technology.

This article represents an attempt to address these questions with particular emphasis on the problem of developing appropriate health indicators for measuring the impact of the personal physician system. The need for developing such indicators hardly needs emphasis in view of the greatly widened access to this system that has been provided in recent years. In order to discuss indicators, however, we need to specify what it is that we are attempting to measure, that is, to define the goal of interventions aimed at health improvement, their nature, and the pathways they take.

THE GOAL OF HEALTH CARE

Any statement of the aims of the nations's health care efforts must begin with a definition of health itself. An operational definition is:

> "Health, like happiness, cannot be defined in exact measurable terms because its presence is so largely a matter of subjective judgment. About as precise as one can get is that health is a relative affair that represents the degree to which an individual can operate with effectiveness within the particular circumstances of his or her heredity and physical and cultural environment." [3]

This goal is approached through the public health system by reducing the threat to the individual person of serious disease from the environment, i.e., by effecting the *absence* of particular diseases from the community. The goal of health care for the individual person, however, is neither the complete absence of disease—a state that would be biologically unreal* —nor a feeling of positive health—a state necessarily subjective. *The goal is the preservation of function.* It is to this goal that a major portion of the personal care physician's effort is aimed. As Dubos [4] put it:

> "Ideally, the goal of medicine has always been to help man function successfully in his environment—whether he is hunting the mammoth, toiling for his daily bread, or attempting to reach the moon."

A wide range of health professionals serve the public health doctor who usually deals through intermediaries and relates to people as groups, whereas the personal service physician relates to people as individuals. The public health physicians are not only a much smaller portion of the profession, but their work is also largely behind the scenes. Consequently, their role, or even their existence, is not widely known. The popular images of "the doctor," therefore, are virtually all of the personal service variety. Indeed, when people are requesting or demanding more medical care for a community, they are almost invariably visualizing physicians from the personal service system.

The question might be raised whether this separation of the two systems is more an academic abstraction than a useful concept, as all three of the health-shaping forces—the public health system, the personal care system and the material culture—simultaneously affect an individual. The answer seems clear. The two health systems represent two quite different ways of using biomedical science and technology, and they are managed by people with quite different expertise. An important sociotechnical choice is involved in deciding the extent to which one or the other is to be used in a given situation. Generally speaking, in attempting to improve the lot of an impoverished society, it is advisable to make the initial effort through the public health system [5]. It must be kept in mind, however, that in the industrialized societies the two systems are simultaneously in operation on the same people.

INTERVENTION AGAINST DISEASE

The Target for Intervention. Although health is a relative affair that cannot be measured in quantitative terms, what can be measured is disease. The words "disease" and "illness," once regarded as virtually synonomous, are now almost antonyms. Disease refers to a set of biochemical and morphologic changes within the body which may or may not give rise to symptoms. Illness describes the totality of experience caused by a medical problem: the worries, the fears, the annoyances and the imaginings, as well as the classic symptoms. It is expressed as malfunction. As stated elsewhere [1], the term illness describes what the patient is *experiencing*, whereas the term disease refers to what he *has*.

When we speak of the interventionist technology of medicine, we mean those products of medical science that are useful in the diagnosis, prevention, alteration or prediction of disease in a specific fashion—medicine's science-based rationalism. In a particular society, the pattern of disease closely reflects certain major features of the society. Thus, there are differences among societies in the patterns which, in effect, form different "substrates" for the action of biomedical technology. The demographic profile also shapes this pattern of substrate. The most common diseases and their respective susceptibilities to our technology may be considerably different in a society in which the median age is 15 years than in one in which it is 27 years. *The substrate for the intervention of biomedical technology in a given society, therefore, can be defined as*

* Definitions that embrace the concept of "the absence of disease" are in reality misleading. For all living things are to some extent diseased—our crops, our lawns, our household pets and ourselves. Even our microbes are themselves diseased with still smaller microbes, the bacteriophages [3].

the particular diseases present within the demographic profile of that society.

Pathways of Intervention. These various factors, age and disease grouping, susceptibilities to technology and epidemiologic considerations deriving from the culture, differ not only from place to place but also over time in the same place. The challenge to biomedical science varies accordingly; it may be to produce an intervention deliverable via the public health system at one time or place, or one deliverable only via the personal care system at another. Thus, it is meaningless to say that one or the other system exerts or has exerted the greater influence on health without defining the time period and the demographic/disease pattern of a particular society.

In this connection it is important to realize that the disease pattern being acted upon by biomedical technology at any one time is itself largely a product of earlier biomedical interventions. The contemporary value of a particular element of the technology thus varies. The fact that the personal physician has at his disposal a powerful antityphoid drug obviously has a different value in an impoverished Third World community than in a community in which the entrance and spread of typhoid bacilli among patients is prevented by a well-functioning public health system.

INDICATORS OF IMPACT: MORTALITY STATISTICS

As we know, vital statistics of a population are presented as birth rates, crude death rates, age-adjusted death rates, infant mortality and so forth. By analyzing them, we can find out who is dying, from what and at what age; we can get a fairly exact notion of the incidence and prevalence of certain diseases. Further refinements of these data are possible, for example, life expectancy by sex and race from birth or from certain other ages. Still other indicators can be obtained, less solidly based but nevertheless useful. For example, a high preschool mortality in an economically underdeveloped area is very apt to reflect a significant shortage of food, especially of high quality protein, in the community.

What are ways by which the three health-shaping forces alone or in concert can produce changes in mortality rate over time? Health as defined herein, is the degree to which a person can function in his environment. The public health system acts on the environment itself to control threats to those who live in it; the personal service system acts on the individual to restore or preserve function.

The material culture also affects the environment. Its influence may be salubrious or harmful; in either case it can be extensive. Like the public health system, the material culture usually exerts an influence on whole groups and tends to work on or through the same biologic mechanisms as the public health system. For example, a key way to eliminate a microbial disease is to prevent transmission of the microbes from one host to another. This can be accomplished in several ways, notably by decreasing the number of susceptible persons through vaccination or by reducing the number of transmitters by specific treatment. But it can also be accomplished by central heating. The ability to ventilate a room between occupations (or comfortably when occupied) is a powerful tool in preventing the transfer from one person to another of certain microbes, such as tubercle bacilli, that can contaminate room air for periods of an hour or more. When it is cold outside, periodic ventilation is much more likely if a room is well insulated and centrally heated than when the occupants must chink the cracks and huddle around the source of heat.

Because health influences stemming from improvements in the material culture actually accomplish what the public health system is merely *attempting* to do, it is difficult to distinguish between the respective influences of the two forces in bringing about certain health "successes." In effect, the material culture can be the wealthy but silent partner of the public health system. This can have the effect of considerably magnifying the contribution of that system. Such misallocation of kudos can be quite misleading in judging the value of transferring a particular kind of program, notably health education, from a wealthy society to an impoverished one in which development of a comparable material culture is not a realistic prospect.

Effects of Antimicrobial Measures. From the mid-19th century to the 1930s, the major actions of the public health system consisted of such measures as ensuring a water supply free from dangerous microbes, interrupting oral/fecal transmission of microbes by sanitation engineering, educating new mothers about the care and feeding of infants, and diminishing the opportunities for the airborne transmission of microbial disease by proper ventilation of workplace and home. These and similar public health measures coincided with a steady fall in the death rate. In order to accomplish significant downward changes in death rates, a very large number of deaths had to be prevented because the total deaths each year numbered in the millions. A convincing drop would mean either that a fairly large number of potentially fatal diseases had become subject to some common influence or that a few numerically common individual diseases had each been affected in some specific way by newly introduced variables. The only diseases that could meet these specifications during this period were the microbial ones. By the same token, the various actions taken by the public health authorities and the improved standard of living were ideally suited to reducing chances for the spread of microbial diseases. By no means were all of these "interventions," particularly those made early on, undertaken because of knowledge of how microbes spread; frequently the grounds for action were primarily esthetic—a desire to get rid of the stench. But viewed in retrospect, it can be seen that the great bulk of the public health programs

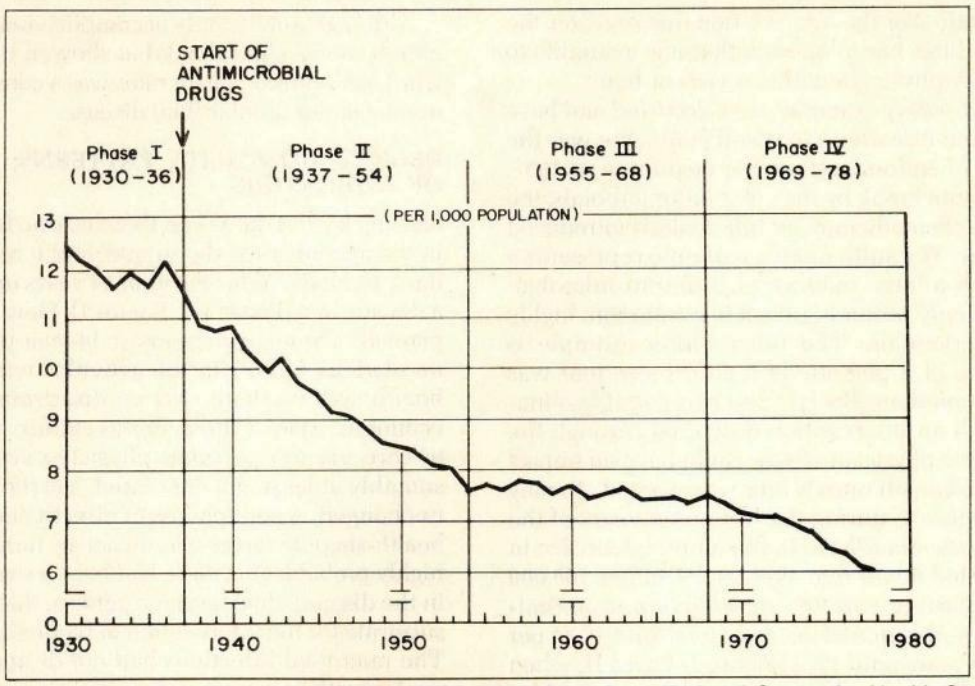

Figure 1. Age-adjusted death rates—United States, 1930–1978. Data from National Center for Health Statistics (slightly modified). Phase I = Last seven years of prechemotherapy era: Annualized decline = 4.28 deaths per 100,000 population. Phase II = 18 years in which effective therapies developed and applied: Annualized decline = 19.4 per 100,000 population. Phase III = 14 years death rate stabilized: Annualized decline = 2.1 per 100,000 population. Phase IV = 10 years—1968 to 1978: Annualized decline = 11.8 per 100,000 population. Population base per 100,000 used as an editorial convenience.

of the industrialized societies of the late 19th and early 20th century (including the management of tuberculosis) were scientifically rational.

What is more, until the mid-1930s, virtually all that was known of biomedical science and technology about the control of microbial disease was of such a nature that it could not be used directly by the personal care physician for the benefit of the individual. Through the public health system, it was possible to purify the entire water supply of a large city, but the only antimicrobial medications available to physicians practicing clinical medicine in that city were those for the treatment of syphilis and malaria. Consequently, the slow, steady decline in death rates from the turn of the century to 1937 seems largely attributable to the influence of the public health system and whatever influence the material culture was exerting along with it. The age-adjusted death rate had fallen from around 17 per 1,000 in 1900, to around 12 by 1937 (**Figure 1**). Moreover, and this is of great importance in connection with interpretation of our public health interventions today, it was *known* that in this period before 1937 a large number of actions had actually been taken that would interfere with the spread of microbial disease. It was known, for example, that chlorine had actually gone into the reservoir and that milk had been pasteurized. That is, the lowered mortality rate, largely the result of a decrease in microbially produced deaths, occurred coincidentally with the widespread application of a biomedical technology that was *known* to exert important effects on the transmission of microbes.

Except for possible effects on infant mortality, interventions from the personal service system had played virtually no role in the reduced death rates before 1937. But by the mid-1930s, powerful interventions against both nonmicrobial and microbial diseases were becoming available to the physicians in the personal service system. How might the effects of these interventions be visible in the mortality statistics? Again, the only situations that could show up on the scoreboard were the large-scale reversal of the expected deaths from either a single, sufficiently common disease, or a group of diseases all susceptible to the same intervention. *The intervention has to be lifesaving, introduced suddenly and its use spread rapidly throughout the personal service system.*

This combination of circumstances has occurred in medical history, but it does not happen very often. Conceivably, it could occur for some fatal condition correctable by surgery, but most surgical therapy is directed not against immediate fatality but toward the restoration of function. Microbial disease is a far more

likely candidate. For the intervention that reverses the potential fatalities has to be such that it is available to virtually every physician within a year or two.

Two contemporary examples have occurred and have been presented elsewhere in detail [1,5]. One was the introduction of sulfonamide at the beginning of 1937, followed without break by the other antimicrobials; the other was the chemotherapy for tuberculosis introduced a decade later. The sulfonamide example represents a case in which a large number of different microbial diseases suddenly became subject to a common, highly effective intervention. The tuberculosis example is representative of a potentially fatal disease that was numerically common. Each of the two possible situations in which an intervention delivered through the personal service physician system could have an impact on the reported death rates is thus represented. As may be seen in Figure 1, during the last seven years of the pre-sulfonamide era (Phase I), the annual decrease in the age-adjusted death rate averaged 4.28 per 100,000 population. Starting with the introduction of antimicrobial therapy, the annual decrease averaged 19.44 per 100,000 for 18 years until 1954 (Figure 1, Phase II) when it stabilized. Such coincidence of sudden and widespread introduction of a technology of demonstrated effectiveness and an abrupt change in death rate is most unusual, as already mentioned. Conceivably the evaluation of the results of a large-scale, five-year demonstration project on the regionalization of perinatal care, to be completed in 1980, may yield another example of an influence reasonably attributable to the personal service system [6,7].

To sum up the respective effects of the two systems: in a society in which the five leading causes of death were all microbial, the known application through the public health system of a variety of measures that would definitely reduce the microbial threat to the individual from the environment was associated with a slow, steady decrease in the age-adjusted mortality. These measures, although deliberately applied by the public health system, were considerably reinforced by improvements in the material culture.* The introduction to the resulting disease/demographic pattern of widely usable interventions for treatment of microbial disease in individual persons, available only through the personal care system, coincided with abrupt further decreases. Thus, biomedical technology applied to the group diminished the "catching" of microbial disease; applied to the individual it greatly reduced the chances of death from microbial disease.

* As noted herein, the actual effects of the material culture were largely mediated through the public health system—the municipal bonds for water and sewage systems, the construction of satisfactory housing and factories and other workplaces, the food supply in the community, the school system, and the like—all had to do either with making the biomedical technology economically possible or by increasing nutrition and education.

Although not the only accomplishment of either system, it seems clear that what showed up in the downward age-adjusted death rates was a consequence of the management of microbial disease.

RECENT MORTALITY PATTERNS: THE LOSS OF INDICATORS

Starting in 1954, however, there was no further decrease in the age-adjusted death rate, and it remained essentially unchanged for the next 14 years until a little over a decade ago (Phase III, Figure 1). How can this be explained? Throughout the entire 14-year period there was no obvious fall-off in the activities within the public health system; there was no disastrous slump in the economic base of the material culture, and the access to care via the personal physician system was, presumably at least, not decreased. Yet the rate remained unchanged. A sudden loss of effectiveness of the three health-shaping forces was obviously unlikely; it seemed highly probable that there had been a significant change in the disease/demographic pattern, that is to say in the substrate for the intervention of biomedical technology. The microbial infections had not disappeared; on the contrary, they were presumably as prevalent as ever. But the nature of the disease problems they usually presented was quite different, and they no longer were a major cause of acute, severe, near-fatal illness. Their role in causing fatalities was a secondary one far more often than it had been in the first three or four decades of this century. Interestingly enough, no new intervention has been developed that would control a previously uncontrollable microbial disease since 1951, three years before the death rate stabilized.*

During these 14 years the data were interpreted by those responsible for the vital statistics, and by outside students of such matters, as reflecting a "hard core" disease pattern that could be expected to show little change in the foreseeable future. In addition, statements became commonplace to the effect that the prevailing diseases were multifactoral and culture-linked, and would not be very susceptible to treatment because substantial changes would be required in an individual's life style [1,8].

This point of view—it could be truthfully called "the conventional wisdom"—persisted well into the 1970s. Starting in 1968, however, when no one was looking, so-to-speak, the age-adjusted death rate resumed the downward course that had been interrupted 10 years before; it decreased at an annual rate of 11.8 per 100,000, a trend that has continued to the present (that is, to the acquisition of the 1978 provisional data). Further examination reveals that, unlike the decrease in the death-rate of the entire previous 20th century, which could largely be accounted for by control of microbial

* Exclusive of certain anti-herpes and possibly anti-influenza virus agents.

diseases, the 1968–1978 decrease resulted from reduced deaths in a fairly wide range of seemingly dissimilar diseases, such as peptic ulcer, coronary heart disease and from lowered rates of infant mortality.

The post-1968 decrease in the death rate differs from the preceding decreases in two other ways: (1) the relation of the three health-shaping forces or particular interventions to the major diseases in the substrate is not scientifically established; and (2) evidence is lacking that even the interventions suspected of exerting beneficial effects were actually applied to sufficiently large numbers of people to produce the decreases in mortality noted.

Consequently, it is not possible to attribute convincingly the recent decreases to the operations of either one of the two health systems or to the material culture. Indeed, as emphasized in a recent report from the National Heart, Lung, and Blood Institute [9], it is not even possible to determine whether the decline in mortality from ischemic heart disease reflects a true decrease in the over-all incidence of the disease or a decrease in the case fatality rate. The latter might represent an influence of the personal physician system, whereas a decrease in the incidence would presumably reflect influences exerted through the public health system and the material culture. We are no longer dealing with identifiable, scientifically specific influences or interventions, and we lack information as to whether even the various hypothesized influences have been widely applied [10]. This also applies to an innovation that surprisingly does not seem to have been cited as a significant influence, namely, the introduction in mid-1965, two and a half years before resumption of the decrease in death rate, of extensive financial support for the personal physician system in the form of Medicare and Medicaid. About all that can be said is that there is an intriguing coincidence of that particular innovation and the phenomenon of a decreased death rate across a wide spectrum of diseases.

The disappearance of indicators of specific system effects represents one major loss, but there is another: no longer do the disease-specific death rates reflect what has been called the "burden of illness" [11]. That is, not only can we no longer use the death rates to identify which of the two intervention systems is responsible for particular effects, we can also no longer use them to inform us about the major diseases prevalent in a society, i.e., its technologic substrate.

Formerly, with microbial disease, each death was the center of ripples representing the near-death of at least several other people. Untreated microbial diseases are not generally fatal, except possibly for rabies and a few rare forms of fairly common diseases. Today, if we still lacked effective treatment for microbial diseases, case-fatality rates in the U.S. would range between say 5 and 30 percent. There would be a wide range in the severity of illness, but generally speaking, for every person who died, there would be considerably more who almost died. For example, the case-fatality from untreated typhoid fever is about 14 percent, but the seriously ill survivors may be bedridden or otherwise incapacitated for three to six months. Moreover, in the absence of specific therapy, the ratio between those who were critically ill but nevertheless survived and those who died is apt to be fairly constant in the same society from one period to another.

Thus, before the introduction of specific therapy, the decrease in the death rate for typhoid fever tells us quite a lot about the health influence of the public health system (and the sanitary improvements stemming from the material culture). We obtain the useful information not only that fewer people are dying of typhoid, but also that it can be safely assumed that a considerably smaller number of people have been seriously ill from typhoid within that year or so. *The fall of the death curve indicates an unseen, but safely presumed, even greater decrease in illness. There is a linkage or continuity between the fatal disease and a significant portion of the burden of illness in that society.* A decrease in one means things are considerably better with the other, and over-all the age-adjusted death rate has considerable relevance to the accomplishments of the health care system.

In the many decades before drug therapy, the curve reflected the impact of the antimicrobial technology of the public health system; for a brief period thereafter (1937–1954) it reflected the antimicrobial technology of the personal physician system with its newly discovered antimicrobial drugs. Now it does neither; indeed, in terms of the impact of the two health care systems, the ups and downs of the age-adjusted death rate are largely irrelevant. This fact, that for fewer than 20 years of this century death rates and other vital statistics have been capable of reflecting the influence of the personal service system, is not generally appreciated. The 1954–1968 essentially flat curve is pointed to as an example of how little is accomplished by incremental investments in this system. This is despite the fact that, by the same reasoning, one would have to deny any new health influence to the public health system and the material culture throughout the same period.

What it comes down to is that as long as the actions conducted through a system could be linked to specific effects on the pathogenetic chain of disease, it seemed reasonable to attribute to that system the effects on that disease that showed up in the death rate. This was equally the case following the sanitary revolution of the 19th and early 20th century and the "antibiotic" era ushered in at the beginning of 1937. But once the substrate consisted primarily of nonmicrobial diseases, such linkage was no longer possible.

We are left, therefore, with no real indicators by which to measure the impact of either system. Such a lack is tolerable with respect to the public health system. Microbial control must continue to represent such a large portion of the public health effort that the very fact

that today's disease pattern in the U.S. (i.e., with minimal microbial threat) continues unaltered, serves as a good "indicator" that a major public health influence is being exerted. Moreover, individual failures in that system's functioning can rapidly emerge to prominence. Indeed, one might argue that except for this maintenance of the control of microbial disease that had been well established by mid-century, the public health system today acts principally only on postulated rather than demonstrated threats to health, e.g., on such matters as low-dose ionizing radiation.

NEED FOR INDICATORS PERSONAL SYSTEM

As we approach the end of the century, therefore, it seems clear that we will be severely handicapped in the wise allocation of resources unless we can develop indicators to measure the impact of the personal service system. This system is by far the larger one in terms of professional personnel, visible facilities and services directly experienced by the public. Most relevant to our discussion here, it is also the locus for almost all new financial investment. The sums involved are very large; the total health investment exceeds $200 billion per year. Major decisions must be made on the allocations of funds within that total and on whether an attempt should be made to add new funds for new purposes or to withdraw support from activities judged less valuable. By no means are all of these many decisions to be made in government; similar choices must be made in the hospitals and doctor's offices, in industry and in other institutions that help to form the system.

Each choice represents the winner among competing alternatives. But because of the sheer size of the nation's current health effort and the role of government in its key financial decisions, the decisions concerning this effort have become major social questions to be debated in the public arena. This has thrust support for health into competition with traditional claimants for large portions of the public purse, such as defense or agriculture. Even at the other end of the line, for example in a 200-bed voluntary community hospital, decisions wrongly made could seriously jeopardize the institution's whole future. By contrast, the penalty for a "wrong" decision in the same institution a decade or so ago was usually no more than the effort of persuading some donor to make good a relatively small financial loss. The decisions were private affairs, usually made intuitively.

But confronted now by multiple possibilities—alternative courses of action created largely through our rich technologic development, each one attractive but requiring large-scale financial investment—we can no longer rely on intuitive decisions. To be convincing, a case must be presented in quantitative and measurable terms. With such keen competition for the allocations, the recommendations based on analysis of measurable phenomena will be the ones most apt to carry the day. This is as it should be, but it carries the familiar danger that "the measurable will drive out the significant." For not infrequently in today's world, numerical expressions arising within dynamic systems are seized upon and used as indicators of some phenomenon they could not possibly reflect with useful accuracy. Yet, in the United States at the century's end, when the pressure building for any health investment will soon find itself up against finite limits, there is grave danger that what cannot be measured will not be supported.

We need a capability to measure the impact of the personal physician system in order to carry on our allocation not only of dollars, but also of people, facilities and institutions. Everything that goes into the system has to be measured to the extent possible. Moreover, the ability to make such measurements would also help us to measure quality [12], for we could do community-based monitoring on a sample basis. The sought-for capability might also help to some extent in the development of so-called "discriminating medicine" [13] in that it might give us more solid background about certain interventions and thus aid us in our decisions of what to do or not to do in a particular case.

THE PHYSICIAN'S ACT

In analyzing the personal service system in a search for indicators, it is necessary to have a clear comprehension of what the physician does or tries to do. For centuries the public image of the physician has been of someone largely occupied in saving lives. The image has often carried with it the notion that this lifesaving is accomplished in a single episode, involving a brilliant diagnosis that leads to the proper medication or surgical procedure. Without question, a major objective of the personal physician is to enable survival in life-threatening emergencies, but even for surgeons such situations are relatively rare.* Far more common are the extensions of effective life made possible by surgical or medical interventions that are spread over the entire period of the physician's management.

The physician seeks to do two main things: to manage biomedical knowledge of practical use—its technology—in an effective and discriminating fashion for the prevention and management of illness and disease, and to help establish peace of mind. For the physician's efforts toward peace of mind, I use the term *samaritanism*. As stated elsewhere:

> "Medicine itself is deeply rooted in a number of sciences, but it is also deeply rooted in the samaritan tradition. The science and the samaritanism are both directed toward the same goal of tempering the harshness of illness and disease. Medicine is thus not a science but a learned profession that attempts to blend affairs of the spirit and the cold objectivity of science.

* The rare, life-threatening emergency would be a situation in which the patient would almost certainly have died within a 24- to 48-hour period without competent medical intervention.

> .... These two functions, the technologic and the samaritan, are separable in the world of analysis but not in the world of real life. ... A doctor cannot get a passing grade by being proficient at one or the other; he must be good at both, for they are to be regarded as opposite sides of the same coin" (1).

As the physician's role in samaritanism is not central to the present analysis and has been discussed elsewhere, no more will be said about it here other than to mention one point, namely, the powerful *samaritan* role served by medicine's contemporary technology. To convince patients that their symptoms are not manifestations of serious disease—a part of the samaritan function—requires that the physician have a legitimatizing base. In the past the ability to radiate reassurance came largely from the physician's obvious experience. This is still important, but more and more the patient is deriving peace of mind from knowledge of the "negative" findings from some reliable diagnostic procedure—machine-based samaritanism, if you will.

The major portion of a physician's activity, however, consists of attempting to preserve or to restore some function of the body that has become decayed due to disease, trauma or age. It is this activity that occupies much of his time and all of his skill.

A basic set of functions has to do with whether a person can arise from bed, care and feed himself (or herself) without assistance, and leave home to journey to a workplace by public transportation. A more complicated set has to do with whether the person can maintain bodily comfort and strength to fulfill the requirements of office work or the more rigorous challenge of work outdoors. Still more complicated functions are related to the ability to undertake recreational exercise and similar physical challenges.

Any impairment of functional ability, let us say for climbing one flight of stairs, can be the result of a variety of quite different disease- or illness-produced effects. Arthritis of the knee joints, arthrosclerosis of a major artery to a leg, damage to a peripheral nerve, severe anemia, a chronic heart disease, emphysema, other bronchopulmonary disease or still other ailments might be involved.

When the dysfunction is caused by a foreign living agent—a microbe—the restoration, if it happens, usually occurs promptly and is generally a one-shot affair. But with the nonmicrobial diseases that make up the greater part of the substrate for medical intervention today, the restoration of function may require constant attention, sometimes daily, over periods of many months or even years.

Generally speaking, the surgical treatment of a condition is accomplished in a single operation, and the surgeon can restore physical functions for considerably more people than can the general physician. It is the latter's responsibility to use medical technology to modulate deranged function and thereby prolong effective life. Given the technology available for the disease/demographic pattern of the present day United States, the ability to use biomedical technology correctly in such a supportive role has become the hallmark of the fine physician.

With intermittent medical care, chronic conditions such as congestive heart failure, diabetes or rheumatoid arthritis can be quite incapacitating and remain so for many months. In all three, the incapacitating illness reflects detectable physiologic abnormalities caused by the disease or by its treatment. Whereas the disease process is not reversible, these physiologic derangements—the thing that actually makes the patient sick—*are* largely reversible. But this cannot be accomplished by anyone; it requires a well-educated and conscientious physician. When it is accomplished, however, the patient may be able to continue in comfort and fully employed for a period of several years or more, with death eventually coming from the very disease that caused the incapacitation in the first place. Yet this extension of useful life for a multi-year period is nowhere recorded in our official vital statistics. It is one of the major triumphs of the "physician's act," and we have no way to count it or to measure it in any other way.

More precisely, the lives actually saved by surgical treatment of acute conditions or trauma and the medical care of certain other more serious, acute infections and heart attacks probably do show up, when aggregated, as a lowering of the death rate; but the respective contributions made to any such decrease by each of the three health-shaping influences are impossible to identify.

The problem can be seen in its cleanest form when one compares the essentially unchanged age-adjusted death rate for the period 1954 through 1968 with the decreasing death rate in the decade immediately thereafter. Presumably all three health-shaping forces were fully active in both periods; yet the death rate remained constant during one and showed a substantial decrease in the other. What could have been so different during the two periods?

It is appropriate to note again that once management of microbial disease had receded to a minor problem, diseases now forming the substrate for biomedical intervention—circulatory and neoplastic ones represent 70 percent—are those for which we lack interventions specific to their basic cause. Given our relative ignorance as to how these diseases are produced, we are unable to make firm attributions to this or that intervention, whether applied through the public health or the personal care systems. Before we can do so, we must obtain information to the effect that a particular influence, for example, change in life style or physiologic modulation to restore function, does indeed constitute an effective force and also that it can be shown to have been operative in sufficient numbers of people to make a postulated effect credible. As mentioned previously,

attributing the decrease in the death rate in the second period to the institution of Medicare/Medicaid a few years previously is an attractive hypothesis. This is especially so in view of both the broad range of different diseases affected and the evidence of a considerable increase in access to the personal physician system [14]. Nevertheless, although the association is suggestive, the data are not yet sufficiently exact to permit the hypothesis to be affirmed or denied.

MEASURING THE PHYSICIAN'S ACT

There is one hopeful element in the case: measurements of the public health system involve trying to evaluate the health effects of education or minute quantities of chemicals in the environment; *with the personal system we are dealing with attempts to restore some important function to an individual*, and the degree of improvement may be accessible to measurement. The loss of function is not necessarily disease-specific; several or more different diseases may lead to impairment of essentially the same function. Moreover, the restoration of function does not necessarily have to mean a return to what existed before; it could mean the nurturing of some bodily fall-back system to serve as an effective adaptation. Esophageal speech after removal of the vocal cords serves as an example. In a recent interview, Rene Dubos [15] stated:

> "We must understand that useful adaptation isn't merely homeostatic adaptation, which strives to return the subject to its previous state. Just the opposite: useful adaptation is adaptation that helps us compensate for irreversible inadequacies, both physical and mental. Medicine today believes that individuals must conform to a norm and that medicine's only goal is to bring them to that norm. But I say that the important issue is understanding and promoting adaptation. On the other hand adaptation of course strives to repair damage; but on the other hand it strives to exploit the organisms's reserve potentialities. A very famous Englishman who has written about physiology said that the big differences between the living organism and inert matter is that if you put on shoes they will wear out. And if you walk with bare feet, these will wear out, too. But instead of remaining worn out, your feet will develop thicker caluses. That's the big difference. It's even a fundamental difference, and it's just what I'm talking about. We must learn how to develop thicker calluses from every point of view."

To be sure, obtaining measurable effects of the personal physician system will certainly require responses or observations of the ability of a number of individuals to perform a particular function "before and after" an intervention. But there is a good deal of latitude. Not even the nature of the intervention need be constant; it could be enough that there is one.

How could such data be assembled? It seems highly unlikely that the fundamental question of impact on health (ability to function) could be accomplished in a single study for it would have to be large, long and extremely expensive. It is much more likely that studies could be designed as individual pieces which could eventually be put together in some sort of construct.

It is not really stretching things too much to state that our measurement problem, created in recent years by the effectiveness of our technology, is not really different from what it was when the need for vital statistics was first recognized in the 17th century, notably by John Graunt [16]. What we need today is a new set of statistics based on the incidence (and prevalence) of each of the major forms of dysfunction. The data could be further refined in terms of the *handicap*, or how much trouble is caused by the dysfunction; common forms of *impairment*, that is, the lesions causing the dysfunction; and similar variables. But what is needed at the start is a reliable definition of the substrate for biomedical efforts, in terms of the numbers of people with the major dysfunctions classified by degree of susceptibility to intervention.

POSSIBLE APPROACHES

Of the possible approaches to the development of indicators, three come immediately to mind: a census type questionnaire; long, continued disease-specific studies; and, most pointed of all, a prospective study by direct observations of the behavior and degrees of success of a sample of physicians in obtaining functional recovery.

Organization for Economic Cooperation and Development Disability Measurements. The Social Indicators Programme of the Organization for Economic Cooperation and Development (OCED), through its Common Development Efforts (CDE's) could provide an excellent basis for studies carried on through National Health Survey methods. Specifically, the OECD group has developed two indicators for measuring disability: Time-based and function-based disability indicators [17]. Weights are assigned to various individual responses to a questionnaire, which are then combined to form single indicators. The questionnaires are the sort employed by most countries that carry on a survey of health. By weighting and combining these, a population broken into different levels of disability is obtained; for example: severe, minor and none.

There is a key feature of these questions that is easy to overlook. They do not rely on events set in motion by recommendations or suggestions of someone other than the respondent, or on inducements such as a "blameless" day home from school or work. An answer to the question, "Can you get in and out of bed?" tells a definite story; the question (taken from a recent published study) ". . . how many days did you have to stay in bed all or

most of the day because of illness or injury?" does not. The subject may have been *told* to stay in bed for reasons that were medically trivial as, for example, in the treatment of a cold. The respondent may have stayed home from work because his paid "sick days" were not all used up.

The possibility should be explored of administering a similar questionnaire (with some additional questions) to the population in a defined geographic area on two occasions separated by one or two years. The additional questions would have to do with whether, on the second round, the respondent was queried on the first; and whether a cited disability had received a physician-directed intervention, and with what result. At the very least, this should yield valuable information on the prevalence of severe or minor disability in a definable population, and it might give us something much more, that is, the beginnings of something of the "before and after" sort.

One objection is that responses based on recall are not considered dependably accurate for much more than a two-week period. Another objection would be that at the time of the initial survey a number of the functionally disabled would already have been receiving interventions, and the passage of many years might be required before a true before and after effect had occurred on a significant scale. Such objections would be included in the exploration of the possibility of this approach.

Disease-Specific Restoration of Function. If an appropriate set of questions could be included in a National Health Survey, the results might form a sort of matrix. Within such a matrix might be inserted results from disease-specific studies, starting with cardiac disease, probably with congestive failure. These studies would be prospective and include the OECD functional disability indicators at the start, as well as the nature, but not necessarily the actual identity, of interventions. The patients could be followed and survival determined in some way, such as by the life table method. A second study might be diabetes, particularly as continued close control now seems feasible [18]. Obviously, both a sufficient number of patients and comparison groups would be hard to find; we would probably have to settle for past experience, such as the records maintained by the Joslin Clinic on patients before the advent of insulin. There are other possibilities along these lines—the Duke data bank of ischemic heart disease might have enough information to be of value on these questions by now [19].

The over-all approach to these disease-specific studies would not seem to be as ready for immediate action as the functional disability approach through a National Health Survey; yet it is important that we begin to think in such terms.

Direct Observations Studies. Finally, in view of the importance of the question of the value of heavy national investment in personal medical care—an issue that seems bound to expand considerably by the century's end—we should at least consider what would be involved if direct observation were to be used to measure the impact of the personal service system. Daily increments in the restoration of function occur in doctors' offices, in other ambulatory facilities and in hospitals. Focusing only on physician's offices, for example, it should be possible to record these individual gains, to measure the effects of intervention and the duration of life of patients with a malfunction controlled by medical management. Trained observers could be placed in say 10 offices in which they would monitor functional complaints, interventions and whether functional restoration was whole or partial. The physician could be interviewed in a standard way for 30 minutes or so each week. There is no intention to attempt at this time to outline such a study in detail; these possibilities are set forth merely to indicate the type of analyses that could be involved. Despite what would probably represent a very large effort, something along these lines should at least be considered. For in the last analysis, a carefully standardized set of direct observations will probably have to be made before the impact of the personal service physician system can be measured.

SUMMARY

To sum up: the public health system is designed to protect whole communities from threats in the environment; the personal service physician system is aimed principally at preserving or restoring the function of an individual. The actual "saving of a life" by medical or surgical intervention in the sense of some act that, if not performed would result in a death in a few hours or days, occurs but it is a relatively rare occurrence, except for the treatment of severe trauma. Saving of a life is less common today for the nonsurgical physician than it was in the early days of antimicrobial therapy. It is not generally realized that once the microbial revolution was accomplished by mid-century, the age-adjusted death rate and other vital statistics were largely irrelevant to the activities of both systems. For from mid-century on, the impact of neither system can be detected through outcome measures. Favorable results are occurring, as witnessed by the falling age-adjusted death rate of the past decade. We can present hypotheses as to causes, but we have been unable to confirm or deny them. In order to rationalize our national allocations for health, both financial and its other forms, it would be necessary for us to develop indicators of the effects of both systems, but particularly of the personal service system. A beginning on this question seems clearly in order. The essential prerequisite is a new set of vital statistics centered on the prevalence and the incidence of the major forms of dysfunction classified by degree of susceptibility to intervention. Two approaches, an expanded questionnaire of the OECD type, and a disease-specific effort, are proposed. It is also suggested that a study based on direct observation be considered for it seems that in the long run this is the only way in which this important issue will be convincingly settled.

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P504F ① Discussion of ~~Nov~~ 24th Staff Meeting ② Title + Shattuck presentation Useful data Expl. env. hazards pp 37-41 See p 54

Worldwatch Institute

1776 Massachusetts Ave., N.W. • Washington, D.C. 20036 • (202) 452-1999

November 11, 1981

Dear Ms Starke,
Kathleen Newland's paper is an excellent resource and very readable. Thank you for sending me the advance copy.
I shall check with our staff about demand and contact your office as soon as possible if we wish to take advantage of the prepublication discount.
Sincerely,
DLE

Dr. John Evans, Director
Population Health & Nutrition Dept.
World Bank
1818 H Street, NW
Washington, DC 20433

Dear Dr. Evans:

Enclosed is an advance copy of the next Worldwatch Paper that I thought you might want to distribute to people at the Bank or use in some way. Kathleen Newland pulls together the latest data on infant mortality trends, dissects the connection between fertility and mortality, and looks beyond the direct causes of infant deaths to the social and physical factors that governments and individuals can do something about.

I think you'll agree that this study, especially with its discussion of the recent rise in this rate in the USSR, confirms that the infant mortality rate is a valuable lightning rod for the overall health of a society. In the final section of the paper, Kathleen discusses the policy implications of changes in this sensitive indicator.

As with other Worldwatch Papers I have sent you at this stage, we have a special price of 50 cents/copy plus shipping for orders of 100 or more received before we go to press. I am also sending a copy to Timothy King to see if his office would like to order copies. If you'd like to take advantage of this prepublication discount, please let me know by November 30th, or, even better, just before Thanksgiving if you get a chance to consider it by then. (Our office will not be open, by the way, on November 27th.) We expect to release the study the second week in December. I'll send you a copy then, of course, even if you decide not to place a bulk order at this time.

Sincerely,

Linda Starke

LS:ot

Enclosure:
Manuscript of Paper 47

WORLDWATCH PAPER 47

December 1981

INFANT MORTALITY AND THE HEALTH OF SOCIETIES

By

Kathleen Newland

Not for quotation or release
withour prior contact

Worldwatch Institute
1776 Massachusetts Avenue, N. W.
Washington, D. C. 20036, U.S.A.

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Introduction

No cold statistic expresses more eloquently the difference between a society of sufficiency and a society of deprivation than the infant mortality rate. It is usually expressed as the number of babies out of each thousand born alive who die before they reach the age of one. Among the most deprived people in the world, as many as 200 of every thousand live-born infants die before their first birthdays. At times of greater-than-usual crisis, the proportion goes even higher. By contrast, rates of fewer than 10 deaths per thousand live births have been achieved in wealthy and egalitarian societies.

The stark difference between the high and low ends of this range cannot be attributed solely to the effects of poverty and affluence. There are poor countries in which the infant mortality rate is quite low, and relatively rich ones in which it is high. Though not perfectly correlated with the average income, the number of children who die before they are one year old is closely related to the overall level of well-being in a country or region--so closely, in fact, that it is regarded as one of the most revealing measures of how well a society is meeting the needs of its people.

As a social indicator, the infant mortality rate illuminates much that a measurement of the gross national product (GNP) obscures. It is particularly sensitive to distributive issues. It reflects not simply per capita stocks of food, clean water, medical care, and so forth, but the actual availability of such amenities to all segments of a population. Deprivation

among the people of a particular region, class, or ethnic group within a country may be masked by average income figures, but it is very likely to show up in infant mortality statistics.

High infant mortality is associated with certain social problems that may persist even in the face of rising per capita income: environmental contamination, lack of education, discrimination against women, poor health services, and so forth. A high or rising infant mortality rate, or even one that fails to decline with income gains, is the sign of a development process gone astray. Conversely, a rapidly declining rate may signify an improvement in social and environmental conditions that is disguised by slow growth of the GNP.

In searching out the explanation of infant deaths, two levels of analysis are needed: one to identify the immediate causes of death and another to examine the social, economic,or environmental conditions that make infants vulnerable to those immediate causes. The proximate cause of a baby's death may be sheer lack of food, a disease, a severe birth defect, extreme prematurity, or an injury. But behind most deaths from one of these there is likely to be a genealogy of hazard, in the form of low family income, lack of sanitation, ignorance, discrimination, crowding, high fertility, or exposure to toxic substances. Many of the direct and indirect causes of death in the very young interact, so that it is difficult to pinpoint a single fatal factor.

There is a sharp dichotomy between the patterns of infant mortality in countries with high and low rates. In countries with very low infant

mortality rates, most babies who die do so within their first month of life as a result of low birth weight or congenital abnormalities. Indirect factors in the baby's environment play a lesser role during these first few weeks, though considerable study is now being given to elements in the parents' environment that may place newborns at risk. In countries where mortality among infants is high, however, environmental factors are paramount. Their importance declines with the infant mortality rate--which is of course what makes the statistic such a sensitive indicator of social welfare. Once moderate rates are attained, specific medical programs become more important in reducing them further.

Precisely because infant mortality is so closely tied to broad economic and social conditions and to the complex interactions between them, specific interventions designed to improve a baby's chances of survival may have a limited effect if they are pursued in isolation. The most decisive gains to be made in moving a country from high to moderate infant mortality rates involve improvements in the indirect causes of infant death--better sanitation, water supply, nutrition, access to fertility control and medical care, and education. Clearly, policies that accomplish these goals will confer great benefits on society as a whole. A reduction in the infant mortality rate therefore sends a double signal: not only has a major humanitarian goal been realized, but the general process of national development is moving in a healthy direction.

Levels and Trends of Infant Mortality

Under primitive physical conditions, between one-fifth and one-quarter of all babies can be expected to die. This was about the rate that prevailed in now-developed countries during the eighteenth century and, with some exceptions, for most of the nineteenth. It is also the rate still found in several regions and countries today--those where extreme poverty is combined with an almost complete lack of modern medical care or public health measures such as mass vaccination.

In these circumstances infants have little protection against the buffeting of an environment in which hunger is a recurrent fact and infection an ever-present threat. The historical record shows that infant mortality rates in Europe during the nineteenth century fluctuated widely in response to crises such as wars, famines, epidemics, and other kinds of upheavals. The social turmoil of the Industrial Revolution was reflected in extraordinarily high death rates among the children of newly urbanized industrial workers: one Bavarian city recorded an infant mortality rate of 449 per thousand in 1870. Demographer Francine van der Valle observes: "The crowded nineteenth century cities were nests of infections, where epidemics spread fast. Hygiene and the quality of water were poor, sewage disposal systems almost nonexistent. Mothers spent long hours outside the home, infants were weaned early or, as in France, sent to be fed and, often, die in the neighboring countryside."[1]

Toward the turn of the century, infant mortality rates in the cities began to fall dramatically. The change came earlier in some parts of Europe, notably France and Scandinavia, but failed to reach other parts until after World War I. Yet generally, with the installation of modern water and sewer systems, with increases in the real income of the laboring classes, and with a better understanding of how diseases spread and how they can be controlled, survival rates among the very young showed a sharp and consistent upturn. By 1940, at least nine out of ten children in most European countries survived their first year of life.[2]

In most, though not all, of the advanced industrial countries, the period since World War II has witnessed a continuing steady decline of infant mortality rates. The age of antibiotics is also an age of lower fertility, widespread public health measures, and increasing sophistication and availability of medical care--all of which supplement the effects of an improved standard of living. In France, Switzerland, Japan, the Netherlands, and all of Scandinavia, fewer than 10 babies in a thousand die. In North America and most of the rest of Western Europe, the rate is between 10 and 20 per thousand. During the course of one century, infant mortality rates in the most advanced countries have been slashed to less than one-tenth their former levels.[3]

In the least developed countries today, however, infant mortality rates as high as any in history can still be found. In the seventies, there was only one country on the entire African mainland, Botswana, that reported an infant mortality rate lower than 100 per thousand. Rates closer to 200 were common, both in Africa and Asia.[4] Ironically, the

most rapid progress in reducing infant mortality has, in recent years, come about in countries where it was already relatively low. Thus the disparity between the world's highest and lowest rates is probably greater now than ever before.

High infant mortality is often associated with poverty and low infant mortality with wealth, but the correlation, as indicated, is far from perfect. Poverty itself doesn't cause babies to die, nor does wealth rescue them. The disposition of available resources is the real determining factor; a low national income can buy a lot of health if knowledge and organization are applied to the solution of widespread problems. Conversely, a high national income can be distributed and spent in a way that mires huge numbers of people in the backwaters of progress.

The inconsistency of the direct relationship between income and infant mortality is revealed by the variation in the rate of infant deaths among countries with similar incomes. (See Table 1.) The differences are most dramatic among the countries with the highest per capita incomes, where the infant mortality rate varies by a factor of 19. Oil-rich countries such as Libya and Qatar, with respective rates of 130 and 138 per thousand, have not yet managed to translate their new wealth into the physical and social benefits that enhance their children's chances of survival. Japan, with a per capita income roughly half that of Qatar's and only $500 more than Libya's, has only nine infant deaths for every thousand live births. At the other end of the income scale, the contrasts in infant death rates are less striking proportionately but more striking in absolute terms: the fivefold variance between

Table 1: Infant Mortality Rates in Selected Countries, by Per Capita Income Class

Country	Infant Mortality Rate (deaths per thousand live births)	Per Capita Income (dollars)
High-Income Countries		
Sweden	7	10,540
Japan	8	7,700
United States	13	9,770
Kuwait	39	15,970
Libya	130	7,210
Qatar	138	15,050
High Middle-Income Countries		
Singapore	13	3,260
New Zealand	14	5,530
Israel	16	3,730
Trinidad & Tobago	24	3,010
USSR	36	3,728
Saudi Arabia	118	6,590
Gabon	178	3,370
Middle-Income Countries		
Jamaica	16	1,190
Cuba	19	1,270
Costa Rica	22	1,610
Romania	30	1,650
Malaysia	44	1,150
Brazil	84	1,510
Iraq	92	1,850
South Africa	97	1,580
Algeria	127	1,450
Ivory Coast	138	950
Low Middle-Income Countries		
Guyana	46	560
El Salvador	53	640
Philippines	65	530
Nigeria	157	600
Congo	180	580
Angola	192	420
Low-Income Countries		
Sri Lanka	42	200
Madagascar	102	250
Tanzania	125	240
Haiti	130	240
Bangladesh	139	90
Afghanistan	185	160
Niger	200	240

Source: Data are for 1978 or 1979, or the latest available estimates; Population Reference Bureau, and World Bank.

Sri Lanka on the one hand and Niger on the other translates into a difference of more than 150 babies out of every thousand who die before their first birthdays.[5]

Observations that contradict the expected association between income and mortality can also be found within countries. Kerala, the poorest state in India, also has one of the lowest infant mortality rates; at 55 per thousand it is less than half the national average. In the United States, Washington, D. C. has the worst survival rate for children under one year old of any major metropolitan area, although it also has one of the highest per capita incomes.[6] The coexistence of low infant mortality with poverty is an encouraging demonstration of the fact that decent health need not await universal affluence. But the persistence of high death rates among the very young even in wealthy surroundings should act as a red flag to policymakers signaling that beneath the surface of economic progress something is seriously wrong.

Measuring the level of infant mortality sounds much simpler than it is. Births and deaths are discrete events, not judgment calls--or are they? In fact, official definitions of a "live birth" do vary from country to country. In some, the newborn must breathe in order to be counted among the living; in others, any sign of life, however fleeting, will suffice. The Soviet Union does not record a birth until the infant has survived for a week. As vexing as such inconsistencies are to the demographer, they are the least of the problems encountered. Vital registration in many of the least developed countries is practically nonexistent. Births

are commonly underreported even if there is a registration system. And of all deaths that occur, those least likely to be reported are the deaths of very young children. This is not exclusively a problem of poor and developing countries: a careful hospital survey in Georgia in the United States discovered that 21 percent of the deaths of infants less than four weeks old went unreported between 1974 and 1977. Most of the babies who died were from poor, disadvantaged, rural families--a description that fits most of the population of the Third World.[7]

Under such circumstances, the work of demographers is more like that of detectives than statisticians. They must derive infant mortality rates from what little is known about a given population's age structure, fertility rate, sex ratio, known birth and death records, and so forth. Different methods of estimation produce different results. Current estimates of infant mortality in China, for example, range from 17 to 63 per thousand.[8] Typically, the countries with the highest rates have the least reliable data, making the areas with the most urgent problems the ones that are the most difficult to approach with any certainty.

When measuring the level of infant mortality is difficult, the problems of discerning a trend are compounded. Censuses are taken once every ten years at the most, methods of data collection may change from one measurement period to the next, and surveys are often poorly conducted. Some countries still have never measured their infant mortality rates at all, or have done so only once. So a large part of the data on trends in high-mortality countries is extremely tentative.

The picture that does emerge from the available data is mixed. There is little information for the period before 1950, but it is clear that infant mortality has dropped, in most countries, over the past two or three decades--even though it remains at extremely high levels in some areas. (See Table 2.) Some developing countries--particularly in the Caribbean and in East Asia--have experienced strong declines, while in most of Africa and South Asia infant death rates have been static. In Latin America, countries such as Costa Rica, Panama, and Paraguay made rapid strides in the sixties while Honduras, Bolivia, and Argentina showed no improvement. In short, it is difficult to generalize about the infant mortality pattern in the Third World since 1960.[9] But it is safe to say that it does not mirror the sudden plunge that Europe and North America experienced around the turn of the century. The patchy, start-and-stop record of infant mortality decline in developing countries testifies to the difficult circumstances in which they are attempting the breakthrough to prosperity.

Table 2: Infant Mortality Rates in Selected Developing Countries, 1960 and 1978*

Country	1960	1978
	(deaths per thousand live births)	
Sri Lanka	61	52
Philippines	114	71
Egypt	141	104
Kenya	160	104
Honduras	162	132
Indonesia	190	134
Cameroon	213	182

*These figures are taken from a different source from those in Table 1.

Source: World Bank, 1981 World Development Report.

Infant mortality statistics in the industrial world are relatively reliable and reveal a much more coherent pattern. Reconstructing the historical record is still tricky, but for the postwar period there is clear evidence of a sustained decline. Infant mortality rates that were typically in the mid to high twenties around 1960 have given way to rates in the low teens or even lower. By 1979, among the 24 member countries of the Organisation for Economic Co-operation and Development, only in Turkey and Portugal did more than 20 babies per thousand die, and in seven countries the figure was under 10 per thousand. An infant mortality rate of 7 per thousand, regarded as the lowest rate attainable before the year 2000 in one important analysis, had already been reached in Sweden in 1980.[10]

To bring the infant death rate down to 7 or even 15 per thousand requires a fair amount of medical heroism--chiefly the ability to save the lives of children who weigh less than 2,500 grams (about 5.5 pounds) at birth. Medical technology has advanced by leaps and bounds in its ability to keep these tiny babies alive. In the United States in 1960, __ out of ___ infants who weighed less than 2,500 grams at birth died, whereas in 1980 __ out of ___ survived. Even babies of birth weights below 1,000 grams (only 2.5 pounds) now have a fifty-fifty chance of survival.[11] Pushing the infant mortality rate below 7 per thousand will mean crossing even farther frontiers in medical care--to save still more very small babies and even to begin treating threatened fetuses in the womb.

It will be many decades before such sophisticated care is available worldwide--if it ever is. Furthermore, it would be a tragic waste of resources to invest money and talent in very expensive, advanced technology in settings where most babies who die succumb to preventable or easily treated diseases. The World Health Organization calculates that, with a judicious application

of existing resources, every country could achieve an infant mortality rate of 50 per thousand or less by the year 2000. Considering that the world average is currently 97 per thousand, and that the average for developing countries is approximately 109, universal attainment of a 50-per-thousand rate within 20 years would represent an impressive accomplishment.[12]

Disturbing Signs of Stress: Rising Infant Mortality Rates

Perhaps the most interesting and revealing trends in infant mortality are those in the few areas where the rates have been rising, in defiance of the typical postwar pattern. These increases are particularly disturbing because they are not the products of wars or natural disasters. Current measures of infant mortality are not available from regions affected by major catastrophes, such as Somalia, Cambodia, and Afghanistan. All of these would undoubtedly show increases in infant mortality brought about by drought, flood, war, and vast refugee-producing civil conflicts. During the 1971 war for independence in Bangladesh, for exmaple, the death rate of infants between 1 and 11 months old increased by 46 percent over the average of the previous three years.[13] Usually, however, the same conditions that raise infant mortality in areas of acute crisis also disrupt the measurement of vital statistics. Most specific increases in infant mortality that have recently been observed arise from quite different circumstances: slow, long-term accretions of social and economic stresses.

Preliminary reports seem to indicate that Great Britain is reaping the bitter fruits of years of economic crisis in the form of elevated infant mortality rates. The real income of British workers has declined by __ percent since 1978. Budget cutbacks have caused the national health-care system to deteriorate--a development that would, logically, raise the infant mortality rate.[14]

In the United States, the city of Washington, D.C. recorded a 10 percent increase in its infant mortality rate in a single year, from 22.2 deaths per thousand births in 1979 to 24.6 per thousand in 1980. The major factors responsible for the high rate were social ones. An increasing proportion of births in the city were to poor, young, unmarried mothers who because of inability to pay, ignorance, inertia, or logistical difficulties failed to get adequate prenatal care. The babies of these disadvantaged women were likely to suffer complications relating to poor nutrition, drug abuse, and untreated infections. As a result, the city's incidence of babies of very low birth weight was three times the U.S. norm, and its infant mortality rate was about twice the national average. [5]

Washington, D. C. is one of the richest cities in the United States, but the average income figures conceal the existence of a substantial underclass of poor and disadvantaged families. A rising infant mortality rate thus signals the entrenchment of a dual society. A similar problem on a far grander scale afflicts Brazil, one of the few fast-growing, middle-income countries where a rise in infant mortality has been documented. The combined rate for the Brazilian state capitals rose from 103 per thousand in 1961 to 109 in 1970. During this period, the wealthiest 3.5 percent of the working population increased their share of national earnings from one-quarter to one-third of the total, while the share earned by the poorest 43 percent of workers fell from 11 to 8 percent. The purchasing power of the minimum wage fell by 30 percent, while the price of staple foods rose. Impoverished people from the rural areas fled into the increasingly crowded

industrial centers, which had neither housing, health services, water, nor waste disposal systems to accommodate them. The effect of all this was most dramatic in Sao Paulo: the infant mortality rate rose from 63 in 1961, to 90 in 1970, and then to 95 in 1973.[17]

The Soviet Union is perhaps the most well-known example of a nation that has reversed its historical progress in reducing infant mortality. A detailed analysis of its experience illustrates the complexity of the interacting influences on mortality trends. Before the seventies, the Soviets were justifiably proud of their health care achievements, having experienced at the turn of the century some of the highest infant mortality rates in Europe. As late as 1910, the western provinces of Russia still had rates of about 214 per thousand. By 1971, however, infants died at scarcely more than a tenth the rate of 60 years earlier--23 per thousand births. Soviet journals proclaimed the triumph with statements such as this from a 1972 article: "Infant mortality is a sensitive barometer of the social, economic and medical well-being of a society....An analysis of the trend in the infant mortality indicator...allows one once again to draw conclusions about the superiority of the socialist society and its health service."[18]

By 1976, this argument was no longer prominent in Soviet literature, for the infant mortality rate had risen by one-third over the previous five years. Although the Soviet Union stopped publishing official statistics on infant mortality in 1974, other sources permit estimates for later years to be made. The difference between the 1971 rate of 23 and the estimated rate in 1976 of 31 meant that 38,704 more babies died in 1976 than would have been the case if the rate had remained at the earlier level. Moreover, the measure-

ment techniques used in the Soviet Union understate the real infant mortality rate by excluding very small or premature babies who die in the first week after birth. Adjusting reported rates upward to compensate for this deviation from standard statistical practice produces an infant mortality rate of 35.6 for 1976. Demographers Christopher Davis and Murray Feshbach, who have done a careful analysis of Soviet trends, conclude that the rate has continued to rise since 1976 and that by 1979 it was probably three times the rate in the United States.[19]

Soviet statisticians have argued that the rising rates in the early seventies merely reflect improved statistical methods that have compensated for underreporting of infant deaths in the past. Davis and Feshbach reject that argument for several reasons. They note that the rise was not confined to the more primitive parts of the country such as Soviet Central Asia, where underreporting might have presented a serious problem in the past. Also, statistical methods have been improving steadily since the twenties in the USSR, yet the rise in infant mortality appears suddenly in the seventies. Furthermore, a change of methodology might account for a one-time jump in reported mortality, but not for the steady, sustained increase observed during the last decade. Finally, the demographers conclude, "if the increase had been mainly a statistical phenomenon, the Soviet authorities would have been well aware of the fact, and demographers and medical analysts throughout the USSR would not be expressing so much concern about the trend."[20]

Because of the lack of detailed information, the reasons behind the rise in Soviet infant mortality are difficult to pin down. Growing alcoholism and smoking among women are suspected contributors, but data are too scant

to document the intensification of these problems in the seventies. Similarly, the average Soviet woman has six abortions in her lifetime, which means that some individuals must have many more; the effects of multiple abortions on subsequent births have yet to be assessed accurately. Ninety percent of adult women in the Soviet Union work outside the home, and they are commonly employed in heavy industry doing strenuous manual labor. They usually continue to work until the seventh month of pregnancy; the strain of heavy labor and of exposure to toxic substances at work may be taking a toll among their infants. But it cannot be proved that these potential hazards increased during the seventies as infant mortality went up; they may not, therefore, have contributed to the rise.[21]

There are, however, several risks for mothers and for young children that did intensify during the seventies, and that are very likely to have played a part in raising infant mortality. They fall into three main categories: resource problems, social problems, and medical problems. In the first area, the shortage of protein foods for both mothers and infants is significant. Meat shortages in the Soviet Union have been well-publicized. They may affect the nutrition of pregnant women, which in turn would affect the likelihood of delivering healthy babies. The protein shortage affects infants directly, as well. Meat-based products comprise only 1 percent of the output of the Soviet baby-food industry. Milk production suffers from the same constraints as meat production, and is even more germane to infant health. While breast-feeding declined in the Soviet Union over the last decade, the manufacture of nutritionally adequate substitutes for mothers' milk did not evolve quickly enough to fill the gap. Thus improper feeding has been implicated in several studies of infant mortality in the USSR.[22]

Rising rates of illegitimacy and divorce, along with the decline of the extended family, are among the social factors that have probably boosted the Soviet infant mortality rate. The first two act to increase the number of households headed by women alone--households that suffer a strong economic disadvantage as well as an excess of demands on the mother's time. And the decreasing likelihood that a baby will have a resident grandmother, aunt, or other adult at home during the day has pushed more infants into institutionalized care. The quality of many child-care institutions is considered low, and high rates of infectious disease among their charges has been documented.[23]

Demographers Davis and Feshbach point out that two contributors to higher mortality rates intensified during the seventies. The Soviet Union was hit by repeated epidemics of influenza, which raised the death rate among adults and children alike. They also found evidence that environmental pollution was an increasingly important cause of both respiratory illness and birth defects. Other observers join these analysts in criticizing the Soviet health-care system's capacity to respond to these and other threats to infant lives. Part of the problem is outmoded equipment and supply shortages; as the proportion of the Soviet budget allocated to medical care has declined, infant mortality has risen. Another part of the problem is attitudinal. Both prenatal and pediatric care are poorly used, allegedly because mothers are reluctant to expose themselves to the long waits, inconvenient hours, and poor standard of treatment that characterize the low tiers of the health care system.[24]

Economic, social, environmental, and medical factors all play a part in determining the direction of change in the infant mortality rate, and they in turn may reflect more general strains in a society. The Soviet Government's choice to emphasize heavy industry at the expense of agriculture and consumer products, to raise military spending relative to health care budgets, and to demand full economic participation from women without guaranteeing equal social status all rebound, ultimately, on the chances for survival of society's youngest members. Decisions about a country's development are often reflected in the setting of budgetary priorities. This is one of the mechanisms by which public policy translates into rising or falling infant mortality.

Direct Causes of Infant Deaths

In privileged communities, the majority of children who die before they are a year old are born with the condition that kills them--physical immaturity, a congenital deformity, a genetic disease, or a birth injury. The children of deprivation have a large share of these problems too, but the impact of these handicaps is swamped by a tidal wave of malnutrition and infection. Ecuador and Sweden, both countries of about eight million people, probably lose a similar number of infants to congenital anomalies. But in Sweden these losses account for a third of all infant deaths, whereas in Ecuador they represent only 1.5 percent of a much larger total.[25]

Malnutrition in the very young does not usually kill outright; rather it is an accessory to the crime, lowering resistance to infections and parasitic diseases that would not be life-threatening to a well-nourished child. The most comprehensive investigation of infant mortality ever conducted in the Western Hemisphere was carried out by the Pan American Health Organization (PAHO) in the late sixties and early seventies. Examining data on 35,000 infant deaths in 15 regions of North and South America, it found that undernutrition was associated with 34 percent of the deaths in the Latin American communities. Another third of the deaths were caused by immaturity, which is often a product of undernutrition in the mother. Thus in well over half the cases PAHO studied, lack of proper food played a part. However, fewer than 6 percent of these babies had actually starved to death or been born with so few nutritional reserves that they soon died. For most, the proximate cause of death was a bout of diarrhea, a case of measles, an attack of pneumonia, or some other disease for which malnutrition set the stage.[26]

Just as undernutrition prepares the way for infection, disease undermines the nutritional status of the child. A sick baby often loses its appetite, so that its food intake is reduced just when it needs more nutrients than usual to fight off illness. Gastrointestinal diseases, among the most common afflictions of infancy, interfere with the absorption of nutrients from food. And most infections cause the body to excrete more nitrogen than normal, which raises the need for dietary protein. For all these reasons, weight loss during illness is common. One community-health study showed that one-fourth of the children who contracted measles lost at least 5 percent of their total body weight as a result. The fatality rate from measles can be 400 to 500 times as high in malnourished children as in the well-fed.[27]

Children who are poorly fed to begin with may not have the chance to recover their nutritional losses from one bout of disease before they are struck with another. In Matlab, a rural district in Bangladesh that has been the subject of a long-term health project, researchers charted the health of 207 young children for one year. The infants they studied each suffered an average of five episodes of diarrhea and ten of respiratory infection during the year, as well as assorted infections of the skin, eyes, and ears. This observation is consistent with a similar report on a group of Guatemalan village children, who on average came down with some sort of illness once every three weeks during their first three years of life. For many infants in these circumstances, life is a brief downward spiral of weakening resistance. The PAHO study found that three out of five infant deaths from infectious diseases in the areas studied had malnutrition as an associated cause.[28] In Africa and the high-mortality parts of Asia, the proportion would probably be even higher, for food supplies there are even more precarious than in Latin America.

The most tragic aspect of these deaths is that most are demonstrably preventable. The experiences of Kerala, Sri Lanka, and China demonstrate that poverty per se need not produce high infant mortality rates. The infectious diseases that kill so many babies in the Third World--several kinds of diarrhea, tuberculosis, measles, tetanus, polio, diphtheria, whooping cough--kill hardly any in the rich industrial countries. Two demographers who analyzed the major causes of death in the Brazilian state capitals in 1970 concluded that 27 percent of the deaths from infectious and parasitic diseases could have been prevented by vaccination, and a further 52 percent by proper sanitation.

In areas with low infant mortality rates, the principal causes of death in the very young are congenital defects, traumas of the birth process itself, and difficulties associated with immaturity in the newborn. The mechanisms of these three have been less well understood than the workings of the malnutrition/infection complex, so preventive measures have been slower to arrive. But progress on all three fronts is being made. New diagnostic tools help parents avoid having children with severe birth defects. Where they are available, genetic counseling, ultrasonography, amniocentesis, and legal abortion have reduced the incidence of Tay-Sachs disease, Down's syndrome, spina bifida, and other conditions that may be life-threatening. The birth process itself continues to increase in medical sophistication, though some techniques such as electronic fetal monitoring and the increasing reliance on Cesarean section are controversial.

The best predictor of an infant's survival is its weight at birth. Low birth weight as a major cause of infant mortality is shared by developed and less developed areas; the World Health Organization estimates that

approximately 22 million babies are born each year weighing less than 2,500 grams (5.5 pounds). The vast majority of these, 95 percent, are in developing countries, not only because 85 percent of all births take place there, but because the average incidence of low birth weight is three or four times higher there than in the industrial world. Furthermore, the nature of the problem differs between well-cared-for and deprived populations. There are two kinds of immaturity. One results from a baby being born prematurely, before its full nine months in the womb are complete. The other occurs when a full-term infant has not grown sufficiently during gestation. In the most developed countries, approximately two-thirds of the babies with low birth weight are premature. But in developing areas, pre-term babies account for only one-fifth of this vulnerable group; four out of five are small full-term babies.[30]

The importance of birth weight as a risk factor for infants can hardly be exaggerated. In the United States, these very small babies make up about 8 percent of all births, yet they account for 62 percent of all perinatal deaths (those that occur between the 28th week of gestation and the end of the first week of life). Among low-mortality countries, differences in infant mortality rates can be accounted for largely by differences in the distribution of birth weights. Sweden has a lower infant mortality rate than the United States because fewer immature babies are born there, not because the Swedes save more of their vulnerable infants. The same explanation applies to different infant mortality rates within countries. For example, non-white American babies have almost twice as high a death rate as white infants: 22 versus 12 per thousand in 1977. Babies of equal weight, however, do equally well regardless of race. Dr. Myron Winick, professor

of nutrition and pediatrics at Columbia University, explains: "Pound for pound, the poor baby does as well as the rich baby; black babies do as well as white babies. The difference in mortality can be entirely explained by the fact that babies from these disadvantaged groups weigh on the average half a pound less at birth than middle-class babies."[31]

Low birth weight appears to be one of the major biological mechanisms through which physical and social stresses operating in a society are expressed as elevated infant mortality rates. The critical intervening variable in this equation is the health of the mother. As with all the other direct causes of death in infancy, it is necessary to look behind the incidence of low birth weight and ask the right questions. What conditions in society are responsible for the undernutrition, infectious disease, congenital defects, and low birth weight that run roughshod over the very young?

Behind the Direct Causes: The Social Environment

Many infants die from preventable or curable conditions because they and their mothers get little or no medical care before, during, or after birth. Observers from New York to New Delhi have found that the outcome of pregnancy is directly related to the quantity and quality of prenatal care. By monitoring the condition of the mother and the developing fetus, trained observers can identify high-risk pregnancies and recommend appropriate interventions when necessary. For millions of women in developing countries prenatal care is nonexistent, but the lack is not exclusively a Third World problem. One-quarter of the women whose babies are delivered at the largest public hospital in Washington, D.C. have had no prenatal care at all--which explains, in part, the city's high infant mortality rate compared with the rest of the country.[32]

The World Health Organization estimated in 1971 that "more than half the pregnant women in the world received neither trained ante-natal supervision nor skilled help in labor."[33] Traditional birth attendants are legendary repositories of folk wisdom, but some of their customary practices are harmful to mother and child. Neonatal tetanus, which is a major killer of infants in some parts of the world, is commonly the result of unclean hands or instruments used during childbirth. Many infections are spread in this manner by midwives who do not know the connection between unseen germs and early deaths. In northern India, for example, it is common practice to cut the newborn's umbilical cord with a dirty razor or sickle, and to "treat" the navel with ashes, mud, or even dung. Teaching traditional birth attendants the basic principles of hygiene is an inexpensive way to reduce infant mortality in areas where there are few nurses or doctors.

Easier access to medical care appears to be one of the reasons that infant mortality today is usually lower in urban than in rural areas. Medical facilities, supplies, and personnel are concentrated in the cities of rich and poor countries alike, but the disparity is particularly acute in most of the poor countries. Zaire, for example, in 1977 had one doctor for every 4,045 people in its capital, Kinshasa. This is not a high ratio by Western standards, but it is good compared with typical ratios in the outlying provinces: one doctor per 22,314 people in Shaba and one per 52,434 in Kasai Occidental.[34]

The poor countries that have lowered infant mortality rates significantly are distinguished by the even distribution of health services throughout their populations. China's network of "barefoot doctors" is perhaps the best known system of low-cost medical care with a strong emphasis on maternal and child health, but it is not unique. Kerala ranks only ninth among the states of India in its per capita health expenditures. Yet it manages to serve the largest number of patients relative to population in the country, with clear benefits for mothers and babies, as the fact that it has the lowest infant mortality rate in India attests. Chile has also substantially reduced infant mortality, from 100 per thousand in 1965 to less than 40 today, while extending basic health services throughout the country. By the late sixties, according to Dr. Giorgio Solimano, almost all Chilean children were being vaccinated, 85 percent of the births were supervised by medically qualified attendants, and more than a thousand clinics were serving rural as well as urban residents.[35]

The unmet health needs of the world's poor majority are vast. The 1980 World Development Report from the World Bank asserts that fewer than

10 percent of the children born each year in developing countries (excluding China) are vaccinated against the most common childhood diseases. And, according to Bruce Stokes, no more than half the couples in the world have access to family planning services that, by enabling women to avoid high-risk births, could lead to dramatic reductions in infant mortality. Millions of infant deaths from dehydration due to diarrhea could be avoided if health educators could reach parents with instructions on how to prepare simple, lifesaving solutions of water, sugar, and salt for their sick children.[36]

Many people in rural areas lack health care because there simply are no facilities or trained people within reach. But for many others, both rural and urban, the lack is a function of low income. If health care is not provided as a social service to people at all income levels, children may die in the shadow of the most modern hospitals because their parents cannot pay for treatment. However, the impact of poverty on infant mortality goes far beyond the question of access to medical care, touching virtually every aspect of the infant's environment. If a strong public commitment to the fulfillment of basic needs is absent, poverty becomes an important determinant of infant mortality.

A 1972-73 study in Chile compared the post-neonatal death rates of children of white-collar and blue-collar workers. The post-neonatal period extends from an infant's 28th day to the end of the first year of life, the period during which congenital problems subside in relation to environmental influences on a baby's health. The study further separated "non-avoidable mortality" from "reducible mortality" in its analysis. In the first category,

infant death rates for blue-collar and white-collar families were equal. But in the second there were dramatic differences. Compared with the white-collar children, lower-class infants were twice as likely to be killed accidentally, three to four times as likely to die from infections or respiratory diseases, and nearly six times as likely to starve to death. A similar study charted the occurrence of low birth weight according to income group in the Indian city of Hyderabad. Researchers discovered that 52 percent of the infants of low-income mothers were dangerously small versus 23 percent of the babies born to women in the lower-middle class.[37]

Income interacts with every one of the common causes of infant mortality except for genetic defects. Poor families often cannot provide their children with food of sufficient quantity and quality, with uncrowded and well-ventilated housing, with enough clean water to keep them healthy, or with medical help when they fall sick. Perhaps most significantly, it is the poor household whose members are least likely to be educated and therefore to understand the origins and the prevention of the kinds of sickness to which their children most often fall prey.

Many observers argue, in fact, that ignorance is a more deadly foe of young children than poverty is--though the two so often go together that it is difficult to separate their effects. But the evidence seems to support their contention. One of the main things besides low infant mortality that distinguishes Kerala in India, Sri Lanka, and China from other low-income areas is the extent of mass education, particularly of women. The female literacy rate in Kerala, for example, was 54 percent in 1977, at a time when the national average was 19 percent. In Sri Lanka, more than 44 percent of the adult women have completed primary school, and virtually everyone

in the younger age-groups learns at least to read and write. In Pakistan and Bangladesh in the mid-seventies, by contrast, only about 10 percent of the girls finished primary school. The difference is reflected in their infant mortality rates of 142 and 139 respectively, compared with Sri Lanka's 42. On the other side of the coin are wealthy countries such as Libya and Gabon where illiteracy is still widespread and infant mortality, not surprisingly, remains high.[32]

There are now several studies from different parts of the world that demonstrate conclusively the link between a mother's education and her children's chances of survival. One of the pioneering investigations of the connection was carried out by Hugo Behm and his colleagues at the Latin American Demographic Center (CELADE). In studies of the socio-economic context of infant and child mortality, the researchers found that maternal education showed the strongest correlation of any variable observed. (See Table 3.) It outweighed rural-urban variations, income differentials, and ethnic origin. In 11 countries studied, the mortality rate of children whose mothers had 10 or more years of schooling was only one-third to one-fifth the rate of children whose mothers were illiterate.[33]

Table 3: Child's Probability of Dying Before Age Two According to Level of Education of Mother, Selected Latin American Countries, 1966-70

Country	Total	Years of School				
		None	1-3	4-6	7-9	10 or More
		(percent)				
Cuba*	41	46	45	34	29	*
Paraguay	75	104	80	61	45	27
Costa Rica	81	125	98	70	51	33
Colombia	88	126	95	63	42	32
Chile	91	131	108	92	66	42
Dominican Rep.	123	172	130	106	81	54
Ecuador	127	176	134	101	61	46
Honduras	140	171	129	99	60	35
El Salvador	145	158	142	111	58	30
Guatemala	149	169	135	85	58	44
Nicaragua	149	178	142	115	73	48
Peru**	169	207	136	102	77	70
Bolivia***	202	245	209	176	110	***

* Division of groups is no schooling, 1-5 years, 6, and 7 or more.
** Division is none to 2 years, 3-4, 5, 6-9, and 10 or more.
*** Division is none, 1-3 years, 4-6, and 7 or more.

Source: Hugo Behm and Domingo A. Primante.

World Fertility Survey data from several Asian countries have supported the findings of the CELADE study. Again, maternal education was the social characteristic that had the closest relationship with infant mortality. The impact was particularly strong on post-neonatal mortality, suggesting that education enables a mother to meet the challenges of a hazardous environment more successfully. In Pakistan during the period 1969-1973, unschooled women lost 142 infants for every thousand born, whereas women who had been educated through the primary level or above lost 100. In Indonesia the range was 93 for the illiterate compared with 62 for those who had at least completed primary school.

The reason that fewer babies of better educated women die is not well understood. Hugo Behm and others have tended to regard women's level of schooling as an indicator of general living conditions, as a proxy measure rather than a factor in its own right. There is ample reason to believe, however, that this assumption underestimates the direct role that maternal education plays in reducing infant mortality. An excellent study of Nigerian data by Australian demographer J.C. Caldwell confirmed the expected differentials in infant mortality according to mothers' education. Caldwell, however, also separated out the effects of other socio-economic factors--such as father's education and occupation, place of residence, maternal grandfather's occupation, family structure, and so forth--by examining the mother's level of education within each sub-category. In every case, her schooling was found to have a strong, indeed a predominant, independent effect.[46]

Professor Caldwell reasons that education has an important impact on maternal capability--on a mother's ability to do her job. It increases her skills, her knowledge, and her ability to deal with new ideas, especially those from outside her own culture. Better information about nutrition and hygiene can lead directly to prevention of some of the most common childhood diseases. An educated mother is also better able to judge the gravity of an illness, to understand the capabilities of modern medicine, and therefore to seek appropriate care for a sick child at the right time. She can see more clearly which traditional ways of caring for children are valuable and can be selective in applying them. She is, in other words, more likely to intervene effectively when problems with a baby's health arise, and more likely to prevent them from materializing in the first place.[47]

Given what is known about the association between female education and infant mortality, it is especially distressing to learn that 60 percent of all the illiterate people in the world are women, and that the absolute number of illiterate women in the world appears to be increasing.[43]

Discrimination against women in educational systems is a recipe for higher infant mortality--as are most other forms of discrimination against women. The relationship between maternal malnutrition and low birth weight has been established, and yet women continue to be underfed more commonly than men, even when they are pregnant. Research has shown that it is not only malnutrition during pregnancy that impairs a woman's ability to deliver healthy babies. Chronic undernourishment in childhood leads to growth deficiencies that have an impact on reproductive health in later life.

A thorough investigation of food consumption in a rural area of Bangladesh showed that females were fed less than males at all stages of life, with the deficits being most pronounced for the very young and the elderly. Malnutrition is measured in two ways. Weight-for-height deficits reveal acute lack of calories, while height-for-age deficits show chronic food deprivation. Both types were much more prevalent among girls than boys: almost three times as many girls as boys were severely malnourished. A research team in Guatemala, noting the health problems of infants born to women who had been underfed as children, observed that it would really take two generations of improved female nutrition to bring down the infant mortality rate.[44]

Behind the Direct Causes: The Physical Environment

If lack of medical care, low income, ignorance, discrimination against women, and family dissolution are elements of the social environment that interact to set the stage for the common killers of infants, the elements of the physical environment that contribute most to the same grim outcome of poor sanitation and water supply. In 1975 the World Health Organization estimated that 1.2 billion people lacked safe water supplies, including four-fifths of the rural residents of developing countries (China excluded). An even higher proportion did not have adequate latrines or sewage systems.[46] Human excrement and polluted water are the vehicles for a host of intestinal infections and parasitic diseases, which are easily responsible for half the infant deaths that occur in the highest mortality areas.

Three Nigerian public health officials investigated the living conditions of a group of children who had been brought to a Lagos hospital with acute cases of malnutrition. Most were from the large slum areas of the city, and the low level of household and community hygiene was found to be a key factor in their poor health. After visits to the children's homes, the team reported:

> Sanitation was very poor. There was not a single water closet (flush toilet) in any of the houses visited. The pail system was used and the stench can be almost unbearable. A few had no lavatory at all. Stools were thrown in the bush around. Generally children's stools are commonly found around the houses. Leaves used for wrapping food, waste food products, rags, and even human and animal stools littered the surroundings and gutters.[47]

In such an environment an infant is constantly exposed to agents of infection, especially when the baby begins to crawl around and explore its surroundings. One of the very few protections available to these babies is the breast-feeding that most of them had during their first several months of life or longer. When a child is exclusively breast-fed, its exposure to contaminated foods and utensils is limited. Furthermore, a mother's milk contains antibodies that increase her child's resistance to infection. And being ideal from a nutritional standpoint, breast milk protects the infant from malnutrition, which so commonly operates in partnership with diarrhea to undermine infant health.

It is understandable alarm, therefore, that greets an apparent tendency in some parts of the world to abandon breast-feeding at ever-earlier stages of a child's life. Innumerable studies show a clear association between artificial feeding and increased illness and death among the very young. More in dispute are the actual extent to which mothers are switching to artificual feeds and the reasons why. Large, long-term, well-designed studies of breast-feeding are practically nonexistent, so researchers have been forced to rely on very small, possibly unrepresentative samples and on evidence pieced together from larger studies not specifically investigating breast-feeding. Even these, however, are highly suggestive.

The Pan American Health Organization study of infant mortality revealed that nutritional deficiency and gastrointestinal diseases were much more important causes of death among artificially fed infants than among the breast-fed. A survey carried out in Port Moresby, the capital of Papua New Guinea, found 69 percent of artificially fed infants were malnourished

compared with 26 percent of the breast-fed. A group of Chilean mothers surveyed in 1969 and 1970 reported three times as many infant deaths among babies given bottles before the age of three months than among those who were solely breast-fed. The Chief of Pediatrics at a Philippine hospital dramatically reorganized hospital routines in an attempt to encourage new mothers to breast-feed, and found that at the end of two years breast-feeding was up 85 percent and infant mortality was down by more than 40 percent.[48]

While the protective effects of mothers' milk are most important to children who are under constant threat of malnutrition and infection, observations in affluent countries suggest that privileged children also benefit from breast-feeding. Doctors at the Queen Elizabeth Hospital for Children in London noticed that only two of the 608 children treated there for gastroenteritis were breast-fed, a rate of 0.3 percent, although the breast-feeding rate in the community served by the hospital was about 14 percent. Dr. Allan Cunningham, a pediatrician practicing in upstate New York, reports that during their first year of life, bottle-fed infants were hospitalized three times more frequently than breast-fed infants. Dr. Cunningham, contrasting post-neonatal mortality rates for breast-fed versus bottle-fed babies, concluded that in the United States today something like 5,000 infant deaths could be avoided annually if breast-feeding were universal.[49]

Fortunately, some national statistics have recently become available on the incidence of breast-feeding, so it is now possible to assess the extent of the practice more accurately than before. The most serious decline has been in the duration of breast-feeding rather than in its initiation. Traditional breast-feeding patterns are least disturbed in Africa and Asia, where almost all children are breast-fed at birth

and continue nursing throughout the first year. In most Latin American countries, by contrast, 10 to 20 percent of infants never nurse at all, and 25 to 50 percent are completely weaned by the age of three months.[50]

In North America, initiation of breast-feeding dropped to very low levels in the postwar period, but has rebounded quite dramatically during the seventies; the number of months infants nurse, however, remains very low. At the lowest point, from 1971 through 1973, only one-quarter of the new mothers in the United States chose to nurse their infants at all; by 1979, just over half did so. In 1971, only 5.5 percent were still breast-feeding by the time their babies were 5-6 months old, a proportion that increased to 23 percent by 1979.[51] If this rate of gain continues, 60 percent of the babies born in 1981 will have been breast-fed for at least a short time--one factor that may have something to do with the continuing decline in the U.S. infant mortality rate.

Some mothers in the United States and other industrial countries have turned away from breast-feeding out of fear that their milk may be contaminated with residues of pesticides, heavy metals, or industrial chemicals. In the U.S. effort to ban the organic pesticide DDT, environmental groups asked "Is mother's milk fit for human consumption?" Since then, residues of DDT, lead, PCBs, and other chemicals have been found in human milk, but their effects on infant health are not yet well understood. Most information about them comes from animal studies or from disasters affecting humans, both of which provide much cause for concern but little guidance in the decision about whether to breast-feed.[52]

Concern over the effects of toxic substances and environmental pollutants on infant health is not limited to breast-feeding, however. A child's health at birth may be influenced by maternal exposure to elements that are capable of entering the fetus's system via the placenta. Subsequent development of the child can be affected by direct exposures. In Brazil, the heavily industrialized city of Cubatão is notorious for its air pollution. Its 50-square-mile area is deluged daily by 473 tons of carbon monoxide, 182 tons of sulfur dioxide, 148 tons of particulates, 41 tons of nitrogen oxide, and 31 tons of hydrocarbons from the surrounding steel and chemical plants. According to the city's health directors, one-third of the city's children die in infancy. Eight percent are born with birth defects--a rate three or four times the norm.[23]

Cubatão is an extreme case, but few infants today completely escape exposure to toxic substances, either in the womb or after birth. Low birth weight, growth retardation, and congenital defects have all been linked to particular exposures to toxics, but the little that is known is suggestive rather than conclusive. Certain pockets of population also experience abnormally high rates of infertility, spontaneous abortions, stillbirths, neonatal illness, and infant mortality. And environmental disasters like the mercury poisoning at Minimata Bay in Japan, the chemical explosion in Seveso, Italy, the rampant pollution of New York State's Love Canal area, and human consumption of PCB-contaminated cooking oil in Japan have increased the incidence of birth defects, spontaneous abortion, or stillbirths. Birth defects now cause between 15 and 35 percent of the infant deaths in advanced industrial countries. One-quarter of the abnormalities are genetic in origin and between 5 and 10 percent are the products of specific agents known to cause birth defects,

including drugs, viruses, radiation, and chemicals. The causes of the remaining 65 to 70 percent are unknown, and may be the result of genetics, environmental factors, or some interaction between the two.[54]

Young children and fetuses may be considerably more sensitive to pollutants than adults are. Because they are smaller and have higher rates of metabolism than adults, children get a higher dose of toxic substances in their surroundings per unit of body weight. Their immature detoxification and immune systems are less efficient than those of adults. And they are in a period of rapid growth and differentiation, especially of the central nervous system, so that environmental insults may have a disproportionate impact on their development.[55]

The toxic substances that contribute most to infant mortality are not, however, the products of industrial or agricultural pollution. They are substances deliberately ingested by parents: alcohol and tobacco. The first has been linked to a variety of congenital malformations and to low birth weight, while smoking has been tied to low birth weight and a heightened risk of respiratory illness. As smoking and drinking have become more acceptable behavior for women as well as men, the number of infants exposed to these toxic substances has grown. The Census Bureau study on infant mortality in the Soviet Union, for example, suggests that maternal alcoholism may be one factor responsible for rising infant death rates there.[55]

In the Biblical Book of Judges, the angel of the Lord appears to the wife of Manoah, soon to become the mother of Samson, and says: "Behold now you are barren and have borne no children, but you shall conceive

and give birth to a son. Now therefore, be careful not to drink wine nor strong drink, nor eat any unclean thing." The result of ignoring most Biblical injunctions may be grave peril to the soul, but to ignore this one threatens a more immediate tragedy--a case of the sins of the mothers being visited upon the sons and daughters. More than 20 mental and physical defects in newborn babies have been associated with drinking during pregnancy, some of which are life-threatening to the child. Grouped under the label "Fetal Alcohol Syndrome," they include severely weakened muscles that can prevent a baby from breathing correctly, disturbed brain structure (involving especially the area of the brain involved in learning and memory), deficient growth of the brain, a poor sucking reflex and other feeding difficulties, tremors, and a peculiar array of distinctive facial abnormalities. Heart defects occur in about 30 percent of children with Fetal Alcohol Syndrome.[57]

Low birth weight has been commonly observed among the children of heavy drinkers, as has reduced length and head circumference in newborns. One study reported that women who drank at least one ounce of pure alcohol per day--roughly equivalent to two standard drinks of hard liquor--in their eighth month of pregnancy delivered infants who weighed 160 grams less, on the average, than the children of lighter drinkers. Stillbirth rates are also higher for heavy drinkers: 25 per thousand versus 10 per thousand for light drinkers in one French study.[58] The many dangers associated with maternal drinking have only recently begun to be thoroughly investigated, but already alcohol emerges as a major avoidable cause of infant death and disability. This new knowledge is cause for great alarm, because alcohol consumption is so widespread

and because negative effects on infants begin to show up at levels of consumption as low as two drinks per day--well within the limits of acceptable "social" drinking.

Some of the effects associated with alcohol consumption are aggravated when a pregnant woman both drinks and smokes cigarettes. In the French study of stillbirth rates, for example, women who drank heavily and smoked had 50 stillbirths per thousand deliveries--twice the rate experienced by heavy drinkers who did not smoke.[59] The effects of drinking and smoking on birth weight are difficult to separate in mothers who do both, but each has been shown independently to retard the growth of the fetus.

Women who smoke during pregnancy deliver babies who on average weigh about 200 grams less at birth than infants of nonsmoking mothers. And smokers give birth to twice as many babies whose birth weight falls below the critical 2,500-gram mark. Furthermore, observed deviation from normal birth weight is proportional to the number of cigarettes smoked. Spontaneous abortions, stillbirths, premature births, and fetal deaths have all been shown to occur more frequently in smokers than in nonsmokers. Several disorders of pregnancy that are often fatal to infants are also found disproportionately in smokers. Poor positioning of the placenta in the womb and premature detachment of the placenta can both lead to premature birth and to dangerous complications during delivery. They are, respectively, 28 and 48 percent more common in cigarette users than in nonusers. A blood disorder known as Rh disease and malformations of the heart and other organs are additional risks to the infant whose mother smokes while pregnant.[60]

As if this grim catalogue were not enough, the negative effects of smoking on infant health continue to mount after a baby is delivered. Recent evidence from the U.S. Collaborative Perinatal Project has established that cigarette smoking is a risk factor for sudden infant death syndrome, or crib death, a mysterious ailment that kills one of every 400 babies born in the United States and similar proportions in other industrial countries. Respiratory illnesses are more common in babies who inhale the smoke from their parents' cigarettes: bronchitis and pneumonia occur twice as often as usual in the first year of life if parents smoke.[61]

Smoking rates in many industrial countries have declined in recent years, but they have often declined more slowly for women than for men. In the United States, the only population group in which smoking increased during the seventies was teenaged girls.[62] That young women should be developing this habit just as they approach their childbearing years is not an encouraging sign for future reductions in infant mortality.

Fertility and Infant Mortality: A Two-Way Street

The total number of children that a woman bears in her lifetime and the timing and spacing of her pregnancies have major impacts on each of her children's chances of survival. Indeed, among all the factors that influence infant mortality, fertility is one of the most important. Unlike other factors, however, the relation between fertility and mortality is a two-way street. In most populations, high fertility and high infant mortality go together, as do low fertility and low mortality. This association reveals nothing about a causal connection between the two, however. Population experts, public health officials, and others have put enormous effort into trying to decipher the exact nature of the relationship.

The effect of fertility on infant mortality has been a fairly easy one to demonstrate. Women who start childbearing while in their teens or prolong it past their mid-thirties increase the chance that their children will die in infancy. Pregnancy and childbirth are safest for both mother and child when the mother is in her twenties. The Pan American Health Organization study showed clearly the effect of maternal age on infant mortality in survey areas that ranged from the affluent to the deeply deprived. In California, for example, PAHO found that 26 of every thousand babies born to teenage mothers died, compared to only 15 per thousand of those whose mothers were between 25 and 29 years old. The rate crept up again for older women, to 18 per thousand among mothers over 35. In the El Salvador project, overall infant mortality rates were much higher yet they showed the same pattern: mothers aged 19 or less lost 120 babies out of every thousand, while mothers aged 25 to 29 lost only 73. The death rate for children born to women over 35 was 94 per thousand.[63]

The time elapsed between the delivery of one baby and the beginning of the next pregnancy, known as the birth interval, is also a major influence on infant mortality. A woman's body needs time to recover from pregnancy, to rest bones and muscles and rebuild nutritional reserves. A 1958 study in the Punjab in India demonstrated that the risk of death in the first year for babies born less than two years after their closest sibling was 50 percent higher than that of children born two to four years later, and almost twice that of children born after an interval of four or more years.[64]

The interaction between maternal age and the number of children a woman has already borne is especially important in determining infant mortality. A 20-year-old mother of two children has a greatly reduced possibility of producing a healthy baby the third time around. By definition, she cannot have had enough time between births to recover her childbearing resources, which are already limited by her youth. Similarly, a woman who has five births by the age of 24 will almost inevitably have difficulties, some of which may show up as infant mortality. PAHO's investigation in El Salvador showed this quite clearly. (See Table 4.) In cases where the age of the mother and the number of children she already had meant that the interval between births was particularly short, the infant mortality rate was three to five times higher than for other mothers in the same age-group.[65]

Table 4: Infant Mortality Rate in El Salvador by Birth Order According to Maternal Age, 1968-70

Order of Birth	Age of Mother					Total
	Under 20	20-24	25-29	30-34	35 or more	
	(deaths per thousand live births)					
First	90	44	31	27	43	61
Second	162	69	40	24	18	72
Third	335	102	53	46	42	81
Fourth		196	68	37	45	87
Fifth		317	86	57	75	97
Sixth			204	74	79	127
Seventh			349	131	61	137
Eighth				292	110	220
Ninth or more					301	427
All Births	117	84	73	81	94	88

Source: Ruth Rice Puffer and Carlos V. Serrano.

The El Salvador data illustrate another aspect of the link between high fertility and high infant mortality: independent of her age, the total number of children that a woman bears has a significant impact on their chances for survival. In every country and every social class, risks to both mother and child escalate as the number of births passes three or four. The infant mortality rate rises sharply for the fifth, sixth, and later children.

The poorest families experience the most dramatic leaps in infant mortality as family size increases. Many poor women in the Third World have more than five children; in fact, it is the poor who tend to have least access to the means to space and limit their births. One-third of the mothers aged 40 to 50 in Kenya, for example, have had more than 10 children, and only 12 percent have had fewer than four. In Rwanda, one out of five of the babies who are fifth-born in their families dies before reaching its first birthday; two out of five of the infants with eight or more siblings die in infancy.[66]

There seem to be two major mechanisms responsible for the greater danger faced by infants with many older sisters or brothers: low birth weight and malnutrition. The former is a reflection of the nutritional drain on mothers who endure a virtually uninterrupted decade or two of pregnancy and lactation. The pregnant woman, after all, is producing a child out of the raw materials of her own body. Toward the end of her reproductive life, if she has borne many children and especially if she has not been well-nourished herself, she has less to give. The food consumption of the members of large, poor families tends, not surprisingly, to be lower than that of smaller families at the same income level, even though the large family typically spends a higher proportion of its income on food. A study in the Democratic Republic of Congo demonstrated that a gap of a thousand calories per person per day separated families with four or fewer members from families with nine or more.[67] The youngest children in large families must face low consumption during infancy and early childhood, precisely when they are most vulnerable to illness and death caused or abetted by malnutrition.

In many countries, lower infant mortality rates can be attributed in part to a reduction in the number of high-risk births involving pregnancies too close together, women who have already had four or more pregnancies, or mothers below the age of 20 or older than 30. The People's Republic of China, for example, has introduced firm policies that discourage early marriage and births outside of marriage, and has virtually eliminated very large families except among certain ethnic minorities. Both policies have undoubtedly contributed to lower infant mortality. Researchers at the University of North Carolina's School of Public Health have concluded that 27 percent of the reduction in the U.S. infant mortality rate between 1960 and 1972 can be explained by the fact that fewer women, especially young women, were having large numbers of children. 68

In several low-income countries, including Sri Lanka, Thailand, Jamaica, and Colombia, the number of births to women older than 30 has declined by one-quarter or more since the mid-sixties. In Costa Rica, which has Central America's lowest infant mortality rate, births to women aged 30 to 35 declined more than half. World Fertility Survey data show that significant proportions of women in Third World countries who say they want more children are using contraception in order to space their pregnancies. The proportion runs as high as 40 percent in Colombia, and 30 percent in Turkey and Peru. Nicholas Wright estimated in 1974 that if all women in Thailand had their children between the ages of 20 and 34 and if none of them bore more than four children, infant mortality would fall by 27 percent--saving 60,000 lives per year. 69

In looking at demographic patterns around the world, there is a clear coincidence between high fertility and high infant mortality on the one hand, and between low fertility and low infant mortality on the other. Because of this, and because fertility plays an active part in establishing high or low infant mortality, many observers have concluded that mortality must play a similar, causal role in determining fertility. According to this theory, parents who expect a high proportion of their children to die insure themselves against such losses by having more children than they would if they were confident that all had a good chance of surviving. By the same token, once they come to believe that virtually all children born will survive to adulthood, parents reduce their family size goals accordingly.

The evidence to support these assumptions, which together constitute the demographic transition theory, has been largely circumstantial. For example, a computer simulation using infant and adult death rates for India concluded that a typical Indian couple would need to have between six and seven children (an average of 6.3) in order to be 95 percent certain that one son would still be alive when the father reached the age of 65. The average number of births per couple in India is actually 6.5--a fact that seemed to be more than a coincidence to demographic-transition theorists.[12]

People concerned about population growth and public health have a high stake in the demographic transition theory, for it resolves what might seem to be a conflict between the objective of lowering population growth and that of improving public health. Obviously, if more infants survive into adulthood, population growth will increase. But the demographic transition theory holds out the hope that reductions in mortality will cause fertility

to fall as well, so that the net sum of birth and deaths will produce little or no change in population growth--or, in time, may actually cause it to decline. Furthermore, the same programs that reduce infant mortality could also be expected to reduce fertility eventually.

Closer investigation was undertaken to establish a causal connection between lower infant mortality and lower fertility. One link was readily apparent, in the form of lactation. Breast-feeding normally delays the return of ovulation and menstruation in a woman who has just given birth; obviously, if the baby dies the mother will stop breast-feeding, resume ovulation, and again be at the risk of pregnancy. Lactation, therefore, extends the interval between births. Researchers in Bangladesh compared the intervals between pregnancies of women who lost their babies in the first year with women whose children survived, and found a difference of 13 months. This figure is unusually high because breast-feeding in Bangladesh is virtually universal and prolonged--and because the nutritional condition of most Bangalee women is poor. In all population groups, however, breast-feeding extends the period of sterility after birth to some degree. The longer birth intervals that result produce lower completed family size even among people who do not use contraception.[71]

Lower fertility as a result of breast-feeding is a biological--not a behavioral--response to lower infant mortality. But the democraphic transition theory posits a change in people's behavior as a result of mortality changes. Attempts to uncover evidence of such changes have been disappointing. Historical studies of the demographic transition in Europe do not support the view that lower mortality led to lower

fertility. In some countries, such as Belgium, the historical sequence was reversed: fertility fell before infant mortality declined. In the various regions of Germany, the order was as often one way as the other. In France, fertility and mortality declined roughly simultaneously. Contemporary studies in Latin America, Asia, and Africa have also been unable to prove a causal connection apart from the biological effect of lactation.[72]

Demographer Samuel Preston has outlined some of the reasons that fertility patterns might be imperfectly matched with mortality trends even if parents do attempt to replace infants who die or to insure against such losses. Couples may not have a "target" number of children firmly in mind against which they measure achieved family size, or their target number may be so high that they have as many children as they possibly can regardless of how many die. On the other hand, the loss of a child may be so traumatic an experience that parents decide not to have additional children who might expose them again to personal tragedy. Some couples may frame their desire for surviving children in terms of one sex only, so that several births may be required to replace the loss of one child. Most importantly, many couples have such imperfect control over their fertility that even if they have clear family-size goals firmly in mind they may not be capable of achieving them. Summarizing an extensive review of the research concerning the effect of mortality on sterility, Preston concluded "that only a small fraction of mortality variation at the family level seems to translate into fertility variation. The picture is not an attractive one for those who look for mortality reduction as a means of reducing fertility through familial effects, let alone for those who advocate such measures as a means to reduce growth rates."[73]

The level of infant mortality remains one of the strongest predictors of fertility; knowledge of the one gives many hints about the other. But there is no room for complacency about overall growth rates on the grounds that whatever reduces mortality will also bring down fertility. If disastrous rates of population growth are to be avoided or brought down, efforts to eliminate the scourge of avoidable infant mortality must be matched by efforts to give parents the means to control their fertility, and by attempts to persuade them that it is in their own and their societies' best interests to do so.

Attacking the Roots of Infant Mortality

There is no quick fix for reducing infant mortality; the chances for survival of a society's youngest and most vulnerable members are determined by a complex set of mutually reinforcing conditions. These fall into two general categories: the state of the physical environment and the conditions that affect a family's ability to control their environment. The factors in the first category act on people, whereas those in the second act through people and require their active participation.

The dramatic gains in infant survival that took place in the industrial world around the turn of the century were largely the result of changes in the physical environment: improved water and sanitation, interruption of some major vectors of disease through vaccination or pest control, stable food supplies, control of some of the most egregious forms of pollution, and the development of medical science. The struggle to improve the physical environment continues, and still can pay huge dividends in lowering infant mortality rates. The World Bank estimates that it costs only about $5 to vaccinate a child against all the major infectious diseases that can be prevented this way. Provision of adequate drinking water for all by the year 2000 is one of the major goals adopted by the members of the World Health Organization. Several countries, such as Egypt and Sri Lanka, subsidize basic foodstuffs--a policy that may wreak havoc with government budget outlays but that almost certainly has a positive impact on the health of infants.

The threat to continued improvement in the physical conditions of life lies in a combination of misplaced priorities and resource constraints. It is hard, for example, to be optimistic about the future course of infant mortality in sub-Saharan Africa when per capita food production there has been falling steadily throughout the seventies.[75] The escalation of oil prices has forced a drastic restructuring of public expenditures in the oil-importing developing countries, with little room left to increase spending on public health and education. Perversely, past progress in reducing infant mortality has helped to exacerbate the problems created by the resource crunch, because lower infant mortality rates have not been accompanied by commensurate reductions in fertility.

The effects of the physical environment on a child's chance of survival depend heavily on its parents' economic and personal resources. Their ability to cope with the challenges of seeing an infant through the first year is determined not only by their income, but also by their knowledge of the resources available to them and their skills in using them. Because mothers are the chief caretakers during infancy, women's access to resources both tangible and intangible is particularly important to the welfare of the child.

Within many countries today there are conflicting influences on infant mortality, with some factors acting to bring down the rate and others acting to maintain or even increase it. In the United States, for example, some of the progress made in keeping babies of very low birth weight alive is cancelled out by an increasing proportion of births involving teenaged

mothers. In Chile, improvements stemming from the extension of the medical service throughout the population are qualified by a deterioration in the food-purchasing power of the working class. In Poland, an improved distribution of births by maternal age and number of previous pregnancies has resulted in lower infant mortality, but part of the gain is negated by the effects of a deteriorating food supply and uncontrolled industrial pollution. In Sri Lanka, government commitment to health and education is fighting an uphill battle against public resource constraints.[76]

The dominant direct causes of infant mortality in the world today do not yield easily to direct medical action. Malnutrition, diarrhea, and respiratory diseases cannot be controlled by vaccination or by eliminating a specific vector of infection. Rather they are functions of social and environmental conditions that must be addressed as part of a larger process of development. And "development" must, in this context, be carefully defined not just as a reflection of economic activity but as a measure of general well-being.

Davidson Gwatkin, in a review of recent trends in mortality in the Third World, observed that "during the 1960s, the most rapid improvements were recorded by countries noted for the egalitarian nature of their social and economic development (Chile and Costa Rica); the slowest in societies better known for the growth of their modern sectors." The experience of some of the egalitarian societies demonstrates that infant mortality levels can change rather quickly, and that the programs that bring the death rate down are not necessarily expensive ones. Such intangibles as health education, a restructuring of budgetary priorities, changes in sanitary practices, and more even distribution of food resources can have enormous impact on mortality

rates without a great expenditure. Kerala, for example, spends less per capita on education and health care and has a calorie consumption only 50 percent that of Punjab. But it spends its funds on primary education and basic health care, and food is distributed through public fair-price shops and an extensive school lunch program. The result: an infant mortality rate 50 percent lower than Punjab's.[77]

This is not to say that medical intervention has no part to play in reducing infant mortality. It most certainly does, especially once the foundation for good health has been laid in society at large. Setting appropriate priorities is as important in medical as in economic policy, however. Erik Eckholm recounts the case of a modern hospital in Cali, Colombia, that had excellent, modern facilities for the care of low-birth-weight babies. The low death rate among the "premature" babies in the hospital was a justifiable point of pride, comparable to that in North America, but 70 percent of the babies died within three weeks of leaving the hospital. Their home environments had not changed.[78] Water and sanitation, nutrition, mass immunization, and education in self-care should come first. Without them, much curative effort will be wasted.

Once broad public-health measures are largely in place, preventive care should focus on identifying those women who are most likely to encounter problems in pregnancy and childbirth. Maternal age and number of previous pregnancies, low income, and environmental disadvantages are among the conditions that can be recognized early in pregnancy, so that medical staff can be prepared to intercept threats to infant health before they materialize. Mass screening for such conditions as low weight gain, anemia, and high

blood pressure can vastly increase the cost effectiveness of specific interventions, be they nutritional supplements or special care during delivery, by helping to assure that they are applied only to those who really need them. Such a process presupposes the existence of a ubiquitous system of paramedical workers. China's barefoot doctors and Sri Lanka's extensive network of health-care volunteers provide two models of how such a system can be extended at relatively low cost.

The appropriate third stage of the endeavor to reduce infant mortality is curative in its approach, and involves the use of increasingly sophisticated medical techniques to save sick infants. A society can consider its resources well-directed if little of the effort involved in this stage goes to cure conditions that could have been prevented.

The stress on preventive rather than curative approaches to infant mortality not only is cost-effective; it also avoids a great deal of suffering among children and their parents. Furthermore, the impact of preventive measures goes beyond a single episode of disease, beyond the health of a single individual. The same actions that prevent infants from dying in the first year of life will also guarantee them a higher quality of life as they mature.

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DRAFT
JREvans/rmf
March 19, 1981

Shattuck Lecture, Oct. 31, 1981

Intro:

Need to take medical and public health audiences into the subject for the third world, showing the similarities to and differences from industrialized country situations

- evolution over two centuries in H.I.C. collapsed into one generation for LDC. Need data on health profile for each stage and illustration by age at death pyramid.
- the existence of subpopulations corresponding to each stage of evolution - legitimate demand but out of balance.
- appropriation of resources to western curative medicine - improve curative vs proven preventive.
- v. slow rate of growth in poorest countries and health status unlikely to benefit quickly thru trickle down from soc-econ development
- the impact of the uncontrolled pop growth on econ dev. and access to and quality of public services. e.g. education, health, housing, water supply.
- the energy and other economic pressures leading to emphasis on short-term production goals and delay in social sector investments.
- increasingly skewed incomd distribution - greater problem for poorest of poor. Income redist. effect of health and education.

Conclusions:

1. Very tough market for health.
2. Unlikely to be much in recurrent cost budgets.
3. Need to operate out of limited "pie" i.e. make choices.
4. Choices are not just by planners - doctors exercise major impact on use of resources - not market or regulatory model that works effectively.
5. Recognizing that preventive measures most cost-effective in health impact but more difficult to get public interest and compliance, less visible politically, more difficult to organize privately (i.e. vs public sector) and budget for them usually

eroded by inexorable growth of curative services. Seeking proper balance of prev and curative.

6. The goals of emphasis on preventive measures and cost-effectiveness are unduly accepted by planners but difficult to implement. Not why? but how? or what?

Section 2

This has been tried in planning depts. in many countries - (H.I.C. and M.I.C.). The problem is that the forces which govern operation of the health system are not influenced by the plan.

The question is how to get these ideas into operations where resource allocation decisions are actually made - micro (the DOC) the _____ and intermediate levels of system.

Section 3

Need to link this to the processes one is trying to establish in Section i.e. cost-effectiveness attitude of suppliers of health services and active responsibility of consumer of health services towards maintenance of health rather than passive dependency on a public(or private) service.

(The problem of "free" services being perceived as "worthless" by citizens in some LDCs).

Section 4

Should include several specific recommendations for action.

e.g. - educ/training of health personnel
- nature of health services, organization and management
- financing of services.
- capability for "health services research"and linkage to planning, management and operations
- "private" sector, community role. viz a viz public admin. role
- etc.
- etc.

developing countries ranges from nearly 100 to more than 200. Whereas the death rate for children between one and five is only about one per 1000 in most developed countries, it averages about 20 in many developing countries and more than 30 in Africa south of the Sahara. Maternal mortality rates in many areas of developing countries, though not well documented, are known to be from 100 to 200 times greater than in developed countries.

Most deaths in most developing countries result from infectious and parasitic diseases. These are closely related to prevailing social and economic conditions, and impede social and economic development. About a tenth of the life of an average person in a developing country is seriously disrupted by disease. The parasitic diseases in particular are chronic and debilitating, and they are endemic in most poverty-stricken areas. The common infectious diseases of childhood are still rampant in the developing countries whereas they have been reduced to minor nuisances in the developed countries. Although they can be prevented by immunization, fewer than 10% of the 80 000 000 children born each year in the developing countries are being immunized against them.

Diarrhoeal diseases are most widespread in the developing countries; they are transmitted by human faecal contamination of soil, food and water. Only about a third of the people in the world's least developed countries have dependable access to a safe water supply and adequate sanitary facilities. Diseases transmitted by insects and other vectors are also widespread in developing countries and have a serious adverse socioeconomic influence. Malaria remains the most prevalent disease, in spite of the fact that in theory it can be prevented by the routine administration of inexpensive drugs or by insecticide spraying to kill the mosquito and its larvae and to reduce the degree of contact between human beings and vectors as well as the lifespan of potential vector mosquitos. Some 850 million people live in areas that still lack active control measures. Schistosomiasis, caused by a snail-borne parasite, is endemic in some 70 countries, where an estimated 200 million people are infected. Onchocerciasis or "river blindness" causes blindness in more than 20% of the adult population in some hyperendemic regions in Africa. Development projects have increased the incidence of these diseases - schistosomiasis due to drainage and irrigation canals providing a habitat for the snails, and onchocerciasis due to the spillways of dams providing a habitat for the blackfly larvae.

In the developed countries, on the other hand, about half of all deaths are due to cardiovascular diseases, a fifth to cancer and a tenth to accidents. These problems are increasing in the developing countries too. Environmental health problems due to industrialization and urbanization are assuming growing importance; these same problems could affect developing countries as they build up their industries. Chronic disease increases as people grow older. In recent years

of health and in consequence alternatives to health and medical technology. The Programme of Public Information and Education for Health will promote the use of available knowledge and new knowledge as it becomes available concerning positive and negative influences on health of people's behaviour and lifestyle. In addition, specific activities are required to ensure health protection and promotion through adequate nutrition, oral health and accident prevention.

Nutrition is one of the most important factors influencing the quality of human life in most parts of the world. Undernutrition is and will likely remain one of the main contributing causes to the very high rates of infant and young child deaths; and in those who survive it retards growth and development, and lowers resistance to infections or environmental hazards. It is estimated that around two hundred million children under the age of five are moderately or severely malnourished. Maternal malnutrition is widespread, being especially important because of its serious implications for the health of the women and their infants. The causes of malnutrition are rooted in underdevelopment, and at the same time, undernutrition is a serious impediment to socio-economic development. Improved use of available foods can significantly help to combat undernutrition and can have widespread health promoting effects, although support is needed through better production, distribution and storage of food if full benefits are to be gained.

Oral health, which is essential for good nutrition and a feeling of wellbeing, can be promoted through individual behaviour in the areas of hygiene and nutrition, supported by preventive policies and measures, especially in making fluoride available. In spite of this, two major oral diseases, dental caries and periodontal disease, affect almost 100% of mankind and consume vast amounts of health resources.

Although not a health problem in the conventional sense, accidents are among the ten highest causes of death in most countries. They also result in disability and loss of income, and the care of injured and disabled people consumes much of the health budget in many countries. Their prevention, whether on the highway or farm, in the factory or, especially, at home will require the systematic application of epidemiological knowledge, much of which is still to be generated.

Objective

To support the development, adaptation, and use of methods for promoting proper nutrition, oral health and accident prevention.

These psychosocial problems place additional burdens on already overextended mental health programmes that too often lack sufficient resources and technology to deal with them or with neuropsychiatric disorders and problems related to drug and alcohol abuse.

Some idea of the magnitude of the problem can be gained from the fact that at least 40 million people in the world suffer from severe mental illness and at least twice as many are seriously disabled by drug dependence, alcohol-related problems, mental retardation, or organic disorders of the nervous system. Epilepsy alone affects some 15 million people. Estimates vary as to the number of people affected by less severe but nevertheless incapacitating mental disorders; none, however, are lower than 200 million. Mental disorders make up a substantial proportion of all morbidity seen in the general health services of both developing and developed countries, and among both adults and children.

Dealing with these problems requires multisectoral commitment, wide application of available technologies and research to develop new and better ones, legislative action and measures, and incorporation of a mental health component into health care at all levels of action and training; the latter must go hand-in-hand with decentralization of care and greater selectivity in problem definition.

During the Sixth General Programme of Work the emphasis of the Mental Health Programme was on efforts to create a WHO-supported technical base for the development of mental health programmes within and among countries and to make them aware of mental health needs. The programme will now concentrate on development of technology for programme implementation. The types of WHO involvement in mental health programmes at national and international level will vary according to national circumstances, ranging from mainly promotional to predominantly technological and behavioural activities.

Objective

To reduce problems related to mental and neurological disorders, alcohol and drug abuse and to facilitate the incorporation of mental health knowledge and understanding in general health care and social development.

special foci on the prevention of mental and neurological disorders can be developed within such programmes and lead to very appreciable benefits by reducing problems like epilepsy, mental retardation, chronic encephalopathy and peripheral neuropathy.

Second, WHO will aim at the development of new, or better, technologies for prevention, treatment and management of disabling mental and neurological disorders that cannot be prevented or adequately controlled through existing knowledge. In view of the heterogeneous causation of these disorders, the strategy will be selective. For children the focus will be on disorders in conduct and retarded development conditions that are often associated with delayed socialization and that carry a high social cost. For adults, priority will be given to conditions such as schizophrenia and recurrent affective disorders, and to depressions and the dementias for the elderly. Effects of these conditions on individuals, their families and the community will be given attention. Emphasis will be laid on identification, adaptation and testing of effective, low-cost methods and strategies for the prevention and treatment of these disorders within the family or the community as well as within the general health care system.

11. PROMOTION OF ENVIRONMENTAL HEALTH

A major prerequisite for health development in all countries is the improvement of environmental health. The lack of safe drinking-water, the insanitary disposal of solid and liquid wastes and the prevalence of contaminants in the environment continue to be important problems. Priority attention must be given to the under-served populations, both in rural and urban areas, linking improvements in water supply and sanitation with other developments in other sectors such as health education and housing. The complementary relationship between sanitation and water supply is now recognized, as is the need to raise levels of basic sanitation in communities by well-defined and complementary programmes so that the health benefits of improved water supply can be fully realized. Difficulties in meeting the global goals of the International Drinking Water Supply and Sanitation Decade, i.e., of safe water and adequate excreta disposal for all by 1990, are caused by a shortage of trained manpower, inadequate institutional development, difficulties in operation and maintenance of existing facilities, and lack of infrastructure for ensuring water quality.

The development of national programmes for prevention and control of environmental hazards has not, in general, kept pace with the increase in environmental health problems brought about by rapid industrialization and urbanization, or by

DRAFT
JREvans/rmf

SHATTUCK LECTURE - OCTOBER 31, 1981

It is the proud tradition of the Massachusetts Medical Society to embrace critical issues and to take the long view. Your choice of the topic "International Health" for this year's Shattuck Lecture fits that tradition. At the time when American society seems to be increasingly inward looking and concerned with our immediate economic problems, your society has chosen a broader vision, namely the plight of those in other countries where health is at the same stage as was the case in Massachusetts when the Massachusetts Medical Society was founded 200 years ago. It is a privilege to participate in your proceedings and particularly so on the occasion of your 200th anniversary. bicentennial,

When WHO and UNICEF launched the campaign to achieve Health for All by the Year 2000 through primary health care in 1978 they might well have found the text for their plan in the report of the Sanitary Commission of Massachusetts which Lemuel Shattuck presented to the State Legislature in 1850. His report was based on a careful survey of the health status of the population of Massachusetts and his recommendations embodied the essential elements of primary health care: immunization and communicable disease control; promotion of child health; improved housing for the poor; environmental sanitation; training of community oriented health manpower; public health education; promotion of individual responsibility for one's own health; mobilization of community participation through sanitary associations; and creation of multidisciplinary boards of health to assess health needs and planned programs and response to sound epidemiological evidence. Furthermore, Shattuck built a political constituency to support the recommendations of this report by highlighting the deterioration of health status over a

decade in major cities of the United States and the major differences in life expectancy between rural areas and Boston.

The conditions described by Shattuck in the United States in 1850 prevail today in most countries of the developing world. In 34 of the poorest countries with annual per capita income of $370 or less in 1979 life expectancy at birth averaged 51 years and in several it was less than 45 years. Mortality rates for infants and for children aged 1 - 4 are ten to twenty times greater than in developed countries. The major causes are diarrhoeal diseases, respiratory infections, tetanus, and childhood infectious diseases, such as diptheria, measles and whooping cough, all of which can be effectively and cheaply controlled by measures used in developing countries. But access to simple health services is very limited. As a result less than 10% of children are immunized. Traditional practices at childbirth may be hazardous. For example, a survey in 1977 revealed that in Bangladesh tetanus was a major cause of death particularly in neonates, and it accounted for 18.1% of deaths in children under 5, ranking second only to diarrhoeal diseases.

Differences in mortality, the only data available, are striking between high and low income countries. If deaths show this variation it is likely that morbidity, disability, misery and loss of productivity will be equally extreme. I would like to quote the comments of a Canadian nurse with extensive experience in outpost nursing in the high arctic who recently visited a remote district of one of the poorer developing countries as a member of a school health team. She examined 1500 girls aged 3 to 16 years and a sample of the general population. All children had worms, and many had mild to severe anemia; a large number had goiter and nearly all had extensive dental caries. Ninety percent of the adult women also had goiter. No iodized salt was available in the community. Many of the group had long-standing tuberculosis with only partial treatment and evidence of recurrence of active disease. Few patients could afford, however, to buy the anti-tuberculous

drugs. There was no concept of hygienic practices or health education. One newborn baby visited had the eyes, face and cord covered with powdered cow dung. The instructions to the mother were that the baby was to be fed/undiluted cow's milk because the grandparents strongly believed that the mother's milk had been cursed. Her five previous infants had died. Another mother expecting her child had been advised by the traditional village health practitioner to have a diet free of meat, eggs, fish and milk. Her hemoglobin was 5 grams. Delivery of services and drugs were impeded by impassable roads for three months a year. To transport a patient to a health unit by jeep was equivalent in cost to two months wages. Few patients could even afford a home delivery which was equivalent to one month's wages in a cash economy but few families had cash resources.

The problems of disease are compounded by malnutrition and high fertility. Not enough food to meet requirements for calories and proteins is a continuing problem in all poorer countries and particularly so in the Asian subcontinent and Africa south of the Sahara. Malnutrition contributes to growth retardation and 20 to 30% of children, reduce educability and is a significant factor in one third to one half of deaths from diseases in children under five years of age. In countries such as India and Bangladesh remarkable achievements in agriculture which have increased food production lately have not been associated with increased food consumption. In fact as food production has increased the proportion of it consumed by the poor has declined. The immensity of this problem is illustrated in the case of India where 48% of the rural population and 41% of urban dwellers live below the poverty line which is less than $90 a year. Coping with malnutrition is a complex process involving not only food supply but also income to purchase food and knowledge of the best way to use available resources and help in environmental practices to reduce the biological loss of the food consumed. Health and nutrition are inextricably linked in the development process and health officials have a heavy responsibility to service the nutrition conscience in the counsels of government since nutrition falls outside the jurisdiction of the usual sectoral ministries.

The problem is made much worse by the rapid growth in population averaging 2.4% for developing countries as a group which means a doubling of population in 30 years. Indonesia added three million people to its already densely populated islands last year. Kenya has the highest population growth rate in the world, nearly 4% per annum, with a prospect of doubling its current population of 15 million in 17 years. These growth rates place an inssuportable financial and administrative burden in providing food, jobs, housing, education and health services. With the gloomy economic prospects for the 1980s, growth in population will outpace real economic growth in many countries and expenditures on health will have to increase just to hold the line on current levels

of quality and coverage of services. This does not take into account the massive growth in urban population expected in developing countries which is already causing new demands for services, serious problems of urban malnutrition and disruption of traditional patterns of family and community life. Since population is the critical denominator of all development activities,with such limited resources reduction of fertility will be a decisive factor in attempting to improve services such as health. At the same time wider coverage of the population with effective maternal child health and family planning services is a necessary part of any strategy to reduce population growth.

Even in the 60 middle income countries with annual per capita income averaging $1420 in 1979 the more favorable national statistics in the aggregate disguise wide disparities between the conditions on the one hand of the rural and peri-urban poor which are typical of low income countries and on the other of the more urban affluent dwellers who are better educated, have better access to health services and whose health status resembles closely the profile in industrialized countries. As economic development proceeds the more prosperous regions of the country have the advantages of greater individual and collective wealth and greater political leverage. Consequently national health policies give priority to their needs and the limited resources of hospitals, equipment, drugs, physicians and other health personnel are concentrated in the urban areas further widening the gap between urban and rural populations.

In the push for development, particularly industrial and commercial development, protective measures for workers and the environment usually lag behind as they did in earlier stages of developed countries. These measures are often disregarded because they are initially expensive and generally can only be enforced by legislation and inspection. Rapid development accelerates the appearance of new health problems such

as traffic accidents, work accidents, poisoning and environmental pollution which are now problems of rapidly growing significance in many developing countries. Similarly, the disruption of families and communities migration and unemployment contribute to a variety of disorders of individual behavior - alcoholism, violence, promiscuity - each with attendant physical and mental risks, counterparts of those seen in industrialized countries

Improvements in health in the United States and Northern Europe which resembled the pattern now seen in the low income developing countries, evolved slowly over more than a century. The first stage of evolution was marked by very high infant and child mortality due to respiratory and gastro-intestinal infections and childhood communicable diseases. These problems responded slowly to improved food supply, housing and literacy made possible by greater economic prosperity and to public health measures particularly safe water supply, sanitation and immunization campaigns. As infectious diseases were controlled and life span extended the second stage emerged characterized by chronic diseases, particularly cardiac and cerebro-vascular diseases, cancer, diabetes, arthritis and mental disorders. Expensive diagnostic and therapeutic techniques have been developed but only a small proportion are of proven effectiveness and very few simple methods have been found to control and prevent these diseases. The rapid increases in public and private expenditures on the personal health care system, now close to $1,000 per person annually in the wealthier industrialized countries, have only produced marginal improvements in the health status of the population.

To an increasing degree attention is being directed to what could be described as a third staged of evolution of health programs concerned with environmental hazards, life style and social conditions of the family and community which predispose to ill health. The personal health care system only deals with the consequences of such processes. This third stage represents a return to recognition that to a large extent the initiative for protective and preventive health measures must come from the individual and the community rather than relying independently on the health service system.

Industrialized countries have evolved through the three stages of evolution over the course of more than a century. In contrast developing countries face the challenge of coping with all three stages simultaneously: the rural and peri-urban poor which constitute the majority of the population are in the first stage; the influential, more affluent urban dwellers are at the second stage; and manifestations of the third stage are already apparent due to environmental deterioration and the social disruption associated with massive urban growth and unemployment. Furthermore, the developing countries must cope with this burden with only a fraction of the financial and human resources available to their industrialized counterparts. In any circumstances, but particularly in these, the strategy to improve health must be highly selective. Success will depend heavily on identifying correctly the most important problems for each population group, selecting the most cost effective interventions and managing the services efficiently. Already developing countries have, by taking advantage of the innovations in the industrialized world (vaccines, micro-biological techniques and anti-biotics) have achieved much faster rates of improvement in health status than occurred in norther Europe and the United States. There are clear signs, however, that this rate of progress is not being sustained. The principal obstacles to progress are: first, lack of a system of health services to make available existing health and technology to a large proportion of the population which has no access to basic health services. Secondly, the lack of appropriate technology to deal with disease within the constraints imposed by poverty, climactic conditions and institutional weakness in developing countries and to cope specifically with the heavy burden of illness from tropical diseases which are peculiar to these countries, and thirdly the extremely limited public resources available to support the health sector.

Accessibility to Health Services

In order to establish a system to bring basic health services within reach of the majority of the population several important deficiences need to be corrected. First, there is a serious shortage of health personnel and those available are concentrated in the urban areas. National averages of one doctor per 17,000 population and one nurse per 6,500 population in the least developed countries are only 1/30 the averages for industrialized countries. Furthermore these national averages disguise the reality that in rural areas in the least developed countries there may be only one doctor serving 40,000 to 200,000 people in such circumstances doctors are key participants in the referral and supervisory systems: if they operate as primary care workers, their expensive training is wasted and the cost of their practice may outweigh the benefits. More important than training larger numbers of doctors and nurses is the need to emphasize the supervisory and managerial role of the physician and the nurse in the health system both in the process of medical education and in the career development and rewards for these professionals in practice.

Secondly, in many developing countries the health manpower pyramid has been inverted with priority given to medicine and the higher levels of professional education. To achieve coverage of the population which currently lacks service, large numbers of less skilled personnel need to be trained to work at the village level. Experience in small projects has demonstrated that community health workers can deliver primary health care effectively provided first, that the number of tasks for which they are responsible is strictly limited; second, various regular supervision and continuous training to adapt their skills to changing needs; and third they are backed up by systems which assures timely delivery of drugs and supplies and the means to refer difficult

cases. Without selectivity in their tasks and the effective backup of a health system, primary health care will not survive the peripheral level, community health workers will become disatisfied and patients will bypass the village level of care in favor of higher level facilities which properly should function as referral centers.

And thirdly the delivery of health services to each of the majority of the population will involve widely dispersed facilities, numerous categories of personnel, general and specialized hospitals, vertically organized programs to control individual diseases such as malaria, tuberculosis, leprosy or venereal disease each with its own personnel and support services, community health care programs for multi-purpose workers and a system of indigenous medicine with traditional healers and birth attendants. The different elements of the system need to be organized to reduce conflict and duplication between programs and to provide a coherent system to screen and treat patients according to the level of care required. Supervision and continuous in-service education of health workers, improved logistics and supply to maintain credible services, institution of personnel policies and rewards to maintain the quality, distribution and morale of staff and policies and financial arrangements that encourage rational use of the health resources by the public are essential corollaries to enhance sector performance. The development of planning and administrative capability at the district level is of special importance since this is normally the lowest tier of the health services organization still communicating directly with central government but also in contact with the villages, aware of their needs and in a position to encourage community participation.

Management of the system of health services is much more than the management of each individual facilities or support systems. It involves decisions about priorities and resource allocation but must

be based on an understanding of the health needs of the population to be served. This epidemiological perspective is missing from the training of most of those in positions of responsibility and the information system on which to base such management decisions is almost invariably inadequate. Management also involves gaining the cooperation and compliance of highly independent professionals and specialists who have their own constituencies and political support. The medical profession is of special importance in this respect because of the profound stirring effect of individual clinical decisions on the demand for expensive facilities and the consumptions of resources for diagnosis and treatment. If the growth in hospital costs in developing countries is to be moderated and the effective use of scarce resources for diagnosis and treatment is to be increased, priority must be given in medical education and in the reward system for physicians in practice. Otherwise resources for basic services for the population at large will be usurped by the burgeoning growth of this portion of the health sector which provides benefits for only a few.

The dispersed system of health services which is a feature of the primary health care approach makes extremely heavy demands on management. The system is almost certain to breakdown if management control is almost entirely at the center and if the full burden of management and administration falls on the government ministry. There needs to be strong management and planning capability in the ministry of health but this must be accompanied by the development of management capability at district and local levels and by stimulating ungovernmental and private groups to organize and manage health services for segments of the population within the framework of national objectives.

Appropriate Technology

A second serious obstacle to progress in achieving a broad health coverage of the population is the lack of technology to control diseases which is simple, reliable and effective and which is affordable within the budgetary constraints facing the developing countries. In Bangladesh, for example, diarrhea is responsible for death in 20% of infants and 60% of children ages 1 - 4. _____treatment with intravenous fluids, anti-biotics is out of the question except for the most severe cases. However, a marked reduction in mortality and shortening of morbidity can be achieved with early oral rehydration with glucose and salts and by counseling mothers. In general the technology needed for the stage 1 health problems associated with infant and child mortality is already available. For stage 2 and 3 problems, however, there are relatively few technologies for dealing with the serious diseases of the adult population which are appropriate to the circumstances and financial resources of less developed countries. Nevertheless many of our technologies including some of the sophisticated measures for cardiac surgery and radiology are being adopted even though the equipment is extremely

expensive and difficult to maintain. At this time there is no framework to determine which interventions are effective and of these which will yield significant health benefits at acceptable cost. The ultimate challenge is to find preventive measures which will reduce the large burden of illness in the second stage from diseases such as cancer, hypertension, diabetes, cardiac and cerebro-vascular disease and mental illness.

The so-called tropical diseases, malaria, schistosomiasis, filariasis, trypanosomiasis and leprosy are a heavy burden in developing countries. Techniques for ecological control of the vectors and transmission routes available, but are expensive and require repeated application over wide areas. Similarly, current methods of treatment of patients are often expensive and sometimes risky. Prophylactic measures such as vaccination are largely underdeveloped. Research on these diseases has not received the attention they deserve from the scientific community and the pharmaceutical industry both of which have been preoccuppied with cancer, cardio-vascular diseases, disorders and the other major diseases of the industrialized world. The special program for research and training in tropical diseases led by WHO is an attempt to mobilize the health science research community throughout the world to focus attention on these neglected tropical diseases in order to discover appropriate technologies for their control.

The most widely used technologies in health are drugs and vaccines. Shortage of supply and failure to provide for the timely distribution of these agents are serious problems which must be overcome for an effective health care system. Looking to the future, however, as access to health services broadens with implementation of primary health care programs, rapid increase in the consumption of drugs

may be expected. In China, with nearly universal access to health care nearly all patients receive medication and recent studies suggest that drugs and traditional medicine account for nearly two thirds of overall health expenditures. In other developing countries with less complete population coverage, expenditures on drugs constitute 30 to 40% of the public sector health budget and over half of private health expenditures. Since the majority of drugs are imported in many developing countries, these outlays are a considerable drain on foreign exchange. The importance of drugs to the quality of care, to the credibility of community health workers, to the development of toxicity and anti-biotic resistance and to the cost of health services makes it imperative that developing countries establish better mechanisms for assessing drug requirements and for purchasing quality control storage and distribution of drugs.

The scientific and development resources of developing countries are limited and their problems are difficult to solve. The most promising results for the development of appropriate technology will come from combining the scientific and technical potential of the industrialized world with the local knowledge of scientists and professionals in developing countries who will have responsibility for applying the new technologies. These partnerships are most likely to be productive if committed groups of scientists of high quality are engaged, if bureaucratic and political impediments can be minimized and if stable support can be sustained over a period of 10 - 15 years.

Poverty

The overriding constraint to improving health status in the least developed countries in the opinion of most development specialists is the extreme poverty of most of the population and the low level of GNP per capita, averaging US$240 in 34 low income countries. Health must compete with other pressing development needs for extremely limited public resources. Available data indicate striking differences in the levels of total public expenditures on health for capital and operating purposes with average figures of US$2.60 per capita per annum in the poorest countries, $19 in middle income countries and $469 in industrialized countries. Bangladesh, Ethiopia, Indonesia and Zaire's annual public expenditures on health of only $1 per capita. These figures are in stark contrast with the combined public and private health expenditures in the United States and several northern European countries which are now close to $1,000 per capita per annum.

What are the prospects for increased public expenditures on health? Predictions for annual growth in GNP per capita during the next decade is estimated to be only 2.1 to 2.3% in middle income oil importing countries and 0.7 to 1.8% in low income countries. Assuming public expenditures for health remain at the same proportion of GNP as in 1977, the allocation for health in low income countries may be expected to increase only by $0.40 to $0.80 per capita; in Asia and Africa south of the Sahara the figures may be even less. Predictions to the year 2000 show little further improvement particularly in the low income countries and as a consequence the gap between rich and poor nations continues to widen.

Is the goal of Health for All possible in the poorer developing countries which may only be able to afford public expenditures of

$2 to 3 per person annually for the health sector? The available evidence suggests that it is. First, analysis of six primary health care projects undertaken in different developing countries during the 1960s and 1970s indicates that 40 to 70% reductions in infant and child mortality could be achieved within five years by providing basic health services with annual recurrent costs of $0.50 to $3.50 per person. The results match closely estimates of $1 to $5 recurrent costs per person annually prepared by three different groups. Second, although there appears to be a strong correlation of per capita income and mortality trends in developing countries nevertheless, Sri Lanka, the state of Kerala in India and the Peoples Republic of China are examples of political jurisdictions which have attained life expectancy close to the level of the industrialized world with income levels in the range of the least developed countries. These achievements may be explained in part by the public priority given to literacy, food supply and health and by special features of political and social organizations.

Thirdly, recognizing the continuing scarcity of public resources and the desirability of alternatives to total dependence on government funding more attention needs to be given to the mobilization of financial support from other sources such as local government revenues, social security schemes, cooperatives based on contributions by employer and employees, user fees for selected curative services and community contributions. Since private spending is estimated to be three to four times greater than government expenditures on health in many developing countries this is clearly one of the most important sources of financing to explore. Diversifying the sources of funding of health services reduces the uncertainty associated with total dependence on government funding and increases the opportunities for participation of the individual community cooperative

or local government in planning and management of health services. It is that the resources are in addition to rather than a substitute for public funding. Furthermore, it is important to match services with the source of funding. For example some health needs are likely to attract private support but in other situations it will only be possible to provide the services with public funds.

In many countries the principal alternative to government financing has been official development assistance from bilateral and multilateral agencies and extensive local contributions by overseas non-governmental organizations. In 1978 total support for health from all external sources totalled approximately $3 billion. Nevertheless even in the poorest countries this was equivalent to 25% or less of public and private expenditures on health. The tendency of governments to discriminate and budget allocations against programs with high recurrent costs in favor of capital intensive projects is aggravated by the policy of many external donors not to support operating costs. Capital expenditures financed by external assistance, for example for high technology hospitals, may create new recurrent cost obligations which are not in keeping with the priorities for use of the limited government funds available for health. Furthermore, unwillingness of external donors to fund operating costs may lead to neglect of maintenance costs in favor of further capital expenditures for rehabilitation and replacement of facilities and equipment - a much more costly approach to sector development. Since primary health care is not capital intensive a key consideration for its success will be the willingness of governments and external donors to attach priority to the funding of recurrent costs for a limited period.

With only a few dollars per person annually to spend on health it is of the outmost importance that the available resources be used

effectively and efficiently. National capability to plan and implement strategies and programs which could make the best use of scarce resources is seriously deficient in most developing countries. The co-existence of sub-populations with different health needs requires programs designed for these groups, not based on national averages. The need to select from among a broad range of possible interventions the most appropriate mix of personnel trained, facilities built and technologies used requires information of relative cost effectiveness trade-offs between capital investments and recurrent costs and assessment of the political and administrative feasibility of implementation. Physicians and administrators with a population perspective of health needs and a cost effectiveness attitude towards management are rare in any country. The need for these qualities in the planning and management of health care in developing countries assumes a special significance in view of the scarcity of resources.

Conclusions

Developing countries face the challenge of coping with a heavy burden of illness which differs markedly in subgroups of the population at different stages of development. The greatest improvement in life expectancy from health investments can be expected in the rural and peri-urban poor with a program which provides maternal and child health services including control of the major infectious and parasitic diseases of children under five. Effective technology for such a program is now available and affordable even within the financial constraints of the least developed countries. Two major problems remain: first, the political will to allocate the necessary resources for the program and second, the management capability to organize and operate a system of services for the rural and peri-urban populations using multi-purpose community health workers.

No satisfactory strategy has been developed to meet the health needs of older children and adults that is within the financial means of most developing countries. There are relatively few, simple, effective interventions to control the metabolic, vascular, degenerative and malignant diseases of the adult population and little understanding of the behavioral disorders. Without new technologies for control and prevention it is unlikely that the poorer developing countries will be able to provide more than symptomatic care for most patients with these health problems. Furthermore, adoption of the expensive technologies now used for the diagnosis and treatment of these diseases in the industrialized world will divert the limited resources available for programs for the rural and peri-urban poor to sophisticated, hospital-based, urban services which will have, at best, a marginal impact on health.

The search for health technology appropriate to the financial and organizational circumstances of developing countries must be seen as a high priority for the research and development community of the entire world. Existing technology must be critically evaluated and new, simpler techniques developed for the control and prevention of common chronic diseases. Greater attention should be given to research and development on the "tropical" diseases which are a major component of the disease burden of developing countries but which have been largely neglected by the world's scientific community. Pharmaceuticals are of special importance since the timely supply of essential drugs is critical to the quality of health care and the credibility of community health workers. The dangers of excessive use or inappropriate choice of drugs necessitate the introduction of policies on procurement, prescription, pricing and quality control to avoid health hazards and excessive costs.

Financial constraints will be an overriding consideration in the development of the health sector for the foreseeable future, particularly in the least developed countries. The poorest countries which now have public expenditures on health averaging only $2.60 per capita per annum also have the least favorable economic prospects for the next decade. Greater efforts are required to mobilize resources for health from other sources, particularly the private sector, and to ensure that the limited resources available from all sources are used in the most cost-effective manner. Few developing countries have the institutional capability to carry out the process of selecting health interventions on the basis of expected health impact, least cost and feasibility of implementation, and to integrate independent facilities, practitioners and disease specific programs into a more coherent, economical, multi-purpose system. High priority should be

attached to strengthening the capability of administrators, physicians and other personnel in positions of leadership in the health system at central and local levels to develop a population perspective in the analysis of health problems, a cost effectiveness attitude towards the use of resources, and management skills appropriate for a human services organization. More efficient management of health services is only one aspect of the problem. It is equally important to mobilize communities and individuals to take a more active role in promoting health and in financing health services rather than relying primarily ~~passively~~ on a government system. in which they are passive recipients of services.

Scarcity of money for health is a critical limitation on progress towards the goal of Health for All by the Year 2000. More money alone, however, will not produce the desired outcome unless there is political commitment to programs for those in greatest need and the managerial capability to implement them. This is first and foremost a challenge for developing countries but it is also a consideration in the investment policies of donor agencies. Progress towards the goal of Health for All can be accelerated if more external assistance can be provided for the areas of greatest need and if the unique scientific and technological resources of the industrialized world can be made available to developing countries to strengthen their institutions and to collaborate in the development of appropriate technology to meet their needs.

The world-wide economic slowdown and the high cost of energy have created extremely difficult economic and balance of payments problems for almost all developing countries. Just as in the industrialized world governments are concentrating on short-term goals to increase productivity, promote exports, substitute for imports and reduce domestic spending, particularly on the social programs such as health and nutrition which have other benefits in the medium and long term. The short-term preoccupation is understandable since economic prosperity is the critical enabling factor for all aspects of development. The ultimate goal of development, however, is not a specific figure for GNP per capita or a trade balance but rather the well being of people. As Mr. McNamara pointed out in his final address as President of the World Bank last year, "The principal goals of development.....are: to accelerate economic growth and to eradicate.....absolute poverty.....the two goals are intrinsically related, though governments are often tempted to pursue one without adequate attention to the other. But from a development point of view that approach always fails in the end. The pursuit of growth without a reasonable concern for equity is ultimately socially destabilizing, and often violently so. The pursuit of equity without a reasonable concern for growth merely tends to redistribute economic stagnation..... Any successful effort to combat poverty would have to do two things. Assist the poor to increase their productivity; and assure their access to essential public services.....Development is clearly not simply economic progress measures in terms of gross national product. It is simply much more basic. It is essentially human development that is the individual's realization of his or her own inherent potential", This is the challenge of Health for All for a few dollars per Person by the Year 2000.

The World Bank / 1818 H Street, N.W., Washington, D.C. 20433, U.S.A. • Telephone: (202) 477-1234 • Cables: INTBAFRAD

October 28, 1981

Dear Dick,

To follow up our telephone conversation about the role of the Bank in the health field, I believe there might be two points worth making.

The first is the significance of the Bank's formal entry into the health field. Most of the Bank's activity has been addressed to the productive sector and judged by the classical parameters of rate of return on investment. It was during Mr. McNamara's period as President that it was recognized that development must not just accelerate economic growth but also eradicate absolute poverty. The two goals are closely related although governments are often tempted to pursue one without adequate attention to the other. From a development point of view, the one sided approach almost invariably fails since pursuit of growth without reasonable concern for equity is ultimately socially destabilizing. Furthermore, the pursuit of equity without reasonable concern for growth merely tends to redistribute economic stagnation. Development, therefore, is not simply economic progress measured in rate of return in investment or increase in gross national product. It is something very much more basic. It is essentially human development.

The Bank's entry into the health field has strengthened the position of the Ministry of Health in the development priorities and has given important legitimacy to the goals advocated by the World Health Organization and UNICEF that improved health for the rural and peri-urban poor is a matter of high priority in both national and international programs of development.

A second advantage of the Bank's entry into the health field is the focussing of its approach to development on the health sector. The Bank places great weight on the analysis of proposed investments in terms of the impact on health and the most cost-effective and efficient means of achieving that impact. Acceptance of this approach by Ministers of Health may enhance the effectiveness of utilization of existing resources and increase the credibility of Ministry of Health proposals to the Ministry of Planning and Finance.

The Bank maintains a profile of information on all important sectors which relate to the development process. In this respect the Bank has gathered data on life expectancy, crude birth rate, crude death rate, nutritional status, infant mortality and other indicators

of the human condition in each country. This information helps to establish the priorities for development finance in the country. The composite of data from countries around the globe is an extremely important indicator of the human condition in the developing world and the trends associated with changing economic circumstances.

I hope this information may be of some use to you. With kindest regards.

Yours sincerely,

John R. Evans
Director
Population, Health and Nutrition Department

Dr. Richard Lewis
466 West 10th Avenue
Columbus, Ohio 43210

WHO PRESS

Press Release WHO/26
15 October 1981

FOOD AND HEALTH

Statement by the Director-General of WHO for World Food Day

Dr Halfdan Mahler, Director-General of the World Health Organization (WHO), has addressed the following statement to the Director-General of the United Nations Food and Agriculture Organization (FAO) on the occasion of the first commemoration of World Food Day to be observed annually on 16 October:-

"For hundreds of millions of people in the world today, mankind's right to adequate and nutritious food is a cruel joke. Among the populations of the developing countries, at least one in four has a food intake below the critical minimum level.

Malnutrition, the direct result of injustice and underdevelopment, daily robs thousands of their intellectual and economic birthright. The burden is heaviest for children, among whom undernutrition and the lack of safe water open the doors to killer diseases. For those who survive, many will have a reduced capacity to learn during childhood and earn during adulthood. Thus the lack of sufficient, nutritious food has retarded the economic progress of the developing world, for development is dependent upon human energy and human energy in turn is dependent upon an adequate diet. Furthermore, widespread hunger today is a clear threat to peace on our planet.

In the industrialized countries, the malnutrition of affluence contributes directly to the increasing burden of obesity, cardiovascular diseases, diabetes and dental problems.

Given our present knowledge, our modern technologies and the social and economic forces at our disposal, it is an indictment of our times that global food problems appear to be increasing in magnitude.

World Food Day is an occasion for the health sector to rededicate itself to greater efforts to reduce malnutrition and lessen its impact. The priorities include reduction in diarrhoeal and other infections, provision of safe drinking water and adequate sanitation, better spacing of births and proper child immunization, promotion of breastfeeding and good weaning practices and improved nutrition education, as well as attacks on specific nutritional deficiencies.

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WORLD HEALTH ORGANIZATION

DIVISION OF PUBLIC INFORMATION

1211 GENEVA 27
SWITZERLAND

TELEPHONE : 91 21 11

CABLES :
UNISANTE-GENEVA

TELEX. 278 21

The Member States of the World Health Organization are making realistic and effective nutrition and nutrition-related activities a cornerstone of their provision of primary health care to every citizen. We shall continue to work closely with FAO and other international organizations to develop food and nutrition strategies for each country as a key element in national development plans.

World Food Day reminds us that every sector of development has a role to play in achieving the twin goals of "Food for All" and "Health for All"."

FORM NO. 75
(9–78)

THE WORLD BANK

ROUTING SLIP	DATE: 10/1/81

NAME	ROOM NO.
Dr. Evans	

	APPROPRIATE DISPOSITION		NOTE AND RETURN
	APPROVAL		NOTE AND SEND ON
	CLEARANCE		PER OUR CONVERSATION
	COMMENT		PER YOUR REQUEST
	FOR ACTION		PREPARE REPLY
	INFORMATION		RECOMMENDATION
	INITIAL		SIGNATURE
	NOTE AND FILE		**URGENT**

REMARKS:

For Shaltiel

FROM:	ROOM NO.:	EXTENSION:

MALNUTRITION
(Suggestions for insert for October 28 Boston Lecture)

I. Order of magnitude

A. Malnutrition takes many forms. Most experts agree that underconsumption of calories--in some cases underconsumption of calories combinedwith inadequate protein--is the most serious nutrition problem. For most people, this could translate into simply: "not enough food."

B. The size of this kind of malnutrition problem is an issue surrounded by controversy. Estimates range from four hundred million to eight hundred million--the differences partly reflecting different methodologies in making estimates (an FAO/WHO expert group is meeting this month to try to sort out these differences)--but more so the differences relating to the question of "adequate nutrition for what?" Some on the lower side are estimating adequate nutrition for survival; on the higher side, for functioning at a reasonable level.

C. But by any measure, we are speaking of a problem of major magnitude--evidence is strong enough to conclude conservatively that at least several hundred million lives are affected by inadequate nutrition.

D. (Who?) Problem is in almost all poor countries, with major differences by income group, occupation and section of country, e.g. malnutrition in parts of Brazil is as bad as in parts of the Indian sub-continent.

1. In sheer numbers, the largest problem is in sub-continent.
2. By proportion of population that is malnourished, largest problem in the Sahel and Bangladesh (this on a year-in-year-out basis; i.e., not including countries affected in any given year by a natural or political disaster).

3. Problem most serious among the rural landless, farmers with very small landholdings, fishermen and the urban unemployed.

Supply of food in most parts of the world has kept ahead of population growth. Exception is sub-Sahara Africa where per capita food production has been declining for a decade.

II. Consequences--i.e., what difference does it make?

A. We cannot quantify consequences precisely but research base continues to expand and confirm what has been suspected: the functional effects are significant.

B. Survival. (As discussed earlier in the paper?) Sizeable portion of deaths in poor countries caused by what we might consider relatively minor diseases--measles, chicken pox, whooping cough. Cause of the death often not so much the infection as the malnourished condition the person was in when it was contracted. Malnutrition a contributory cause in a third to a half of deaths from diseases among children under five. Malnourished people are more likely to:

1. contract infectious diseases
2. suffer more severe cases
3. die more readily from disease than those who are well-nourished

C. Physical Development. 20-30% growth retardation not uncommon. Eleven year olds often with stature of eight year olds. (So what?)

1. Low weight is related to performance and capacity to work (taller workers cut more sugar cane; produce more in factories).
2. Growth retardation associated with malnutrition is accompanied by decreases in the circumference of the head, the size of the brain, and the number of brain cells and a lowering of scores on tests of cognitive and sensory ability.

So under conditions in which malnutrition and other hardships inhibit growth, is bigger better? Yes.

D. Mental Development and Educability. In addition to above, malnutrition interfers with child's motivation, ability to concentrate, and ability to learn, whatever its ultimate effects on the conditions of the brain itself. Learning time is lost during the most critical period of learning. A malnourished child is listless, lacking in curiosity, and unresponsive to maternal and other stimulation. Even if this were not so, the maternal stimulation he requires for proper development frequently is not available; the mother herself is often a victim of nutritionally induced lethargy. By the time he reaches school he already is behind his adequately nourished classmates and then falls further behind because of his frequent bouts with nutrition-related illnesses (in Latin America not uncommon to miss as much as one-third of the scheduled school days). Leads to high repeater and dropout rates common in developing world. All this has effect of permanently handicapping the child quite aside from what is happening in brain development due to malnutrition, i.e., child has suffered an irreversible loss of opportunity.

E. Productivity. As shown above, malnourished people are less effective workers. In addition, malnutrition:

1. increases the number of work days lost because of illness
2. reduces the working life span
3. reduces cognitive skills that affect certain types of work performance.

F. Family Planning. Reducing malnutrition, a prime contributor to child mortality, appears to be a necessary part of efforts to

reduce birth rates.

G. Well-being. There isn't much in the way of material goods that the poor can enjoy--and not much more likely in the future for many of them. Malnutrition (and feeling rotten because of it) limits people from enjoying whatever sources of non-material satisfaction that are available--the joy of children, friends, love, physical beauty, good talk at the tea stall--important aspects in the quality of life.

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If you also want to get into micronutrient deficiencies, the major ones are

1. iron defifiency anemia, affecting an estimated 500 million people, and related to fatigue, lethargy, apathy and adverse effects on productivity and school performance.
2. vitamin A deficiency, seen in up to half of the children in some developing countries, affecting growth, skin condition, the severity of other nutritional-related illnesses and vision. Severe Vitamin A deprivation is a major casue of blindness in low income countries; in India there are an estimated one million cases. In addition 10-15 percent of children in India are said to suffer from night blindness or more severe ocular manifestations of Vitamin A deficiency.
3. iodine deficiency, affecting perhaps two hundred million people; in its severe form can stunt physical and mental development. In areas of high goiter incidence, 3-4% of the population may be deaf mutes and/or cretins.

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III. What to do about it?

A. Problem reflects inadequacy in:

1. food supply
2. income to purchase food
3. physical access to food that is available
4. knowledge of the best way to use the available resources
5. health practices that affect biological use of the food that is consumed.

B. Accordingly, nutrition efforts need to be designed to:

1. expand food supplies (increasing production and reducing food losses) in ways that will benefit the poor--with more attention than has been given on what is grown, who grows it and what is stored.
2. increase the incomes of the poor
3. improve their access to food by improving the marketing system and adjusting price policies in ways that benefit consumers without creating a disincentive to producers
4. setting up special feeding programs
5. through education, bringing about changes in food preferences, in the distribution of food within families, and in hygiene
6. improve health and environmental conditions--water, sanitation, immunization, and management of diarrhea--and to attack specific problems of micronutrient deficiences.

C. Some can best be attacked through government policies (e.g., a shift in prices on key foods in ways that benefit low-income consumers); others require more direct forms of nutrition intervention.

IV. Links to Health

A. We must consider malnutrition as a key determinant of health status and the alleviation of malnutrition as a major goal

of health activities.

B. Breaking down the barriers between health and nutrition is therefore a priority in programming for improved health. To say that malnutrition must be a focus of health programming does not, of course, mean that health programs alone can reduce malnutrition to acceptable levels, e.g. if we think of getting food into children is a way of immunizing them against malnutrition it is clear that this can be done much more efficiently before they become involved in the health system.

C. But there are areas in which health activities can efficiently address the malnutrition problem:

1. Identification of those in need through nutrition surveillance programs (tied to other health information being collected)
2. Provision of food supplements, either directly or indirectly (i.e. the latter by provision of coupons to obtain food through commercial channels)
3. Educating families to better use of existing resources for food, to encourage breastfeeding, to encourage introduction of weaning food at appropriate ages, to encourage appropriate distribution of food within the family
4. Controlling micronutrient deficiencies both through clinics (e.g. mass dose capsules and shots) and outside the clinic (e.g. fortification of staple foods)
5. Provide nutrition rehabilitation and other forms of curative treatment for the severely malnourished.

D. Health officials must play a more active role in serving as the nutrition conscience beyond health ministries. Malnutrition is a problem that escapes all the programs. It is a problem that cuts across organization charts and traditional disciplines. It needs

sustained advocacy in the councils of governments and because malnutrition is a health problem, health officials are the most appropriate (and potentially the most credible) sources of this advocacy.

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Note: If you want to link to Food Day, a blurb attached.

TAKING AIM AGAINST HUNGER

ROWAN SHIRKIE

When the conference that established the Food and Agriculture Organization of the United Nations (FAO) was held in Quebec City, on 16 October 1945, the world food situation was critical. Production had been forced into restricted patterns, and normal distribution of food supplies had been violently disrupted by a global war. The objectives of the new organization then were to promote the common welfare of its member nations by "raising levels of nutrition and standards of living of the peoples under their respective jurisdiction; securing improvements of the efficiency of the production and distribution of all food and agriculture products; and bettering the condition of rural populations and thus contributing toward an expanding world economy and ensuring humanity's freedom from hunger."

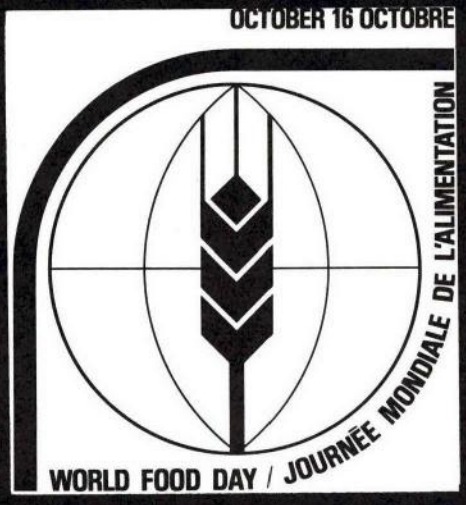
Hunger still holds much of humanity in chains today, and the effort to feed the world is still on a war footing. The opening shot of a new campaign to meet the objectives set before the United Nations' first-born agency will be fired Friday, 16 October 1981, soon to be better known as World Food Day. The 36th anniversary of the founding of FAO, that day will mark the beginning of a global effort to draw public attention to the severity of world hunger and promote efforts to overcome it.

It is an anniversary with little to celebrate. FAO estimates that the number of severely undernourished people in developing market economies (the developing countries not including China or the other Asian centrally planned economies) rose from some 360 million in 1969 – 71, to about 420 million in 1974–76, to more than 500 million today.

Poverty is the main cause of hunger. It also increases the havoc that climate or political events can wreak on food supplies. Price hikes caused by shortages hit hardest at the poor, because they must spend a larger part of their income simply to eat.

Developing countries are obviously the most affected by malnutrition, but industrialized countries are not exempt. In Canada, for example, many elderly people, native populations, and single-parent families live below the poverty line. And even affluence has its nutritional price. The degenerative diseases of the heart and digestive system that are major health problems of the developed countries result from overeating and poor diets.

Canada is indeed fortunate in having cheap food in abundance, and a vigorous agricultural industry — agriculture contributes almost a third of Canada's gross domestic product. Canada and the USA together hold more than 40 hold more than 40 percent of the world grain reserves, take a two-thirds share of total world grain exports, and supply two-thirds of all food aid. The abundance of North American agriculture is "the world's last line of defense against famine" says the FAO.



To whom much is given, much will be required. As Agriculture Minister Eugene Whelan pointed out in a speech launching World Food Day activities in Canada, "Many Canadians do have a deep desire to share the wealth we have with others around the world. But we need to be moved; we need to feel that we are making a personal contribution — actively participating in the world, helping in our family of nations and not just sitting numbly watching it flickering by on the television set."

The idea of a community of nations has little meaning, the Brandt report on international development issues points out, while it allows millions of its members to die or be permanently disabled from lack of food. World Food Day is planned to give all people a chance to join together and demonstrate their commitment to ending hunger.

Canada has a special role to play in World Food Day. The FAO was created here, in no small part due to the efforts of Canadians like the late Lester B. Pearson, who was Chairman of the Quebec Conference in 1945. As one of the leading food-producing nations of the world, Canada continues to contribute human, financial, material, and technical resources to international food programs.

Canada has chosen as its theme "Food for all", and has begun organizing activities to give individual Canadians an opportunity to, in Mr Whelan's words, "put their own views on food and world nutrition into clearer focus," and to act on them. Representatives of federal and provincial governments, development agencies, voluntary organizations, and producer and consumer groups have formed a coordinating body to plan for World Food Day. Some of the proposed activities include public lectures, exhibitions, television specials, poster and essay contests, and "hunger suppers" as well as other fund-raising events. A national World Food Day Coordinator has been appointed to provide support and resources to individual initiatives.

Worldwide, activities range from special issues of coins and stamps, to schoolchildren's gardening exercises. Some countries, like Burma and Mauritania, plan to honour their farmers with special awards for outstanding production achievements. Indonesia will be holding a special television panel on food issues, including the Minister of Agriculture and farm-level representatives. Zaire is planning farming and fish farming demonstrations — many countries are turning agricultural fairs or festivals into World Food Day events. Coordination and information on international activities are being handled by the World Food Day Secretariat, FAO Headquarters, Via delle Terme di Caracalla, 00100 Rome, Italy.

For more information on World Food Day in Canada, contact the World Food Day Coordinator, Agriculture Canada, Ottawa, Canada K1A 0C7. □

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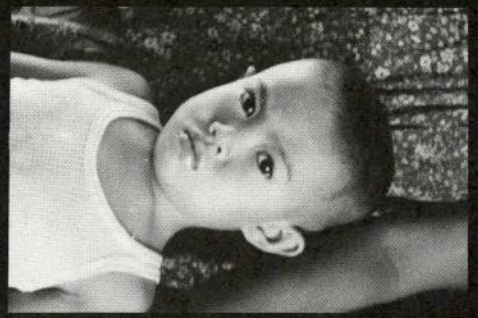

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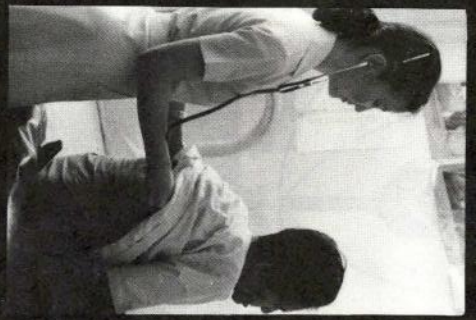

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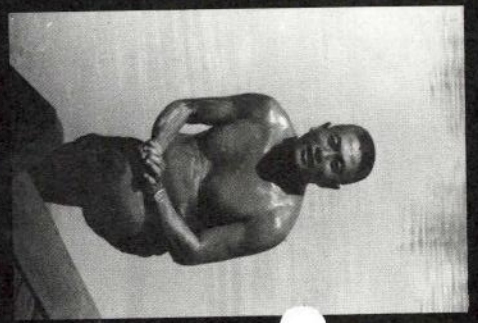


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WHO FEATURES

RMF file: with Strathclyde speech

September 1981
No. 72

WHO REPORT URGES LARGER HEALTH ROLE IN PLANS FOR DEVELOPMENT

-- Aimed at U.N. Conference on Least Developed Countries --

Even though a healthy worker is indispensable to the attainment of economic goals, the role of health is "often under-estimated or ignored by policy-makers."

In a report for presentation to the U.N. Conference on the Least Developed Countries, the World Health Organization (WHO) makes a plea for support of health programmes and a larger share of the development dollar.

The population least provided with health services is estimated to be around 200 million out of a total population in the LDCs of 280 million. The infant mortality rate in the 31 LDCs is highest in the world, and the life expectancy lowest.

They are the world's most needy, yet most neglected.

WORLD HEALTH ORGANIZATION

DIVISION OF PUBLIC INFORMATION

1211 GENEVA 27
SWITZERLAND

TELEPHONE : 91 21 11

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Health and Related Socioeconomic Indicators

	Least developed countries	Other developing countries	Developed countries
Number of countries	31	89	37
Total population (millions)	283	3 001	1 131
Infant mortality rate (per 1000 liveborn)	160	94	19
Life expectancy (years)	45	60	72
% birth weight 2500 gr or more	70%	83%	93%
Coverage by safe water supply	31%	41%	100%
Adult literacy rate	28%	55%	98%
GNP per capita	$170	$520	$6 230
Per capita public expenditure on health	$1.7	$6.5	$244
Public expenditure on health as % of GNP	1.0%	1.2%	3.9%
Population per doctor	17 000	2 700	520
Population per nurse	6 500	1 500	220
Population per health worker (any type, including traditional birth attendant)	2 400	500	130

Note: Figures in the table are weighted averages, based upon estimates for 1980 or for the latest year for which data are available.

WHO REPORT URGES LARGER HEALTH ROLE IN PLANS FOR DEVELOPMENT

-- Aimed at U.N. Conference on Least Developed Countries --

by Peter Ozorio
Information Officer

Health is prerequisite to a country's development, according to the World Health Organization (WHO).

This is particularly true for the 31 countries designated by the United Nations as "least developed", with populations among the world's least provided with health services.

Too often, however, plans for development turn exclusively on the consideration of such issues as trade and tariffs, raw material and energy -- to the neglect of health.

Indeed, the role of health is "often under-estimated or ignored by policy-makers" even though a healthy worker is indispensable to the attainment of economic goals, WHO contends in a report for presentation to the U.N. Conference on the Least Developed Countries, meeting in Paris from September 1st to 14th.

Stressing that the UN General Assembly, in a resolution (34/58) adopted in November 1979, urged that health be considered as an integral part of development, and not separately from it, the WHO report calls for support of health programmes through allocating to them a larger share of development funds.

"It is unrealistic to plan the development of a country without taking into account the health of those who must implement that development," the WHO report states.

The population of the LDCs total some 280 million. Those in dire straits -- essentially the population without access to safe water supply systems, or to health care -- are estimated at about 200 million.

According to WHO estimates, almost $164,000 million are required to provide that target population with primary health care, $61,200 million for the eighties, and $102,500 million for the nineties.

"It may be assumed, as a working hypothesis," the WHO report adds, "that the LDCs are able to provide 80 per cent of the resources needed" for improving their health situation. Thus, funding sought from multi- and bi-lateral sources amount to $32,750 million, or $12,250 million for the eighties, and $20,500 million for the following ten years.

The LDCs: A Profile

The following countries have been designated as LDCs:

In Africa: Benin, Botswana, Burundi, Cape Verde, Central African Republic, Chad, Comoros, Ethiopia, Gambia, Guinea, Guinea Bissau, Lesotho, Malawi, Mali, Niger, Rwanda, Somalia, Sudan, Uganda, United Republic of Tanzania, and Upper Volta.

In Asia and Oceania: Afghanistan, Bangladesh, Bhutan, Democratic Yemen, Laos, Maldives, Nepal, Western Samoa, and Yemen.

In Latin America: Haiti.

The report attributes the low standard of health in the countries to a combination of economic, geographic, political, and administrative factors.

Not only are material and financial resources of the LDCs inadequate for improving health, WHO says, but also inflation and rapid population growth aggravate the economic condition of the countries.

In addition, the terrain of most of the LDCs is rugged; half of the countries are land-locked, and five are islands, thus making transport and communication difficult, the report says, particularly at times of seasonal rains or floods. Many are situated in the world's "disaster belt", with a high risk of natural catastrophes that "destroy in one fell swoop" years of work.

Another point made by the WHO report is that "military expenditure per capita is several times greater than public health expenditure," with the ratio being $5.5 to $1.7 respectively in some countries. Moreover, many are afflicted by civil strife.

Added to the foregoing is the fact that all LDCs are "deficient in all categories of health personnel." For example, the report shows that there is but one health worker for 2,400 people in the countries, many of them being "inadequately trained".

Even worse is the doctor-to-population ratio. According to the report, there is one physician for 17,000 in the LDCs, as compared to one per 2,700 for the other developing countries. The average ratio is one for 520 in the industrialized world.

Goals for the next decades

The report compares health and economic conditions in the least developed countries not only with those prevailing in the industrialized world, but also with conditions in other developing countries.

It finds, not unexpectedly, a gap between developing and developed countries, but also between the LDCs and the other developing countries. Among the proposed goals to bridge that gap over the next two decades are the following:

-- Infant Mortality: A decrease in the infant mortality rate to less than 50 deaths per 1,000 live births. The figure now is 160 per 1,000.

By comparison, the rate in other developing countries is 94 deaths per 1,000 live births, while it is 19 in the industrialized world.

-- Life Expectancy: An increase in the life expectancy rate to at least 60 years, from 45 now.

By comparison, life expectancy is now 60 in the other developing countries, and 72 in the industrialized world.

-- Birth Weight: An increase to at least 90 per cent in the numbers of babies weighing a minimum of 2,500 gr (5lbs 8oz) at birth.

The figure is 70 per cent now, as compared to 83 per cent for other developing countries, and 93 per cent in the industrialized world.

The report also shows that in the LDCs the average per capita intake is 2,000 calories daily, as compared to 2,400 in the other developing countries, and 3,400 -- "far in excess" -- in the industrialized world.

"Malnutrition is a major contributing factor to the very high rates of infant and young child mortality", the WHO report notes.

-- Adult Literacy: An increase to over 70 per cent of the literacy rate combined for men and women. It is but 28 per cent now among adults, and even lower, 13 per cent, for women alone.

By comparison, it is 55 per cent for the other developing countries, and 98 per cent for the industrialized world.

-- GNP Per Capita: An increase in the GNP to at least $500 per capita, from $170.

By comparison, it is now $520 in the other developing countries, and $6,230 in the industrialized world.

-- Public Spending on Health as % GNP: An increase of public spending on health from the present 1 per cent of gross national product to five per cent at least.

By comparison, the figure is 1.2 per cent for other developing countries, and 3.9 per cent for the industrialized world.

-- Water Supply and Sewage Systems: That a supply of safe water be available in all homes, at a walking distance not exceeding 15 minutes, and that adequate sanitary facilities be available also in homes, or in the "immediate vicinity".

At present, less than a third of the population in the least developed world can count on sure access to either. In the LDCs of Africa, the figure is even lower -- less than 20 per cent have access to such systems.

By comparison, in the other developing countries, 41 per cent of populations are now served, and in the industrialized world, coverage is virtually 100 per cent.

-- Primary Health Care Facilities: That primary health care facilities, with at least 20 essential drugs available, be within an hour's walking distance from homes.

-- Immunizations: That all children be immunized against six childhood diseases, namely, measles, whooping cough (pertussis), tetanus, poliomyelitis, tuberculosis, and diphtheria.

Even though vaccines have existed, for decades, not more than 10 per cent of the 80 million children born in all developing countries are estimated to be protected against the six children killers, with the rate of immunization even lower in the LDCs

"Such is the state of deprivation of the least developed countries that greater resources than for other developing countries will need to be directed" at them, the WHO report goes on to say.

"The special nature of their problems will call for specific efforts and initiatives", it adds, and particularly in health which is fundamental to development.

By way of example, the report cites WHO's region for the Eastern Mediterranean. There, the "more affluent countries have relinquished their share" of the regional budget thus freeing more funds for programmes in Afghanistan, Democratic Yemen, Somalia, Sudan, and the Yemen Arab Republic.

In addition, Kuwait, Libyan Arab Jamahiriya, Qatar, Saudi Arabia, and the United Arab Emirates, "the richer countries of the region... have contributed substantially... to programmes in LDCs, notably for malaria control".

It is, however, clear from the WHO report that world-wide efforts have so far been insufficient, and that more, much more, needs to be done if the least developed countries of the world are to reach the goal, set by the World Health Assembly in 1977, of "Health for All by the Year 2000".

INFECTIOUS DISEASES AND HANDICAPS IN DEVELOPING COUNTRIES

Projection based upon WHO estimates, July,1981.

Year and estimated populations in millions - Note *1	1980 2'300m m *2	2000 3'670m m
Parasitical diseases:		
Helminth infections, including hookworm in 726 to 907 million people	1'200	1'420
Schistosomasis (bilharzia) - endemic in 71 countries, with 500 million at risk	200	330
Filariasis (including Onchocerciasis (river fly blindness) and Trypanosomiasis (sleeping sickness))	250	430
Endemic Goitre (*3)	200	300
Tuberculosis (3,5 million new cases per annum)	30	50
Malaria (perhaps 250 million by 1981, in 70 countries	150	300
Leprosy	10	12
Trachoma - at potential risk of blindness	500	800
Blindness, all causes (*4) - at 3/60	22	45
- at 6/60	34	67
Diarrhoeal diseases, per annum per person (under 5 yrs av. 2,5 p.a.; over 5 yrs av. 0,5 p.a.)	1'970	2'940
Immunisable diseases of children: *5		
Pertussis (whooping cough)	58	87
Measles	68	102
Tetanus ("lockjaw")	0,6	0,9
Poliomyelitis - infects over 90% but physical paralysis is estimated at 1% to 2%	0,85/ 1,7	1,27/ 2,5
Diphtheria - total not known	?	?
Tuberculosis - total not known separately	?	?
Sexually transmitted diseases (estimates believed to be conservative, as trend is rising on known data)	100	200

*Notes:

(1) China is not included; and many countries do not yet give full data.

(2) Many individuals may have more than one infection simultaneously.

(3) Dietary correction can reduce or eliminate goitre incidence.

(4) Two-thirds of cases of blindness are estimated to be preventable and curable.

(5) At present, less than 10% of the 260'000 children born each day in Developing Countries are immunised. The WHO target is 100% by 1990.

(6) World population was estimated at 4'400 million in 1980, and to be 6'250 in 2000AD, by the Population Reference Bureau, Washington, D.C., (1980).

PLA/SF/235.221/2 - September, 1981.

P. Livingstone Armstrong
1171 Fechy
Vaud, Switzerland

File for

Skattuck Lecture.

p 10 - line 4.

"Conducive to vectors"

means "leads to" and is not quite the right word (my mistake.)

Try "substrative of "vectors"
"that support vectors"
"in which vectors thrive."

The New England Journal of Medicine

10 SHATTUCK STREET, BOSTON, MASSACHUSETTS 02115—TELEPHONE 617/734-9800

OFFICIAL PUBLICATION OF THE MASSACHUSETTS MEDICAL SOCIETY

OFFICE OF THE EDITOR

81-2085

September 22, 1981

John R. Evans, M.D.
Director, Population, Health and
Nutrition Department
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

Dear Dr. Evans:

Thank you for the article,

"Health for All for a Few Dollars per Person: A Dilemma for Less Developed Countries to the Year 2000"

which the Journal is pleased to accept for publication. This acceptance is made with the implied assurance that neither the article itself nor any part of its essential substance, tables or figures has been published or has been submitted for publication elsewhere, prior to its appearance in this Journal. News reports about the article should not appear until the date of publication. Please notify the Editor promptly if there are any questions about compliance with this policy.

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Sincerely yours,

Arnold S. Relman

Arnold S. Relman, M.D.
Editor

E106

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The New England Journal of Medicine

10 SHATTUCK STREET, BOSTON, MASSACHUSETTS 02115—TELEPHONE 617/734-9800

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OFFICE OF THE EDITOR

Sept. 11, 1981

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If the manuscript is submitted for possible publication in the Original Article, Special Article, or Medical Intelligence sections, the Journal undertakes review with the understanding that neither the substance of the article nor any of its pictures or tables have been published or will be submitted for publication elsewhere during the period of review. This restriction does not apply to abstracts published in connection with scientific meetings, or to news reports based solely on formal and public oral presentations at such meetings, but press conferences at these meetings are discouraged.

Sincerely yours,

Arnold S. Relman

Arnold S. Relman, M.D.
Editor

ASR/ejd
Enclosure

E113

Washington DC 20433
1818 H Street N.W.
Director Population,
Health and Nutrition
The World Bank

No. 81-2085

Authors *Evans, John R.; Hall, Karen Lashman; Walford, Jeremy MISCELLANEOUS

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OFFICE OF THE EDITOR

R.M.F
please vote

Sept. 2, 1981

Dear Dr. Evans:

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If the manuscript is submitted for possible publication in the Original Article, Special Article, or Medical Intelligence sections, the Journal undertakes review with the understanding that neither the substance of the article nor any of its pictures or tables have been published or will be submitted for publication elsewhere during the period of review. This restriction does not apply to abstracts published in connection with scientific meetings, or to news reports based solely on formal and public oral presentations at such meetings, but press conferences at these meetings are discouraged.

Sincerely yours,

Arnold S Relman

Arnold S. Relman, M.D.
Editor

ASR/ejd
Enclosure

E113

Washington, D.C. 20433
1818 H Street, N.W.
Director, Population, Health and
Nutrition Department; The World Bank

No. 81-2085

Authors
*Evans, John R.; Hall, Karen Lashman, Warford, Jeremy

MISCELLANEOUS

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The Rockefeller Foundation
1133 AVENUE OF THE AMERICAS, NEW YORK, N.Y. 10036

Health Sciences

CABLE: ROCKFOUND, NEW YORK
TELEPHONE: (212) 869 - 8500

September 1, 1981

Dear John:

Thanks for your prompt return of the proofs of your Measurement and Management manuscript. It has gone to the printers. We hope to have it out by the end of September. Naturally, such things often surprise one by the variety and richness of causes of delay.

Will Lybrand sent on to me a copy of the release which you sent to him on July 22. The copy I had received on July 17 had no such footnote, but his referred to the Shattuck Lecture and the China Medical Board talks.

I have discussed this with Praeger. There is no difficulty or objection to that use of the material providing that proper citation of this chapter is included. That is easily done at the end of the articles and I should think both the China Medical Board and the New England Journal would be pleased to include the information that an expanded version of this material can be found elsewhere for interested readers (to the effect that an "extended version of this material will be published by Praeger Scientific in 1982 in the book Population-Based Medicine, Mack Lipkin, Jr. and William A. Lybrand, eds., Praeger, NY, 1982").

With best personal regards.

Sincerely yours,

Mack Lipkin, Jr., M.D.
Visiting Research Fellow

John Evans, M.D.
Director, Population, Health and
Nutrition Department
Room N-437
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

cc: Jerry L. Stone, Ph.D.

August 27, 1981

Dear Bud,

I enclose a text for the Shattuck lecture for 1981. If you find the title in questionable taste, a more austere substitute would be "Health Care in the Developing World: Problems of Scarcity and Choice". This is the title that I gave Roxanne Herly a few months ago. If by any chance it is necessary to maintain conformity it could be substituted for the title on the text.

The quality of the text leaves a lot to be desired and in addition there may be some comments from the Bank reviewers which I will be obliged to incorporate. If this is the case I will let you have the changes as soon as possible.

With kindest regards.

Sincerely,

John R. Evans
Director
Population, Health and Nutrition Department

Dr. Arnold S. Relman
Editor
New England Journal of
Medicine
10 Shattuck Street
Boston, Mass. 02115

Attachment

cc: Ms. Roxanne Herly
The Massachusetts
Medical Society
22 The Fenway
Boston, Mass. 02215

Dictated but not signed before Dr. Evans' departure on leave.

Health for All for a Few Dollars per Person: A Dilemma for Less Developed Countries to the Year 2000

John R. Evans, Karen Lashman Hall and Jeremy Warford
Population, Health and Nutrition Department
World Bank, Washington, D. C.

Acknowledgement: The authors are indebted to Mr. Ved Kumar for his helpful contributions and advice.

The World Health Organization (WHO) and UNICEF together with representatives of 134 member governments launched a campaign in 1978 to achieve Health for All by the Year 2000 through Primary Health Care.1/2/ The objective of this campaign was to increase the political commitment of member countries to address the health needs of their people and particularly to improve the health status of the rural and urban poor in the third world. This presentation addresses the difficulties of putting this objective into practice and what might be possible on the very limited budget available for health in most developing countries.

WHO and UNICEF might well have found the text for their plan in the Report of the Sanitary Commission of Massachusetts which Lemuel Shattuck presented to the state legislature in 1850.3/ The report was based on a careful survey of the health status of the population of Massachusetts and its recommendations embodied the essential elements of primary health care: immunization and communicable disease control; promotion of child health; improved housing for the poor; environmental sanitation; training of community oriented health manpower; public health education; promotion of individual responsibility for one's own health; mobilization of community participation through sanitary associations; and creation of multi-disciplinary Boards of Health to assess health needs and plan programs in response to sound epidemiological evidence. Recognizing the importance of political commitment, Shattuck built a strong public health constituency by highlighting the major differences in life expectancy between rural areas and Boston and the deterioration of health status over a decade in major cities in the United States.

HERE TABLE 1

The conditions described by Shattuck in the United States in 1850 prevail today in most countries of the developing world.4/5/6/ (table 1) In low income countries life expectancy at birth averages only 51 years and in several it is less than 45 years. Mortality rates are ten to twenty times greater for infants and for children aged one to four than in developed countries. Nearly half of all deaths occur in children under five years of age. The major causes are diarrheal diseases, respiratory infections, tetanus and childhood infectious diseases such as diphtheria, measles and whooping cough all of which can be effectively and cheaply controlled by measures used in developed countries. Malnutrition is important as an associated, and even primary, cause of death in young children and short birth intervals adversely affect the survival of infants. For those who reach the age of five, life expectancy is only eight to nine years less than in developed countries and the commonest causes of death are similar to those in industrialized countries: cancer, cerebro-vascular disease, heart disease, respiratory disease and trauma. However, in developing countries, tuberculosis ranks among the most common causes of death. They are also plagued with endemic diseases such as malaria, schistosomiasis, trypanosomiasis, onchocerciasis and leprosy which are major causes of serious morbidity and mortality in adults and children but for which effective control measures have not been available or have proved difficult to implement or maintain.

Even in middle income countries more favorable national statistics in the aggregate disguise wide disparities between the conditions, on the one hand, of the rural and peri-urban poor which are typical of low income countries and on the other, of more affluent urban

dwellers who are better educated, have better access to health services and whose health status resembles closely the profile in industrialized countries. Table 2 contrasts the high mortality rates for infectious and parasitic diseases in the less developed northeast and frontier regions of Brazil with the high rates for cancers and cardiovascular diseases in the more affluent southeast region of the country. As economic development proceeds the more prosperous regions of the country have the advantages of greater individual and collective wealth and greater political leverage. Consequently, national health policies give priority to their needs and the limited resources of hospitals, equipment, drugs, physicians and other health personnel are concentrated in the urban areas further widening the gap between urban and rural populations.7/

In the push for development, particularly industrial and commercial development, protective measures for workers and environment usually lag behind, as they did in earlier stages of developed countries. These measures are often disregarded because they are initially expensive, and generally can only be enforced by firm legislation and inspection. Rapid development accelerates the appearance of new health problems such as traffic accidents, work accidents, poisoning and environmental pollution. Similarly disruption of families and community, migration and unemployment contribute to a variety of disorders of individual behaviour--alcoholism, violence, promiscuity--each with attendant physical and mental risks, counterparts of those seen in industrialized countries.

HERE TABLE 2

Urban problems will increasingly dominate the health pattern of the developing world. According to United Nations projections, the urban population will increase by 1,320 million in developing countries between 1975 and 2000: by 2000 it will average 43% of the population of the less developed regions overall and 75% of the population of countries in Latin America.8/ The primary health care approach developed to address rural health problems may need to be modified to address different problems arising from the lifestyles and diets in the urban setting. Recent analyses, for example, indicate that in several countries there are large numbers of malnourished urban dwellers, and that their numbers are increasing more rapidly than those of the rural malnourished.9/

Stages in the Evolution of Health Systems

The pattern of diseases in northern Europe and the United States evolved in stages over the past two centuries and with each stage distinctive control measures were introduced.

HERE TABLE 3

The first stage, dominated by major and minor infectious diseases linked to poverty, malnutrition and poor personal hygiene, responded slowly to improved food supply, housing and literacy made possible by greater economic prosperity and to public health measures, particularly safe water supply, sanitation and immunization campaigns. The steady decline in infant mortality (table 3) and the reduction in child mortality as a percentage of all deaths (table 4) may be attributed to these

HERE TABLE 4

changes. As scientific advances provided a wide array of immunological and therapeutic techniques to control acute bacterial and viral infections,

life expectancy increased and the principal causes of death in the developed countries like the United States switched from respiratory and gastrointestinal infections in 1900 to heart disease, cancer, stroke and accidents in 1975 (table 5). With these changes public health measures were relegated to a regulatory role and personal health services became the primary channel for both preventive and curative services.

HERE TABLE 5

The second stage in the evolution, as a result of the increase in lifespan made possible following the control of infectious diseases, has been dominated by chronic diseases particularly cardiac and cerebrovascular diseases, cancer, diabetes and arthritis. The development of expensive and complicated technology for diagnosis and treatment has led to the transfer of care from doctors' offices to elaborate and expensive hospitals. Doctors and patients have looked to these curative techniques and facilities to provide striking improvements in health. Sadly, experience has shown that for many problems the hoped for benefits have not been realized. As Cochrane10/ has noted, the massive public and private expenditures on health, now close to $1,000 per capita annually for capital and recurrent costs in the wealthier industrialized countries, have not produced commensurate improvement in the health status of the population. Only a small proportion of the interventions used are of proven effectiveness and the benefits to be gained from the intensive services for terminal illnesses are at best marginal.

A third stage of evolution can now be defined. It reflects a shift from preoccupation with intrinsic disorders of structure and function of the body to an awareness of the health hazards arising from environmental exposure to an increasing number of chemicals, drugs and other toxic subtances and from changes in the social conditions of the family, community and work place which influence individual behavior and lifestyle and which are associated with absenteeism, violence, alcohol and drug abuse of epidemic proportions. The personal health care system concentrates on the consequences of such processes. New approaches are needed to encourage the healthy individual to avoid patterns of behaviour which will lead to disease and to identify and treat the social and environmental causes of disease which originate in the community. Industrialized countries have recently recognized the importance of this third stage and the need to adapt their health systems to give greater emphasis to health promotion and preventive measures at individual and community levels.11/12/ This stage is not new. These concerns provided much of the impetus for reform of industrial and other health practices for well over a hundred years. The significance of the third stage is a return to the recognition that responsibility for health should not be so exclusively the prerogative of health professions-- that protective and preventive measures have to be the responsibility of the individual and the society.

Industrialized countries have evolved through the three stages over the course of more than a century (table 3). In contrast, developing countries face the challenge of coping with all three stages simultaneously: the rural and peri-urban poor which constitute a majority of the population are in the first stage; the influential, more affluent urban dwellers are at the second stage; and manifestations of the third stage are already apparent due to environmental deterioration and the social disruption associated with massive urban growth and unemployment. Furthermore they must cope with just a fraction of the financial and human resources available to their industrialized counterparts. In any circumstances, but particularly in these, the strategy to improve health must be selective. Success will depend heavily on identifying correctly the most important problems for each population group, selecting the most cost-effective interventions and managing the services efficiently. Uncritical acceptance of new and expensive high technology will not serve the purposes of developing countries. But developed countries do have much to offer in scientific and technical cooperation. Already, developing countries, by taking advantage of the innovations in the industrialized world (vaccines, microbiological techniques, antibiotics are examples) have achieved much faster rates of improvement in health status than occurred in northern Europe and the United States. There are signs, however, that this rate of progress is not being sustained. As Gwatkin and Brandel point out, life expectancy in the less developed regions of the world, which had been rising by 0.64 years annually between 1950-60, slowed to 0.40 years annually 15 years later.13/ Several factors stand out as impediments to progress.

Obstacles to Progress

(i) Uneven Distribution of Health Services

Access to health services is very uneven and large segments of the rural population are not reached. Health facilities and personnel are concentrated in urban areas and within this population the services are oriented to the middle and upper income groups neglecting the peri-urban poor. Political considerations may override all other priorities and little progress can be expected unless the political commitment exists to apply resources where the need is greatest.

There is a shortage of skilled health personnel particularly in the least developed countries, but the national averages in table 6 disguise the fact that in some rural areas there may be only one doctor serving 40,000 to 200,000 people. Furthermore, the pyramid of health manpower is inverted particularly in the least developed countries. Instead of a broad base of inexpensively trained, less skilled personnel working at the community level, priority has been given to expensive training programs for 'conventional' doctors who expect sophisticated facilities and equipment, gravitate to practice in the cities, and have a propensity to emigrate. To achieve effective coverage of the population, large numbers of less skilled personnel need to be trained and these health workers need to be part of a system which provides supervision, drugs and supplies and the support services necessary for their practice. Otherwise dissatisfaction will lead to high turnover of health workers and low utilization of their services as patients by-pass the first level of care in the community in favor of higher level facilities which properly should function as referral centers. Doctors are key participants in the referral and supervisory systems: if they operate as primary care workers, their expensive training is wasted and the cost of their practice may outweigh

the benefits. The supervisory and managerial role of the physician in the health system must be addressed more directly in the process of medical education and in the career development and rewards for the physician in practice.14/

HERE TABLE 6

(ii) Lack of Appropriate Technology

A second obstacle to progress is the lack of appropriate technology to address stage 2 and stage 3 health problems and to cope with the serious endemic diseases prevalent in the developing world. For stage 1 health problems, much of the technology needed is already available and in the case of vaccines technological advances which would reduce dependence on the cold chain are imminent. In contrast, however, for stage 2 health problems, there are relatively few technologies for dealing with the serious diseases of the adult population which are appropriate to the circumstances and financial resources of less developed countries. Most of the technologies which are being transferred from the developed world are expensive, and the equipment is often difficult to maintain. It is necessary to determine which interventions are effective and of these which yield large benefits at acceptable cost. The greater challenge is in the search for preventive measures to reduce the large burden of illness from cancer, hypertension, diabetes, respiratory, cardiac and cerebrovascular disease. For stage 3 health problems we are still handicapped by inadequate understanding of the determinants of behavior or the linkage of social and environmental hazards with specific diseases. We have much to learn about conveying health education messages, motivating community participation and using modern communications technology to circumvent the barrier of illiteracy.

The so-called "tropical diseases" (e.g. malaria, schistosomiasis, filariasis, trypanosomiasis, leprosy) are a particular problem for developing countries, in part because they generally have climates and ecologies conducive to vectors. Techniques for ecological control of vectors or transmission routes are available but are expensive and require repeated application over wide areas. Treatment of patients is generally expensive, sometimes risky and often late. Prophylactic measures such as vaccination are largely undeveloped. Knowledge of the biology of the diseases is far from complete. Research on these diseases has so far been largely neglected by the scientific community and the pharmaceutical industry which have been preoccupied with cancer, cardiovascular disorders and the other major diseases of the industrialized world. The Special Program for Research and Training in Tropical Diseases led by WHO is an attempt to mobilize the health science research community throughout the world to focus attention on these neglected tropical diseases in order to discover appropriate technologies for their control.

The scientific and development resources of the developing countries are limited and their problems are difficult to solve. The most promising results will come from combining the scientific and technological potential of the industrialized world with the local knowledge of scientists and professionals in developing countries who will have responsibility for applying the new technologies.

(iii) Pharmaceutical Policies or Drugs for All by the Year 2000

The most widely used technologies in health are drugs and vaccines. Shortage of supply and failure to provide for the timely distribution of drugs and vaccines are serious problems which must be overcome for an effective health program. Looking to the future, however, the problems may be excessive and irrational use of drugs and unsustainable costs to the health system. Patients who consult health personnel expect to receive drugs or, in some cultures, an injection. As access to health

services broadens with the implementation of primary health care programs, rapid increase in the consumption of drugs may be expected. Experience in less developed countries supports this contention. In China, with nearly universal access to health care, curative medicine occupies 90% of the time of barefoot doctors and nearly all patients receive medication: in that country there is evidence to suggest that drugs and traditional medicines account for two-thirds of overall health expenditures. In countries with less complete population coverage, expenditures on drugs constitute around 40-60% of the health budget, compared to 15-20% in developing countries,15/ and over half of private health expenditures. In most developing countries, the majority of drugs are imported and these outlays are a considerable drain on foreign exchange.

The importance of drugs to the quality of health care, to the credibility of community health workers, to the development of iatrogenic disease (for example, from toxicity or antibiotic-resistant micro-organisms) and to the cost of health services makes it imperative that developing countries establish better mechanisms for assessing drug requirements, and for purchasing, quality control, storage and distribution of drugs. Experience in Tanzania and Ghana indicates that savings of up to 70 percent of the budget for pharmaceuticals could be achieved by adoption of a policy promoting generic alternatives and introduction of controls against overprescription.16/17/ The South Pacific Pharmaceutical Scheme projects cost savings of at least 25% by limiting the availability of non-essential drugs and by bulk purchasing.18/ Without policies on national formularies, procurement, prescription and pricing this powerful and ubiquitous health technology could become more of a liability than an asset to the health system.

(iv) Management of Health Resources

One of the most difficult and pervasive problems to solve in the establishment of effective health services in developing countries will be deficiencies in management. The health sector presents a formidable organizational challenge! Some of its objectives can only be achieved with the cooperation of other sectors such as water supply and sanitation, education, agriculture and community development. The delivery of health services involves widely dispersed facilities, multiple categories of personnel, general and specialized hospitals, vertically organized programs to control individual diseases such as malaria, tuberculosis, leprosy or venereal disease each with its own personnel and support services, community health care programs with multipurpose workers and a system of indigenous medicine with traditional healers and birth attendants. The different elements need to be organized to reduce conflict and duplication between programs and to provide a coherent system to screen and treat patients according to the level of care required, referring difficult problems. Supervision and continuous in-service education of health workers, improved logistics and supply to maintain credible services, institution of personnel policies and rewards to maintain the quality, distribution and morale of staff, and policies and financial arrangements which encourage rational use of the health resources by the public are essential corollaries to enhance sector performance.

The weakest links in the administrative chain of most developing countries are institutions at district and local levels which are usually poorly staffed, have inadequate authority or control of resources and are unable to provide the necessary support and supervision of field staff. The development of planning and administrative capability at the district level is of special significance since this is normally the lowest tier of the health services organization still communicating directly with central government but also in contact with the villages, aware of their needs and in a position to encourage community participation. It is at this level that matching of health needs and resource allocation is most likely to occur.19/ Community based non-governmental organizations active in health care may make an important contribution to the process of devolution of administrative responsibility.

The management of a system of health services is much more than the management of its facilities and support systems. It involves decisions on priorities and resource allocation which are based on the health needs of the population to be served. This epidemiological perspective is missing from the training of many of those in positions of responsibility and the information system on which to base such management decisions is typically inadequate. Management also involves gaining the cooperation and compliance of highly independent professions and specialists who have their own constituencies and political support.

The medical profession is of special importance because of the profound steering effect of clinical decisions on individual patients on the demand for expensive facilities and the consumption of resources for diagnosis and treatment. Most practicing physicians give relatively little weight to consideration of the efficacy of these procedures and almost no attention to the real cost and foregone opportunities in terms of resources used. Abel Smith has estimated recently that the consequential costs generated by the average medical specialist in Great Britain are in the order of L500,000 per annum20/; if eliminating unnecessary procedures reduced expenditures by 10%, the savings nationwide would be enormous. In developing countries the secondary health system costs generated by physicians are smaller largely due to absence of much of the high cost diagnosis and treatment modes, but the same problem exists and the implications are more serious because of the much more limited resources available for health. A priority for medical education and for the reward system for physicians in practice is to place clinical decisions on individual patients in the context of the health needs of the population and to promote more discriminating use of scarce resources for diagnosis and treatment based on evaluation of the effectiveness and the cost of these procedures. These decisions involve difficult ethical judgments. The concepts behind these decisions have only recently been introduced into medical education and health services administration in developed countries.14/

Poverty

Money alone will not suffice to ensure good health. However, in the opinion of most development specialists, the overriding constraint to improving health status in the least developed countries is the extreme

poverty of most of the population and the low level of GNP per capita, below US$400. Health must compete with other pressing developmental needs for extremely limited public resources.

The problem is made worse by the rapid growth in population averaging 2.4% per annum for developing countries as a group and reaching nearly 4% per annum in the case of Kenya. At this rate the population of Kenya will double in 17 years. At current average annual growth rates, half the population will be under 15 years of age and demands for employment, housing and all basic services will increase rapidly. Public expenditures on health will have to increase commensurately just to "hold the line" on current levels of quality and coverage of services. Since population is the critical denominator of all development activities, with such limited resources reduction of fertility will be a decisive factor in attempts to improve services such as health. At the same time, wider coverage of the population with effective maternal child health and family planning services is a necessary part of any strategy to reduce population growth.

Given the extremely limited resources and the rapid growth in population, several basic questions need to be addressed. First, what are the prospects for increased public expenditures on health and to what extent are improvements in health dependent on economic progress? What other sources of financial support might be mobilized? Second, can existing resources be used more effectively? And third, within these constraints is Health for All through Primary Health Care feasible?

Financing of Health Services

Analysis of health expenditures in developing countries is hampered by lack of satisfactory financial information on programs operated by different levels of government and the private sector. The available data indicate striking differences in the levels of total public expenditures on health for capital and operating purposes with average figures of US$2.60 per capita per annum in the poorest countries, US$19 in middle income developing countries and US$469 in industrialized countries (table 7). The combined public and private health expenditures in the United States and several northern European countries are close to US$1,000 per capita per annum, more than 100 times the level in the poorest group of countries. At the other extreme a few of the poorest countries--Bangladesh, Ethiopia, Indonesia and Zaire--have annual public expenditures on health of only US$1 per capita. Since recurrent expenditures are concentrated in urban areas where hospitals and specialized manpower are located, it may be concluded that the resources available to operate health services for the rural population are very limited and in the poorest group of countries average substantially less than $1 per capita per annum.

HERE TABLE 7

During the decade 1980 to 1990 average annual growth in GNP per capita is estimated to be 2.1 to 2.3 % in middle income oil importing countries and 0.7 to 1.8% in low income countries.6/ Assuming public expenditures for health remain at the same proportion of GNP as in 1977, the allocation for health in low income countries may be expected to increase only by US$0.40 to $0.80 to a level of US$3-3.40 per capita per annum by 1990 (table 7); the increment will only be US$0.20 to $0.50 in Asia and even lower in Africa where a reduction in per capita income is possible in the sub-Saharan countries during the decade. Predictions for the year 2000 show little further

improvement, particularly in the low income countries, with the gap between rich and poor countries continuing to widen. A substantial increase in their public resources for health by the year 2000 is only possible if there is a shift in resources from other sectors. This seems unlikely unless investing in health can be justified more convincingly to Ministries of Finance and Planning in terms of immediacy of benefit and return on investment.

To what extent are improvements in health dependent on economic progress? Preston's study of the contribution of economic factors to declines in mortality using national income and mortality data from populations in 43 countries between 1938 and 1963 indicates that income is critical but not the major determinant of mortality level.21/ In the aggregate, income growth explained only 16% of the improvement in life expectancy in the countries studied. In the subgroup of countries with incomes less than $400 per capita there appeared to be a stronger correlation of income and mortality trends. Nevertheless, Sri Lanka and the State of Kerala in India,22/ and the People's Republic of China, are examples of countries which have attained life expectancy close to the level of the industrialized world with income levels in the range of the least developed countries. The achievements may be explained in part by the public priority given to literacy, food and health and by special features of social and political organization. Furthermore, as McDermott illustrated in the case of chemotherapy for tuberculosis in blacks in New York City and Maoris in New Zealand, advances in medical technology can be very effective in reducing mortality promptly without any preceding improvement in living standards.23/ These examples are of great significance for the least developed countries which have such gloomy economic prospects for the next two decades.

Recognizing the continuing scarcity of public resources, what opportunities exist to supplement the central government's capacity to finance health services by mobilizing support from other sources? The possibility of revenue sharing by local government for local services warrants further exploration although the capacity of local government to generate tax revenues is limited. In two regions of Senegal, 8% of general rural taxes are set aside for health and in Colombia 35% of state beer tax is earmarked for hospitals. If these taxes generate new public revenue they could expand support for health; otherwise the process is merely an exercise in allocation.

Social security schemes based on contributions by employer, employee and sometimes government, are an important financing mechanism in middle income countries, particularly in Latin America. The services financed are predominantly curative and since the benefits are restricted to employees the schemes cannot be relied upon to attain full coverage of low income populations many of whom are outside the wage economy. The equity of social security systems has been questioned since the public sector contributions in effect serve to subsidize the better-off segment of the population and employers may pass their costs through to consumers by raising prices. Private financing of health care has also been undertaken by productive sectors. One of the largest examples is the Colombia Coffee Growers' Association which in 1978 alone contributed two-fifths (41%) of the total operating costs of the rural health delivery system in the country.*

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* Proportions based on assigned budget figures from Colombia Ministry of Health Budget, 1976, as reported in "Financing for the Rural Health Plan from 1976-1980," World Bank Resident Mission, Bogota (unpublished).

User fees and contributions in kind from the individual or community are also important means to supplement financing from government. Many governments resist any form of user charges for fear of excluding the poor or in the belief that users will not understand the value of the services. Paradoxically, imposition of user chargers can have a positive impact on utilization of health services by increasing the perceived value of and hence demand for services over alternative "free" care. Mission clinics and hospitals have demonstrated the feasibility of recovering a significant portion of their operating costs for selected curative services when quality of care is acceptable. Institution of a pricing policy for selected curative health services has been attempted in several countries. The establishment of community pharmacies in the Philippines and village drug cooperatives in Thailand and Senegal are examples of this approach. Traditional healers and birth attendants practice on a fee-for-service basis and enjoy a high level of community acceptance: with appropriate training, they could serve as a valuable extension of the health system financed by user fees. Village organizations and popular self-help movements such as Saemaul in Korea and Sarvodaya in Sri Lanka illustrate the value of community participation for mobilizing local labor and materials for health facilities and salary support of community health workers. Local initiatives, however, may lead to disillusionment if they are not supported by appropriate services within the public health system. Multiple independent initiatives may complicate the evolution of a rational system unless developed within a general framework.

China, one of the few low income countries with a broadly based health care system, uses a variety of financing devices. In addition to central, provincial and county government appropriations and some user fees, health insurances schemes are also employed. The "public medical expenses" scheme is similar to a social security system covering government employees

and students. The "labor medical insurance" scheme covers about 10% of the population and is financed by two to three percent of factory income before payment of salaries. The large rural population is covered by "cooperative medical services" financed by the participating communes through production brigade revenue, individual premiums equivalent on average to 1.5% of the family's disposable income, and user fees.24/ All preventive health expenditures are borne by the State.

Much work remains to be done in analyzing the effect of prices on demand for health services in developing countries, recognizing that private sector success in this area is not necessarily a reliable guide to public sector pricing policy. Even when a superior public service replaces a private one, the public cannot be assured of capability to collect the same level of charges since it is less able to refuse services to those unwilling to pay as has been shown in the case of public water supply. Nevertheless, since private spending is estimated to be three to four fold greater than government expenditures on health in many developing countries,25/ it is clearly one of the most important sources of financing to explore.

Mobilization of resources for health from the widest spectrum of alternative sources should be actively pursued, ensuring that these resources are a net addition to rather than a substitute for public funding. They have the added benefits of reducing the uncertainty associated with total dependence on public funding and of increasing the participation of the individual, community, cooperative or local government in planning and managing the health services.

In many countries the principal alternative to government financing has been official development assistance from bilateral and multilateral agencies and extensive local contributions by overseas non-governmental organizations. According to Howard, assistance for health

from all external sources totalled $3 billion in 1978, equivalent to less than one quarter of the total estimated public and private expenditures on health in the 67 poorest developing countries (excluding China).25/ The largest component, $1,008 million, came from 18 bilateral donors; they allocated approximately 10% of their total concessional assistance to the health sector, a share only exceeded by agriculture, public utilities and education.26/ In view of the economic difficulties facing industrialized countries it seems unrealistic for developing countries to rely on any significant increase in external assistance for health in real terms to compensate for their shortfall in public expenditures. Furthermore, care must be taken to avoid capital expenditures financed by external assistance if the recurrent cost obligations which they create are not in keeping with the priorities for use of the limited public funds available for health.

The tendency of governments to discriminate in budget allocations against programs with high recurrent costs in favor of capital intensive projects is aggravated by the policy of many external donors not to support operating costs. In general, recurrent costs generated per dollar of capital investment are higher for health than for other major public sectors but the ratios are particularly high for primary health care programs and rural health centers where expenditures are mainly for manpower and drugs (table 8). This makes these programs very vulnerable to budget cutting by government. In addition, even when general operating expenditures have been met, neglect of maintenance expenses leads to further capital expenditures for rehabilitation or replacement of facilities and equipment - a much more costly approach to sector development. An important consideration in the success of primary health care will be the willingness of governments and external donors to attach appropriate priority to the financing of recurrent costs.

HERE TABLE 8

Efficiency and Effectiveness of the Use of Resources

National capability to plan and implement strategies and programs which could make the best use of scarce resources is seriously deficient in most developing countries. The co-existence of sub-populations with different health needs requires programs designed for these groups, not based on national averages. The need to select from among a broad range of possible interventions the most appropriate mix of personnel trained, facilities built, and technologies used, requires information on relative cost-effectiveness, trade-offs between capital investment and recurrent costs and assessment of the political and administrative feasibilitry of implementation--all of which data are seriously deficient.

Health planning is under a cloud of skepticism because the substantial efforts to date have had so little effect on resource allocation decisions for the health sector in most countries. Much of the planning has been normative, based on international estimates of the number of personnel and hospital beds needed to establish or extend coverage of services rather than on the nature of the health problems of a given population and the most cost-effective methods of solving them. Almost all planning and management has been central with inadequate understanding of the real constraints on implementation at the operating level.

Matching programs more closely with needs will be dependent on strengthening planning in several areas. Some definition initially of priorities for the sector is essential. This may be achieved by a review of estimates or epidemiological measures of the disease profile of representative population groups, clarification of explicit health sector objectives and assessment of the technical, political and administrative

feasibility of dealing with the most important problems. From this general framework it should be possible to define population specific objectives for health investments and establish targets for reductions in critical sector development indicators such as infant mortality, malnutrition, fertility or disease prevalence. Setting targets provides a mechanism not only to assess the value of use of scarce resources but also to monitor and evaluate actual program performance. Alternative approaches to achieve the targets should be reviewed and the most cost-effective solution selected, weighing not only technical and financial considerations but also cultural acceptability and feasibility of implementation. This exercise will raise difficult questions about tradeoffs: whether to pursue inexpensive short-term symptomatic therapy or more expensive long term measures to eliminate the cause of disease; the relative merits of interventions in health and in other sectors such as water supply and sanitation; and the choice between disease specific, vertically organized health services and the multi-purpose, horizontal primary health care approach. Walsh and Warren reviewed published reports of the infectious and parasitic diseases endemic in tropical countries and concluded that the strategy of intervention should be selective based on evidence of the contribution of each disease to mortality and morbidity, the efficacy and cost of currently available control measures and the feasibility of applying these measures.29/ The extensive studies of Morrow and his co-workers in Ghana illustrate the potential value of cost-benefit analysis in sorting out priorities within the health sector

and in justifying to government investments in health vis-a-vis other sectors.30/ Application of this technique is limited by the difficulty in quantifying benefits in health, the inadequacy of the human capital approach to life valuation and the lack of suitable data for analysis in most developing countries.31/32/ In the absence of cost-benefit analysis, unit costs to achieve specific health improvements may be compared in order to identify the least cost solution. To apply these epidemiological and economic measurements when planning health programs requires much information and takes time. In many cases, we cannot make detailed measurements, but a more vigorous review of available evidence on the health needs of different population groups and the consideration of cost-effectiveness in selecting interventions offer the best hope for stretching limited resources to achieve maximum impact on health. In addition to encouraging better policies and practices in the health sector, this should enhance the acceptability of Ministries of Health proposals to the Ministries of Planning and Finance.

The development of measurement capability both for planning and managing health services is a high priority for health administrators, physicians and others with leadership responsibility in the health system. This can be best achieved by strengthening existing institutions through mid-career training of the staff, improving management information systems, and by undertaking operational research on health services at central and peripheral levels of the health system.

Financial Feasibility of Primary Health Care

Primary health care has been accepted by the member governments of the World Health Organization as the key to achievement of Health for All by the Year 2000. Assuming that the low income countries will have no more than $3 to 4 per capita per annum in public resources to devote to health by the year 2000 (table 7) is it possible to achieve the goals envisaged in the primary health care approach with this financial constraint?

HERE TABLE 9

Evidence from six primary health projects undertaken in the late 1960s and 1970s in different developing countries indicate that significant health improvements can be demonstrated within five years through provision of basic services with annual operating costs ranging from about US$0.50 to $3.50 per capita (table 9).33/34/35/ Corrected for inflation these figures would be $1 to 7 per capita in 1981 prices. The results must be interpreted with caution since five of the projects were of a pilot nature involving very small populations and the cost data varied greatly. As a rule, they did not include capital investment, training, expenditures beyond the primary level of health care, or the value of expatriate and volunteer labor. The contribution of voluntary health workers is of special significance since they provide a large share of rural health services and volunteerism may be difficult to sustain over the long term.36/ While there should be economies in scaling-up to national programs, in fact higher marginal costs would be expected with expansion of primary health care to more widely dispersed populations. Furthermore, political and administrative problems involved in scaling-up would add costs for management, supervision and support systems. Nevertheless, the results of

the pilot projects adjusted for inflation are of the same order as the estimates of $1 to $3 by Joseph and Russell[37] and $5 by Patel[38] for per capita recurrent costs of primary health care programs.

An alternative approach to estimating the cost of primary health care is to price the individual components of a model program designed to address the principal causes of mortality in children in low income countries as outlined in a recent WHO discussion paper.[39] The model for a total population of 100,000 would aim to provide basic care for children under five years of age (about 17,000), tetanus toxoid, iron and folic acid for pregnant women (about 4,000) and contraceptive advice and supplies for fertile women (about 5,100 at a 30% level of coverage). Based on estimates of the need for immunization against common infectious diseases and for treatment of diarrhea, acute respiratory infections, malaria and intestinal parasites and assuming that all in need will be treated with the least expensive, effective treatment available, it is possible to calculate the annual cost of drugs and supplies for each condition. As an example, to immunize the 4,000 children under 1 year of age against measles, 3,200 doses would be required to achieve 80% coverage (the minimum to halt transmission) which at $0.23 a dose would cost $736 each year. The annual cost of all the drugs, vaccines and supplies for the model program was $36,000 or $0.36 per capita for the population as a whole to cover the selected target groups.

The cost of commodities is, of course, only one component. It is necessary to add the cost of salaries of health workers, training, transportation and maintenance. If these additional costs are the same

proportion to total primary health care costs as drugs are in national health budgets (drugs account for 25% at a conservative estimate)*, then the total annual recurrent costs for primary health care might be in the range of $1.40. Since annuitized capital costs for primary care are about one third of recurrent costs (table 8), $0.45 to 0.50 might be added to cover capital investments. The combined capital and recurrent costs of the primary health care program would be under two dollars per capita per annum, well within the financial reach of low income countries.

The fragility of the assumptions involved in multiplying the commodity costs is acknowledged. The model itself is relatively insensitive to changes in the assumptions about the commodities with the exception of the contraceptive prevalence rate. (Increasing contraceptive prevalence to 50% of the women at risk would increase per capita costs of commodities from $0.36 to $0.44.) A more significant factor is the assumption that the primary health care worker will provide early diagnosis and treatment. If, for example, treatment of diarrhea were delayed so that 50% of children rather than 10% required intravenous fluids and antibiotics, the cost of commodities would be increased from $0.36 to $0.63 per capita. The model also assumes encouragement of breastfeeding and nutrition education of mothers and children at nominal cost, but if food supplements are added, the cost of the package of commodities would be substantially increased. Using data from Project Poshak in India40/ on the cost of the basic food supplements adjusted for inflation and assuming 30% prevalence of

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* For example drugs accounted for 24% in Thailand (1979), 22% in Tanzania (1976) and 30% in Ghana (1976-77) of the national health budget, as reported in the World Development Report 1981.6/

malnutrition as reported in several national nutrition surveys* the added cost would be $0.71 per capita, double the cost of supplies for the basic health and nutrition interventions. Provision of rural water supply which might be proposed in addition or as an alternative to primary health services is estimated to cost $5 per capita of which approximately half would be annuitized capital cost.41/**

The value of the modeling exercise is limited by the pyramid of assumptions on which the calculations are based. More important than the results, however, is the process involved in developing the model which illustrates the trade-offs which countries must consider in determining the balance of services to be provided to their population. The process of targetting and choosing the most cost-effective approaches to meeting health needs is the essence of the planning and decision making process outlined in the previous section.

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* Government of Sri Lanka, US Center for Disease Control Nutrition Survey in Sri Lanka 1975/76 indicated weighted rural average of 42.1% children suffering from 2nd and 3rd degree malnutrition using the Gomez classification and of 35% prevalence of chronic undernutrition (stunting) and 6.6% acute undernutrition (wasting) using Waterlow classification. A 1977/78 national nutrition survey in Cameroon, conducted by the government with assistance from the University of California and USAID indicated prevalence rates in under fives of 21% for chronic malnutrition (less than 90% of reference group median height for age); 1% for acute malnutrition (less than 80% of reference group weight for height); and 21% for malnutrition (less than 80% of reference group median according to weight for age standards). Additionally 45% of children surveyed between 6 and 59 months of age were anemic.

** The 1977 capital cost of $26 per capita41/ annuitized, together with the provision for operations, maintenance and support costs yields an annual combined capital and operating cost of approximately $5 per capita.

Conclusions

Developing countries face the challenge of coping with a heavy burden of illness which differs markedly in subgroups of the population at different stages of development. The greatest improvement in life expectancy from health investments can be expected in the rural and peri-urban poor with a program which provides maternal and child health services including control of the major infectious and parasitic diseases of children under five. Effective technology for such a program is now available and affordable even within the financial constraints of the least developed countries. Two major problems remain: first, the political will to allocate the necessary resources for the program and second, the management capability to organize and operate a system of services for the rural and peri-urban populations using multi-purpose community health workers.

No satisfactory strategy has been developed to meet the health needs of older children and adults that is within the financial means of most developing countries. There are relatively few, simple, effective interventions to control the metabolic, vascular, degenerative and malignant diseases of the adult population and little understanding of the behavioral disorders. Without new technologies for control and prevention it is unlikely that the poorer developing countries will be able to provide more than symptomatic care for most patients with these health problems. Furthermore, adoption of the expensive technologies now used for the diagnosis and treatment of these diseases in the industrialized world will divert the limited resources available for programs for the rural and peri-urban poor to sophisticated, hospital-based, urban services which will have, at best, a marginal impact on health.

The search for health technology appropriate to the financial and organizational circumstances of developing countries must be seen as a high priority for the research and development community of the entire world. Existing technology must be critically evaluated and new, simpler techniques developed for the control and prevention of common chronic diseases. Greater attention should be given to research and development on the "tropical" diseases which are a major component of the disease burden of developing countries but which have been largely neglected by the world's scientific community. Pharmaceuticals are of special importance since the timely supply of essential drugs is critical to the quality of health care and the credibility of community health workers. The dangers of excessive use or inappropriate choice of drugs necessitate the introduction of policies on procurement, prescription, pricing and quality control to avoid health hazards and excessive costs.

Financial constraints will be an overriding consideration in the development of the health sector for the foreseeable future, particularly in the least developed countries. The poorest countries which now have public expenditures on health averaging only $2.60 per capita per annum also have the least favorable economic prospects for the next decade. Greater efforts are required to mobilize resources for health from other sources, particularly the private sector, and to ensure that the limited resources available from all sources are used in the most cost-effective manner. Few developing countries have the institutional capability to carry out the process of selecting health interventions on the basis of expected health impact, least cost and feasibility of implementation, and to integrate independent facilities, practitioners and disease specific programs into a more coherent, economical, multi-purpose system. High priority should be

attached to strengthening the capability of administrators, physicians and other personnel in positions of leadership in the health system at central and local levels to develop a population perspective in the analysis of health problems, a cost effectiveness attitude towards the use of resources, and management skills appropriate for a human services organization. More efficient management of health services is only one aspect of the problem. It is equally important to mobilize communities and individuals to take a more active role in promoting health and in financing health services rather than relying passively on a government system.

Scarcity of money for health is a critical limitation on progress towards the goal of Health for All by the Year 2000. More money alone, however, will not produce the desired outcome unless there is political commitment to programs for those in greatest need and the managerial capability to implement them. This is first and foremost a challenge for developing countries but it is also a consideration in the investment policies of donor agencies. Progress towards the goal of Health for All can be accelerated if more external assistance can be provided for the areas of greatest need and if the unique scientific and technological resources of the industrialized world can be made available to developing countries to strengthen their institutions and to collaborate in the development of appropriate technology to meet their needs.

Table 1

Health Related Indicators in Countries at Different Income Levels a/

	Year	Low income Countries	Middle Income Countries	Industrialized Countries
GNP per capita (US$)	1979	240	1420	9440
Crude birth rate (per 1000 population)	1979	42	34	15
Crude death rate (per 1000 population)	1979	16	10	10
Life expectancy at birth (years)	1979	51	61	74
Infant mortality rate b/ (aged 0-1) per 1000 live births	1978	(49-237)	(12-157)	13
Child mortality rate (aged 1-4) per 1000 children in that age group	1979	18	10	1
Proportion of population with access to safe water (%)	1975	25	58	c/
Daily per capita calorie supply (% of requirement) d/	1977	96	109	131
Adult literacy rate (%)	1976	43	72	99

a/ Country classifications used in this table refer to 34 low-income developing countries with a per capita income of $370 or less in 1979 (China and India are excluded from the low-income group in this table); 60 middle income developing countries with a per capita income of more than $370 in 1979; and 18 industrial market economies.

b/ Weighted averages; figures in parentheses denote the sample range.

c/ Data not available but assumed to be close to 100%.

d/ Requirements based on calories needed to sustain a person at normal levels of activity and health, taking into account age and sex distributions, average body weights and environmental temperatures, as estimated by the UN Food and Agriculture Organization.

Source: World Development Report 1981.6/

Table 2

Inter-Regional Variations in Cause-Specific Mortality, Brazil, 1970
(as percentage of all deaths)

Cause of Death	Northeast	Frontier	Southeast
Infectious and parasitic diseases	24.5	26.6	11.2
Neoplasms and cardiovascular diseases	21.1	19.1	42.1

Source: Adapted from de Carvalho AVW, de Moura Ribeiro E. Estudo da Mortalidade Proporcional, Segundo Grupos de Idade e Causas de Obito, em Algunas Capitais Brasileiras, em 1970. Revista Brasileira de Estatistica 1976; XXXVII (148): 475, as reported in World Bank. Brazil: Human Resources Special Report. Washington, D. C.: October, 1979.

Table 3

Infant Mortality Rates, 1750 - 1975, In Selected Countries
(per 1000 live births)

	Sweden	France	United States
1751 - 1755	206	277	*
1851 - 1855	149	166	*
1901 - 1905	91	141	124
1971 - 1975	10	14	18

* Data not available.

Source: Arriaga E, Boulanger PM, Bourgeois-Pichat J, Cantrelle P, Hecht J, Houdaille J, Lapham RJ, Loriaux M, Poulain M, Sullivan J, Tabutin D, Wunsch G. La Mortalitẽ des Enfants dans le Monde et dans L´Histoire. Departement de Demographie, Universitẽ Catholique de Louvain, Liege, Belgium: Ordina Editions, 1980:147-9.

Table 4

Proportional Child Mortality in Belgium 1880-1970
(as percentage of all deaths)

Year	<1 Year of Age	1-5 Years of Age	Total 0-5 Years
1880	27.7	13.3	41.0
1900	27.4	9.0	36.4
1920	17.7	4.1	21.8
1950	7.5	1.0	8.5
1970	2.5	.04	2.6

Source: Adapted from Arriaga E, Boulanger PM, Bourgeois-Pichat J, Cantrelle P, Hecht J, Houdaille J, Lapham RJ, Loriaux M, Poulain M, Sullivan J, Tabutin D, Wunsch G. La Mortalitẽ des Enfants dans le Monde et dans L´Histoire. Departement de Demographie, Universitẽ Catholique de Louvain, Liege, Belgium: Ordina Editions, 1980:127.

Table 5

Changing Patterns of Mortality in the United States, 1900-1975
(as percentage of all deaths)

Cause of Death	YEARS 1900	1940	1975
Influenza and Pneumonia	11.8	6.0	3.0
Tuberculosis	11.3	4.1	*
Gastroenteritis	8.3	*	*
Heart Diseases	8.0	28.4	37.8
Stroke	6.2	8.6	10.2
Accidents	4.2	6.9	5.3
Cancer	3.7	11.6	19.5

* Not among ten major causes of death.

Source: National Academy of Sciences. Science and Technology: A Five-Year Outlook. San Francisco: W. H. Freeman and Co., 1979:384.

Table 6

National Supply of Physicians and Nurses

		Least Developed Countries	Other Developing Countries	Developed Countries
Physician:	Population Ratio	1:17,000	1:2,700	1:520
Nurse :	Population Ratio	1:6,500	1:1,500	1:220

Source: World Health Organization. Global Strategy for Health for All By the Year 2000. Geneva: 1981:23.

Table 7

Current and Projected
Public Sector Health Expenditures 1/

	Year	Projection	Low Income	Middle Income	Industrialized Countries
Total Health Expenditures (percent of GNP)	1977		1.1	1.2	4.4
Per Capita Health Expenditures2/ (1980 US dollars)	1980		2.60	19.10	469.00
	1990	Low	3.00	23.80	587.10
		High	3.40	26.70	635.90
	2000	Low	3.50	29.60	734.80
		High	4.30	37.20	862.10

1/ Capital plus recurrent expenditure.

2/ Estimated assuming a constant sector share of GNP at the 1977 level.

Source: World Bank estimates

Table 8

Illustrative Ratios of Annual Recurrent to Annual Equivalent Capital Costs in Selected Development Activities

Primary health care	2.4-3.5
Rural health centers	2.7-7.1
District hospitals	1.1-3.0
General hospitals	1.8
General agriculture	1.0
Manufacturing, commerce and construction	0.1
Roads	0.3-1.4

Source: Over AM. Five Primary Care Projects in the Sahel and the Issue of Recurrent Costs. Department of Economics, Williams College, Massachusetts, 1981 (Mimeographed)27/; and Heller P. The underfinancing of recurrent development costs. Finance and Development, March 1979; 38-41.28/ Their estimates of the ratio of recurrent to total capital costs are adjusted by annuitizing the capital costs at a discount rate of 10% over a 25-year period.

Table 9

Reported Impact and Cost of Selected Primary Health Care Project

Project	Period	Population Coverage	Infant Mortality Rate			Child Mortality Rate			Project Cost per Capita (US$)
			Base of Study Period	End of Study Period	Per cent Reduction	Base of Study Period	End of Study Period	Per cent Reduction	
Miraj, India	1974-77	230,000	68	23	66	1/	1/	1/	0.50
Jamkhed, India	1971-76	100,000	97	39	60	1/	1/	1/	1.25-1.50
Narangwal, India	1968-73	10,500	128 2/	70 2/	45	19 2/	11	42	0.80-2.00
Hanover, Jamaica	1973-75	65,000	36	11	69	13-15	5-6	60	0.40
Deschapelles, Haiti	1968-72	9,600	55	34	38	11	6	45	1.60
Rural Guatemala	1969-72	3,000	150	55	63	28	6	79	3.50

1/ Data not available.

2/ Comparison of average rates for 1970-73 in medical care intervention and control areas.

Sources: Faruqee R, Johnson E. Health, Nutrition and family planning: a survey of experiments and special project in India. World Bank Discussion Paper No. 81-14, Population and Human Resources Division. Washington, D. C. (unpublished); Gwatkin DR, Wilcox JR, Wray JD. Can Health and Nutrition Interventions Make a Difference? Monograph No. 13. Washington, D. C.: Overseas Development Council,1980; and Berggren WL, Ewbank DC, Berggren GG. Reduction of mortality in rural Haiti through a primary health care program. New England Journal of Medicine, 1981; 304: 1324-30.

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PRELIMINARY REVIEW AND COMMENTS ON HEALTH IMPACT ESTIMATION AND RELATED ISSUES IN DEVELOPING COUNTRIES

J. A. Tieffenberg, MD, MPH

Paper prepared for the Population, Health and Nutrition Department of the World Bank as part of a summer program developed jointly with the Health Policy and Management Department of the Harvard School of Public Health

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"Give a man a fish and you feed him for a day; tomorrow he may be a beggar.

Teach a man to fish and you feed him for life; tomorrow, if well taught, he will be teaching others".

Ancient Chinese Proverb

Introduction

1. In a world of scarce resources, the need to find the most cost-effective intervention plan has become a chief concern for health planners and decision makers.

2. There is evidence that (at least in populations of up to 60-70,000) effectively operated projects can reduce infant and child mortality rates by 1/3 to 1/2 or more within 1-5 years, at a cost of less than the equivalent of 2% of per capita income.[1,2]

3. Since the WHO Alma-Ata meeting,[3] focus on Primary Health Care Delivery has been intense, and the search for appropriate ways of measuring the health impact of intervention programmes has accelerated.

4. As a part of the effort of the PHN Department in finding better ways to establish the effectiveness and efficacy of health interventions in the LDC, it was suggested that I:

a. Select a plausible national policy objective for the reduction of the infant mortality rate;

b. List all the major discrete interventions, both preventive and curative, that might be expected to contribute to attainment of this objective;

c. Indicate which of these interventions interact with others to produce a joint effect greater than would result from their application independently, and hence what packages might be

most effective;

d. Having established qualitative linkages between different interventions and IMR reduction (over a specified time period), give quantitative estimates on the basis of your own experience and published research, of the probable effectiveness of these interventions in reducing the IMR;

e. Indicate also the nature and magnitude of non-IMR health benefits that might be produced at the same time;

f. If possible, extend the analysis to include estimates of the costs of the listed interventions.

(N. Prescott, D. de Ferranti - Dr. Tieffenberg's Suggested Work Programme, World Bank, June 24, 1981.)

5. To discuss the issue of priorities for health interventions, it would be useful to develop a consensus about the methodology to use to define inputs, linkages between them, and to quantify the effectiveness of each intervention effort.

6. As a first step in that direction, I found it useful to perform a literature review focussing on (a) the development of priorities for health intervention in developing countries, and (b) the methodology to use to measure the impact of health programs in developing countries.

7. Based on that review and using real life data, I constructed some examples of quantification of the impact of Tetanus Neonatorum and Measles reduction on the infant mortality rate. The individual results and combined effects were then expressed as years of life saved or increase in the life expectancy.

8. This methodology can be applied to the measurement of the effectiveness of health intervention in developing countries. I intend to further develop this in the next academic year.

9. A set of criteria can be drawn from these reviews. These are listed below. A few are elaborated in the text and all are concentrated on in author's Concluding Comments.

A. Define a Target Population

B. Identify Health Problems

C. Establish Priorities

D. Define Health Access and Availability

E. Organize Effective Surveillance

F. Reorient the Training of Health Personnel

G. Integrate Programs at Village Level

H. Decentralize Planning and Budgeting

I. Assess the Financial and Economic Cost of a Program and Define Reimbursement Mechanisms

J. Consider the Program Indirect Benefits

K. Promote Self-Reliance

10. In this paper I did not analyze the literature and the data on cost/benefit and cost/effectiveness analysis in developing countries. Efforts in that direction are already in progress in the Department, and I considered it more useful to concentrate on the problems of health benefits definition and measurement. Anyone interested in that subject may find it useful to review the annotated bibliography on cost/benefit analysis and health impact estimation that I prepared as part of my work program in the Bank.[4/]

I. ESTABLISHING PRIORITIES FOR HEALTH INTERVENTIONS: A LITERATURE REVIEW

11. In setting priorities for basic health interventions, "the objective should be to identify the most cost effective combination of interventions for achieving the desired health and nutritional effects within a given commitment of resources....even in the absence of adequate cost/effectiveness information....it should nevertheless be possible to make informed judgments about appropriate intervention packages based on assessment of the expected effects and the estimated costs of available alternatives."[5/] The least costly intervention is that of health care and disease control.

A. Defining the Target

12. According to W. L. Berggren, et al, "Achievement of this goal required identification of the persons at risk for each problem, and planning and provision of appropriate services for the persons at risk."[6/]

13. In "Global Estimates for Meeting Basic Needs"[7/] the "target population" has been identified as "the absolute poor." This has been estimated to be about 830 million (of which slightly over 2/3 - 650 million - is rural).

14. The number of children under age 5 who are members of those (absolute) poor households is about 165 million (from which about 80% are living in rural areas). Although they comprise only 1/5 of the total population, deaths of children under 5 years account for 50-80% of all deaths in these countries.[5/]

15. Infants are particularly susceptible to low levels of health and nutrition.[5] The mean infant mortality rate in 42 "low-income countries" (per capita GNP under $300) was 149.8 per 1000 live births (range = 45 to 200) in the early 70's.[8]

B. Identification of Health Problems

16. To assess the relative weight of a disease in a defined population, the data should be disaggregated.

17. For example, taken together, tetanus, measles and diarrhea accounted for 1/3 of all infant causes of death in Teknaf, Bangladesh.[9]

18. Tetanus was responsible for 19.3% of the deaths of all infants; but when we exclude neonates and take the data of infants from one month to one year, tetanus accounts for 6.2% of the deaths while measles and diarrhea together account for 19.5% (6.7% and 12.8% respectively).

19. Studies of unimmunized populations indicate that although not constant, in most of the poorest Third World countries tetanus is responsible for 1/4 to 1/3 of all neonatal deaths.[10] In the rural municipios of El Salvador, for example, more deaths were caused by tetanus than those from diarrheal disease,[11] and the tetanus-specific mortality rate among a non-vaccinated rural Haitian population was estimated as high as 145 per 1000 LB.[6]

20. When assessing health problems, there are certain features and patterns of disease that are particularly useful in the identification process.

21. For example, Black, et al, used mortality in days 4-14 as indicators of neonatal tetanus. Over 90% of neonatal deaths caused by tetanus but only 25% of neonatal deaths from other causes would occur in this period.[12] In addition, Chen, et al, found in Bangladesh that while the neonatal rate remained relatively unaffected, the post-neonatal mortality rate showed marked fluctuations following 2 disasters (the 1971 war and the 1974-75 famine).[13] These correlations are of help especially in countries where statistics about mortality by cause of death are considerably unreliable.

22. Another important feature to examine is seasonality. For example, in Bangladesh, the peak number of Tetanus Neonatorum cases occurs from July to November, and this is related to the fact that births are known to peak during the last 1/3 of the calendar year. The peak number of cases for measles, instead, develops from February to April.[13]

C. Establishing Priorities

23. A variety of criteria have been advocated for the analysis of the impact of health problems in developing countries.

24. According to D. Shepard, epidemiological surveillance data is the first way that one can look for effects of a particular program.[14] The larger the baseline data, the more accurate the evaluation. As Shepard points out, the advantage of using epidemiological surveillance data is that they are actual results under real conditions; but may be hard to obtain and to adjust.

25. An alternative approach is an "epidemiological model"[14/] Such a model uses program characteristics and facts from the epidemiological literature that are extrapolated to estimate the theoretical impact. Where some parameters are uncertain, subjective estimates can be used.

26. This model has two main advantages. First, it can be used to predict effects of certain programs (but perhaps not so accurately) while the data requirements are more modest. Second, the theoretical effect of the program can be computed even before implementing it, as opposed to the surveillance information model.

27. One disadvantage is that of any model: gives theoretical predictions, which may omit important factors (the closer to reality, the more realistic the model will be). Another disadvantage is that the additive qualitative effect of surveillance itself is lost.

28. K. Morrow, et al, did a study of health impact as part of the Ghana health assessment project. They described a method for assessing quantitatively the relative importance of different disease problems on the health of a population. They proposed that the "number of healthy days of life which are lost through illness, disability and death as a consequence of the disease," may be used to help determine the priorities for the allocation of resources to alternative health improvement procedures. However, one limitation might be the aggregation of morbidity and mortality needed to assume that a day of total disability is equivalent to the loss of a day due to death.[15/]

29. For L. Chen, et al, priorities for intervention programs should be based on mortality rates data;[13/] and the possibility of preventing those deaths "with simple techniques already developed and applicable at low cost." They estimate the impact of their proposed program (involving several immunizations and ORT for diarrhea) in terms of number of deaths of infants and children less

than 5 years old averted. The rationale for this approach is simple but appealing: a) 1/6 of the population was responsible for contributing 1/2 of the deaths, and b) the average life-expectancy from birth would increase with the intervention proposed from 49.9 years to 63.1 years. Similar reasoning has been advanced by Curlin and Black.12/

30. Berggren, et al, defined health impact as the changes in mortality rates associated with the health services provided, showing associations in time, age group, place and specific disease category between the provision of services and the decline of mortality rates. In order to assess needs for service, the most common causes for performing service at the local hospital were studied, together with deaths of census tract residents during the first year of surveillance according to category of underlying cause, and cross-tabulation of data from retrospective interviews of all mothers in the census tract.

31. In this way, they decided that malnutrition, diarrhea, tuberculosis and tetanus should be "target disease categories for preventive services." Since immunization is easy to expand, the program also included finally measles, pertussis, diphtheria and poliomyelitis. They measured the efficacy of the intervention effort by "the years of expected life saved by the health services" provided.

32. Walsh and Warren designed a Selective Primary Health Care Criteria, based on the principle that the vast number of health problems of mankind "cannot be attacked simultaneously."2/ They point out that "Traditional indicators, such as infant mortality or life expectancy, do not permit a grasp of the issues involved, since they are actually

composites of many different health problems and disorders." They have based their priorities criteria on 4 factors that "should be assessed for each disease: prevalence, morbidity, mortality and feasibility of control (including efficacy and cost)."

33. Based on these criteria, the major infections endemic to the developing world were evaluated and assigned high, medium and low priorities.2/

34. For major diseases for which control measures are inadequate, they consider research an inexpensive approach, based on a "cost allocation per infected person per year."

35. Based on high morbidity and mortality and of feasibility of control, a circumscribed number of diseases are selected for prevention in a clearly defined population. In that way, they selected as principal recipients of care the children up to 3 years old and the women in the childbearing years.

36. The care to be provided would be measles and DPT vaccination for children over 6 months old, TT to all women of childbearing age, encouragement of long-term breast feeding, provision of chloroquine for episodes of fever in children less than 3 years old (in areas of malaria prevalence) and oral rehydration packets and instruction.

37. They estimated that the cost/effectiveness of such a program would be $200-250 per infant and child death averted (with medications accounting for 30-50% of this cost), and this cost per death averted is, in their judgment, the best indicator to follow.

D. Organizing Effective Surveillance

38. The systematic and iterative gathering and interpretation of health information from a defined population is called health surveillance.

39. Berggren, et al, proposed to integrate the identification of health problems and the population at risk, with the simultaneous performance of the planning and the provision of adequate services for them.[6]

40. That implies basically to perform surveillance while delivering health services and being able to evaluate the impact of the services delivered.

41. In that way, "all members of a defined population are identified and counted, the members needing certain health or nutrition services are identified and served, all deaths are identified and the cause is certified. From these data, the rates of births, deaths, and certain diseases can be calculated. The rates and annual changes in the rates are analyzed to plan services and to evaluate the impact of the program on the population's health."[6]

42. Berggren, et al, have shown in Haiti that the simultaneous delivery of health services and health surveillance also can have in itself significant impact in reducing mortality, if done with the participation of the village population.

43. This goal may be accomplished by:

a. Using village-level health workers, which makes available extensive coverage at minimal cost.

(1) Those "health collaborators" may be community residents selected among village volunteers, whose work is supervised through periodic home visits.

(2) In other approaches, these village workers have been selected among volunteer mothers, with a health-specific problem-oriented selection criteria, which allows for simplification and reduction of the training process, and incorporates valuable incentives for performance.[16]

(3) Several successful experiences showed that the best training method was supervised on-the-job training, involving one task at a time.[6,16]

b. The data gathered this way provides immediate feed-back, which allows for the program to constantly refocus on the priorities of the population, maximizing efficacy and efficiency.

E. Estimating Indirect Benefits

44. "Indirect benefits" can be interpreted, for example, as the impact of the program in a country's Gross Domestic Product (GDP). Morris D. Morris put together a new index that tries to take that into account: The Physical Quality of Life Index (PQLI). It was developed with "the purpose of measuring somewhat more sensitively than has previously been possible, the degree to which societies' provide certain important social benefits."[8] More directly, certain economical techniques can be used also. D. Shepard estimated in the Ivory Coast the marginal GDP per death averted calculating the discounted marginal GDP over a person's life.[14]

45. Other important benefits derived from health programs are those that are gained as a natural consequence of the intervention effort without being part of the program target. For example, measles has a more serious effect on nutritional status than any other common childhood infection.[17] Hence, a measles control program will have a marked effect on the nutritional status of the targeted population. The same can be said for other common diseases in developing countries, like whooping cough and diarrhea.

46. A very important indirect health benefit is the claimed effect of breast feeding on the birth interval. In "See How They Grow," D. Morley, et al, cited data from H. Van Balen in Rwanda where bottle feeding has not been yet introduced, to show a strong relationship between duration of breast feeding and birth interval.[17]

47. Where women have continued breast feeding, the mean birth interval is about 2 years. But for women who did not breast feed (mainly because of still births) the mean birth interval is only 14 months. (see figure 1)

FIGURE 1

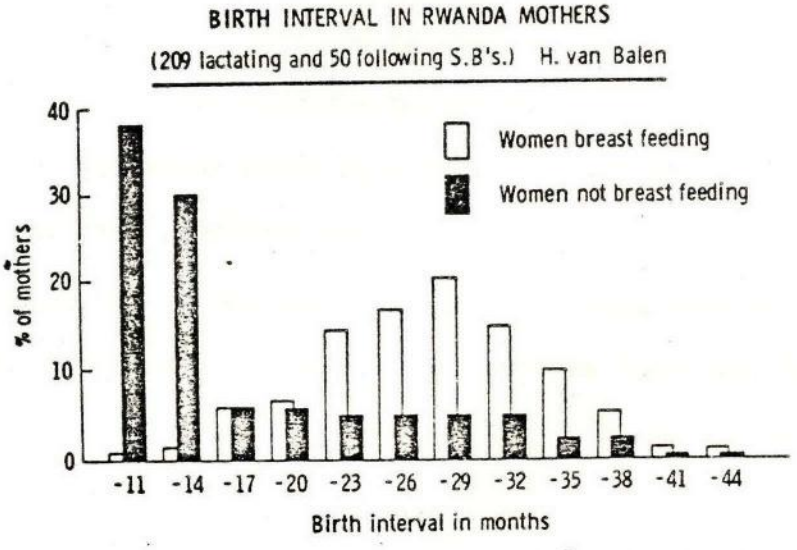

FIG 8.14 The birth interval in mothers who breast feed and those who, due to a stillbirth, did not breast feed.

48. According to Morley, breastfeeding delays the next pregnancy in several ways. He cited several authors (Baxi, P.G.; Chinnatamby, S.; Cronin, T.; McKeown, T., et al; and Salker, E. J.) to support his claim that many mothers who breast feed have an extended period of amenorrhea, which is related to failure of ovulation. He underscores that the ovulation failure lasts longer in the less well nourished communities (see figure 2). He attributes that to the fact that in these communities the infants have to suck more frequently and spend more time sucking which triggers a complex hormonal pathway to inhibit ovulation.

FIGURE 2

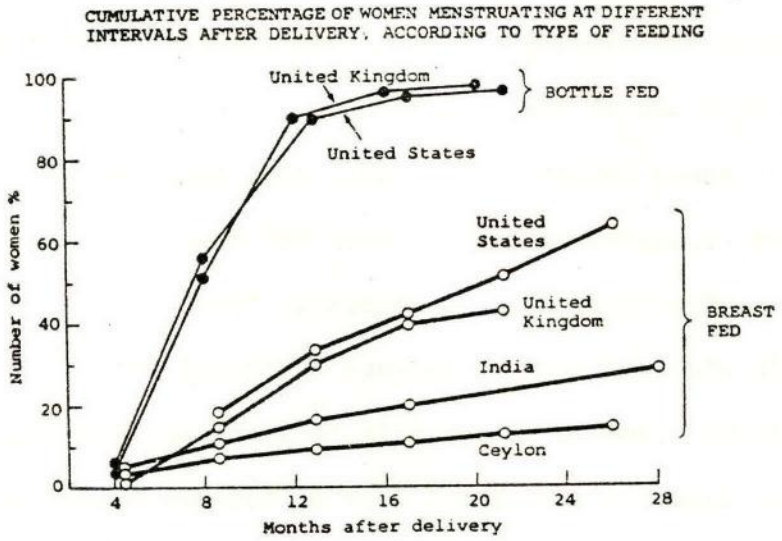

FIG 8.15 Duration of amenorrhoea in several studies shows that this depends on the duration of breast feeding. In India and Ceylon where the baby sucks very frequently at the nipple, three-quarters of the women may not have menstruated two years after the birth of their children.

II. THE MEASUREMENT OF THE INFANT MORTALITY REDUCTION IMPACT

A. Quantifying the Health Impact of Tetanus Neonatorum Control

1. Background Information

49. As in many other LDCs, the death rate in children is high in Bangladesh, particularly in children less than 5 years of age.[10,11]

50. Life expectancy at birth is less than 50 years. The CBR is 46 per 1000. The CDR is 18 per 100, with an IMR of 140 per 1000 LB. The child mortality (less than 5 years) is 250 per 1000 LB, while maternal mortality is 10 per 1000 LB.[18]

51. Almost all the deliveries in rural areas take place at home under unsanitary conditions. Only 0.4% are attended by trained personnel. The rest are taken care of by Traditional Birth Attendants (TBA) or unskilled relatives and neighbors, which use mostly bamboo splits for cutting the umbilical cord.[9] The stump is later covered with ash or burnt earth.

52. Based on these conditions, tetanus is a major cause of death, particularly among neonates. A country-wide WHO random sample survey (March 1977) gave a Neo-Natal Tetanus Incidence Rate of 23.9 x 1000 (case fatality rate = 93.5%). In the same survey, tetanus accounted for 18.1% in the under 5 age group, ranking second only to diarrheal diseases.[19]

53. Maternal immunization with 1 dose of tetanus toxoid or Td provides protection against neonatal tetanus up to 20 months after immunization.[12] It has been shown that immunizing yearly for 2 years either all women of childbearing age or all pregnant women (with subsequent booster doses of TT at 3 year intervals), may make it possible

to reduce neonatal mortality by 1/3. In other words, erradicating (or reducing to a minimum) the neonatal tetanus, will have an impact on infant mortality of 1/3 reduction.[12]

54. This will no doubt have an impact on the health indicators. This can be calculated by comparing the expected data under the protection plan (assuming the vaccine is 100% effective) with the observed baseline data before the plan is implemented.

55. This comparison may be done based on mortality rates, deaths averted and years of life saved (e.g. as mentioned above, assuming 100% coverage, the infant mortality would be expected to be at least 1/3 lower than before the program).[6]

2. Calculating the Number of Years of Expected Life Saved

56. In order to calculate the number of years of expected life that would have been saved, it is necessary to assume that without that program, new-borns would continue to die at the same annual rate found before the program.

57. Therefore, the number of years of expected life saved for this age group is equal to the number of deaths averted multiplied by the national life expectancy at birth.[20]

58. In the example used, that is: 26.2% deaths averted, 2.62 per 1000 x 49.9 (life expectancy at birth for Bangladesh, 1977) = 131 years of life saved that year.[6]

59. In case of uncertainty about the number of deaths, (many times these are projected estimates) a sensitivity analysis can be done taking the projected estimate on one extreme and a

local sample in a selected area (health center, village, etc.) on the other. In that way, the number of neonatal deaths per thousand population per year (or the number of person-years of expected life per thousand population) will be expressed as a range.

3. The Effective Proportional Coverage

60. The same can be done when estimating more realistically the coverage of the plan.

61. Immunizing 100% of women would achieve 100% protection. Obviously, some estimate is needed to correct for incomplete coverage. The weight, in this case, will depend on several factors, ranging from distance to health facilities, accessibility of them, availability of personnel, etc. (most of which can be measured and estimated) to such subjective factors as cultural characteristics of the population, political stability, etc. (most of which are impossible to quantify).

62. Obviously the program coverage would be larger if it relies on non-professional primary-care personnel (village workers, TBA, volunteer mothers, etc.) than if it has to be done, for example, only with physicians and nurses.

63. H. Barnum, et al,[21/] distinguished between "activities" ("Number of units of a given service that are available but not necessarily used") and "intervention" ("Effective proportional coverage of a given target group by an activity actually used").

64. The "effective proportional coverage" can be estimated if the proportion of the target population that has been actually reached (in this case, immunized) is known.[14]/

65. For example, let us assume a % coverage in Matlab of 70%, and a proposed target of 80%.

	Coverage	Effectiveness[a]		
Ideal Total	100%	98%	=	98%
Matlab	70%	98%	=	69%
Proposed Target	80%	98%	=	78%

[a]level of protection of 1 dose of T. Toxoid for 12 months.

In this way, the ideal, actual and proposed adjusted number of cases prevented for Matlab would be:[b]

Ideal	Matlab	Proposed
1174[c] x .98 = 1152	1174 x .70 = 822	1174 x .80 = 939

[b]for simplification, we assume No. of cases = No. of deaths (in reality it is about 95%)

[c]number of infant deaths from tetanus, 1975-1977, Matlab, Bangladesh.

66. Hence, the number of cases of Tetanus Neonatorum that can be prevented annually would be 939, not 1174.

67. Still, this would have a substantial effect. As mentioned before, the life expectancy at birth is in Bangladesh 49.9 years. The expected reduction in T.N. deaths would extend life expectancy at birth by 7.70% or about 4 years.[14]/

B. Quantifying the Health Impact of Measles Control

68. Measles causes in Bangladesh about 3 million cases and 150,000 deaths per year; 97% of the cases occurred in children under 10 years. Overall case fatality rate is 8% Since pneumonia, diarrhea and malnutrition are common complications among those who die, the cause of death may be difficult to assign.[19/]

69. As stated above, the expected reduction in mortality and/or morbidity can be estimated multiplying the proportion vaccinated times the average efficacy of the vaccine.[14/]

70. In the case of measles, this is more complicated, because not only is this vaccine more expensive (which makes it less easily available) but to be effective requires a "cold-chain" that in conditions like the one we are analyzing is difficult to achieve.

71. In addition, sero-conversion rates vary with the age of the child. If immunized at 6 months of age, the sero-conversion rate would be around 50%. That % would increase progressively, and at 15 months of age is thought to be over 95%.[22/]

72. So let us assume that children were immunized at 6 months of age and achieved a sero-conversion rate of 50%, while those immunized between 12 and 15 months reached a level of protection of over 90%.*

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*This assumption is based on experiences done in some developing countries, where plans were made to immunize children at 6 and 12 months of age to increase infant protection. Improved knowledge of measles immunity has led to changes in this practice. This example, based on the Shepard paper, is used merely to demonstrate the technique used to correct for confounding factors.

73. Lets assume further that, due to the logistic difficulties menitoned above, those hypothetical planners found it more convenient to vaccinate against measles in annual campaigns (presumably, concentrating in the months of September to November). In this way, it is reasonable to assume that roughly half of the children will have a sero-conversion rate of 50%, and half of 90%

74. In 6 different primary health care programs in rural Guatemala, targeting a total population of 375,550, the average coverage rate for measles was 73.2% (range = 62%-98%).[23/] Based on that information, a 75% coverage can be assumed to be a reasonable target.

75. The average vaccine efficacy would then be:

(50% + 90%) 1/2 = 70%, and the estimated reduction in measles cases:

	Coverage (%)		Effectiveness (%)		Measles % Reduction
Village A	62%	x	70%	=	43%
Village B	98%	x	70%	=	69%
Target	75%	x	70%	=	52.5%

76. Getting back to our case in Bangladesh: assuming that a national program achieved the target levels, the number of cases of measles prevented annually would be:

52.5% x 3,000,000 = 1,575,000 cases

and the number of deaths prevented per year would be:

52.5% x 150,000 = 78,750 or 2% of a cohort of births.

(Assuming a CBR of 46.5 x 1,000 population and an estimated population of 82.7 million.)

77. So, given a life expectancy at birth in Bangladesh of 49.9, the expected reduction in measles deaths would extend life expectancy further by 2% (or 1 more year).

78. Adding the effects over life expectancy derived from the reduction in tetanus mortality and measles mortality secondary to the intervention program, we reach (4 + 1) = 5 years (or a life expectancy of 55 years). As we saw before, the results of the program can be expressed either that way or in number of deaths averted.

79. The same methodology can be applied until all the targeted problems are covered.

III. CONCLUDING COMMENTS

80. The most suitable policy about funding for health in the Third World appears to be to maximize the health benefits for the rural poor at the least marginal cost. While some of the criteria listed below have not been dealth with in the text, they are mentioned in the passing for I think these are substantial criteria even though the basis for their inclusion may require further study and analysis which could not be included in this paper.

A. Define a Target Population

81. If we want to maximize the impact of health intervention in a country, it is necessary to define a target population.

82. Among the rural poor of the Third World, (defined target of the Alma-Ata Conference) that population appeared to be the children of less than 5 years of age, and the women of childbearing age.

83. As stressed in the Introduction, children under age 5 comprise only 20% of the absolute poor population living in rural areas, but they contribute 50-80% of all deaths. And it has been shown repeatedly that the infant mortality rate is a suitable indicator which correlates closely with the general socio-economic and sanitary status of a given population.

B. Identify Health Problems

84. Once the population at risk is defined, identification of their health problems is needed. Analyzing morbidity, mortality and other demographic data available, intervention priorities can be established.

C. Establish Priorities

85. The evidence available suggests that those priorities should be age-specific, and that mortality rates are the most reliable indicator of the serious conditions prevalent in the Third World.

86. Several reports agreed that for those major problems that have no adequate control available, investing in research is the most cost effective approach.

87. There are other problems that are easily amenable to control just by expanding existing programs and for that reason, since it represents only incremental costs, can be readily included (e.g. polio vaccine if cold chain is operating for measles vaccination).

88. These are not definitive solutions to the health problems of the vast population of the Third World. But they might be considered as interim strategies, not only to help the neediest to survive today, but to create the foundation for the health programs that will be a consequence as well as a part of the socio-economic development.

D. Define Health Access and Availability

89. The identification of the health status of a population is incomplete without determining the availability and accessibility of that population to the offered or planned services.

90. This information has to be region-specific and target-population-specific.

91. For example, Bangladesh had a total of 12,518 existing hospital beds in 1977, but most government beds were in urban areas.[19] Furthermore, the doctor-urban population ratio was 1:1,200, while in the rural areas it was 1:31,300. In addition, 43% of the inpatients and 19% of outpatients had travelled more than 6 miles to receive service.[24] Regarding the need for specific target-population information, as has been repeatedly pointed out, the main cause of death varies by age group and this also changes between regions.

E. Organize Effective Surveillance

92. The provision of health services simultaneously with health surveillance is one of the significant features that makes Selective Community Primary Health Care more effective and efficient.[6]

93. The information provided allows for constant refocusing on the priorities of the target population. At the same time, this helps to organize the community around their problems and the monitoring maximizes efficacy and efficiency.

F. Reorient the Training of Health Personnel

94. Manpower shortages in the health field have been claimed for years as one of the main obstacles for the adequate coverage of the population.

95. Even though this is undoubtedly true, the solution to this problem is not merely to increase the output of health practitioners.

96. Relying upon traditional healers and village workers has been advocated as a cheaper, more cost-effective alternative to the more specialized, "western" oriented practitioners.

97. However, this is not a simple matter. It requires better and more intense field supervision, and a high level of organization and planning.

98. It also requires health professionals trained to deal with community problems and ready to cooperate and work side by side with the large variety of traditional healers that populates the rural areas of many developing countries.

99. This will require an effort to reorient the curricula of most of the medical and paramedical training schools.

100. Shorter and more functional programs are required. They should concentrate on the local health priorities of the country, rather than try to encompass a vast array of disease processes in the curricula. It should concentrate particularly on the problems of rural areas.

101. As part of that effort, medical students can spend part of their training working in rural areas, developing clinical, public health and management skills. Working with villagers and traditional healers while learning, they will contribute to diminish the manpower shortage.

102. The financing of medical education should take this into consideration in providing adequate incentives that help to gain support for the curricula changes.

G. Integrate Programs at Village Level

103. There has been much debate about "vertical" vs "horizontal" programs. First, the debate has to be placed in the context of what is achievable as interim strategy in the present conditions. Second, instead of confronting them as alternatives, it is possible to integrate those programs at the village level, allowing for effective disease control while at the same time building the foundation for an adequate Primary Health Care System.

104. The use of modern methods of organizational design for Health Units at Village or Regional level (like the matrix structure) allows for that type of integration and is an impulse for its development. Such degrees of management sophistication have to be tested to ensure if it is practical to institute.

H. Decentralize Planning and Budgeting

105. Decentralization of planning is important to involve persons at the village level to understand their aspirations and goals and balance these with regional and national thinking.

106. This system of planning allows a start to be made for an adequate budgeting process from the periphery to the center, creating the necessary incentives for the development of integrated cost and responsibility centers at the village and regional level.

107. This, in turn, not only facilitates the health surveillance process, but also eases the monitoring of the health intervention program.

I. Assess the Financial and Economic Cost of a Program and Define Reimbursement Mechanisms

108. Appropriate cost information and certain definition about reimbursement mechanisms will have significant influence in the shape of the health program.

109. The way the health system is financed will significantly affect the number of people who are served, the amount they use the service and the quality of the service provided.[23/]

110. Also, whether the program uses national or foreign, "hard" currency will significantly impact the economic cost of a program.

111. Sometimes, using simpler and locally available technologies will save the country the use of much needed foreign currency reserves by avoiding alternative methods which require imported inputs.

J. Consider the Program Indirect Benefits

112. The program might have indirect health benefits which increase their health impact at the same cost per unit delivered (for example, the successful promotion of breast feeding will have a significant impact on diarrhea and birth control).

113. It is hard to measure to what extent that happens. A decentralized surveillance process, as part of a Selective Primary Care Delivery System, can provide comparative information which will help to estimate those answers.

114. But the more indirect health benefits a program has, the more successful it will be. In this kind of assumption resides the advantage of Selective Primary Health Care delivery over simple vertical control programs.

J. Promote Self-Reliance

115. There are two other elements of significance for an international lending institution to consider:

a. That the country will be able to support the program without recurrent external intervention, and

b. That the program will build mechanisms which will help the system become and remain self-reliant.

116. In this, too, resides the advantage of the Selective Primary Health Care Delivery System, with a village-based decentralized surveillance and service structure.

"We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the fountain of life. Many of the things we need can wait. The child cannot. Right now is the time his bones are being formed, his blood is being made and his senses are being developed. To him we cannot answer "tomorrow." His name is "Today."

Gabriela Mistral

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John,

There is something in the Navajo studies that conceivably could be relevant to your point. It is marked on page 29 starting in column 1.

Walsh McDermott, M.D.

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SCIENCE

Health Care Experiment at Many Farms

Walsh McDermott, Kurt W. Deuschle, and Clifford R. Barnett

On Page 4, center column -- first line, parenthetical information should read (Figure 2, table 3; and in table 3, change months to years and 0-12 to 0-1

On page 7, center column, 4th line from bottom, change 100 to 1000.

Health Care Experiment at Many Farms

A technological misfit of health care and disease pattern existed in this Navajo community.

Walsh McDermott, Kurt W. Deuschle, and Clifford R. Barnett

Medicine and the other health professions are undergoing wide-ranging scrutiny as parts of a total health care system. One part is the system for primary health care (*1*) consisting of a university-connected health center manned full time by physicians and nurses, with the aid of well-trained, indigenous, auxiliary personnel who work both at the center and in the homes. A chance to measure the impact of such a system on the endemic disease pattern of a poverty-stricken, rural, and traditional tribal society was provided as part of a larger series of studies on a Navajo community (*2*). Naturally, the human support components of medical care were heavily involved in this activity. However, these aspects have been purposely excluded from this analysis, which is concerned solely with the influence of the technology. By technology is meant the capability to alter disease in a predictable fashion by such entities as drugs, vaccines, diagnostic equipment, or surgery. In a community with satisfactory health services, those services delivered to the individual and those delivered to the group operate simultaneously; hence it is difficult to separate their respective effects. Such a separation is necessary, however, if rational choices are to be made in setting up systems of medical care in communities where the existing systems are ineffective or nonexistent. In the present study, the circumstances were such that the influence of one of the systems—in which the technology is selectively applied by a clinical physician to one patient at a time—could be evaluated free from significant influence by the other system—in which the technology is applied by a variety of professionals to the community as a group.

Dr. McDermott is chairman of the department of public health, Cornell University Medical College, New York 10021. This article is based, in part, on the Bruce Lecture of the American College of Physicians, 1 April 1968. Dr. Deuschle is chairman of the department of community medicine, Mt. Sinai School of Medicine, New York. Dr. Barnett is professor of anthropology and associate professor of pediatrics, Stanford University, California.

Background and Methods of Study

The Navajo–Cornell Field Health Research Project was organized by the Navajo Tribe, Cornell University Medical College, and the U.S. Public Health Service in 1955, when the responsibility for the health of the U.S. Indian was transferred to the Department of Health, Education, and Welfare. The stated purposes were fourfold: to develop effective methods for the delivery of modern medical services to the Navajo people; to see to what extent these methods could be applied to other people in similar socioeconomic circumstances; to study discrete diseases, particularly in light of their possible shaping by Navajo culture;

and to find out whether the sudden apposition of modern biomedical science and technology and the disease pattern of a nontechnological society could provide valuable knowledge in the attack on contemporary medical problems.

The research on these questions covered a wide range. There were studies of such familiar entities as infant feeding (*3*), congenital hip disease (*4*), coronary heart disease (*5*), tuberculosis (*6*), and accidents. There were also studies of an immediately practical nature, such as effective cross-cultural training for paraprofessional field health workers and the development of a manual to be used as a text in training them (*7*). Finally, there were studies in such sharply focused areas as the discovery of a new, genetically determined transferrin (*8*) and ethnolinguistics (*9*).

It is unlikely that any of this research, with its requirement of continued and enthusiastic community participation, could have been conducted in a remote, non-English-speaking tribal society unless there were clearly visible, immediate benefits to the people living there (*10*). Indeed, without the capability of supplying substantial benefits, it would have been inappropriate even to propose the project. The procedure chosen, therefore, was to create a comprehensive system of primary health care and, as a major corollary, to organize various programs of research (*11*). Thus, the introduction of a complete system of personal medical care to a community in which only a rudimentary system had existed became, in itself, one of the major experiments.

A natural and political unit of some 800 square miles, known as the Many Farms–Rough Rock community (hereinafter called Many Farms), near the center of the 23,000-square-mile Navajo reservation was selected jointly by project and tribal representatives. The community was considered to be reasonably representative of Navajo society and was thought to contain about 2000 people.

The System

The system of primary health care was in actual operation from May 1956 to July 1962. It included a well-equipped health center for ambulatory care, a rudimentary satellite facility, and several automobiles with two-way radiotelephones for visits to the homes. The medical and nursing services were supplied by two field physicians, two nurses, one Navajo teacher, and four Navajo auxiliary health workers. The staff in residence received guidance from resident social scientists, and a steady flow of consultants in the various professions and disciplines was available from the parent university. Patients were usually seen in the central facility, but, when necessary, they were seen in their homes. Transportation to the government hospital 90 miles away, or to the mission hospital 55 miles away, had to be on an improvised basis over the corduroy dirt roads. Critically injured persons could be removed by light airplane in the daytime, weather permitting.

Over 90 percent of the population were examined in the central facility at some time during the study, and approximately two-thirds sought care at least once a year during those 6 years. Evidence exists that the health care delivered was of a consistently high standard; but since that evidence does not lend itself to a brief presentation, we can merely state our conviction that the results observed are representative of what happens when medical care from a large university medical center is made available to an impoverished rural society in the general circumstances of Many Farms.

The Society at the Start

The Navajo society at Many Farms was one of a nonliterate, non-English-speaking people who lived in extended families in one-room, windowless, log and mud dwellings with dirt floors. These dwellings were separated from each other and from any supply of water by one or more miles of intermittently impassable dirt roads (*11*). The water was pure at the source, but was easily contaminated through the communal dipper in the home. There was no refrigeration. The climate was one of harsh extremes of winter cold (averaging −4°C) and summer scorching (reaching highs of 43°C during the day and dropping 22° or more at night). Rainfall averaged 12 to 15 inches per year. Six or seven, and occasionally as many as 15, persons might sleep in a single, large, poorly ventilated room, usually on sheepskins or the dirt floor. A wood stove, sometimes made from a kerosene drum, supplied the heat and was used for cooking. The meals were not usually served on a table, but were eaten while sitting on the floor. There were no latrines or privies; horses wandered up to the hogan door and dogs roamed freely.

The economy consisted of a little dry farming, sheepherding, the weaving of wool rugs, some silver work, and occasional laboring jobs, usually farther than an overnight trip from the home. The average cash income for a family of four was estimated to be $586 per year, or $147 per capita per year (*12*). Of this income, 82 percent was earned and 19 percent was from various sources of welfare. There was a federally supported, tribally administered supplemental food program. Primary school children would learn to speak English, but it was not spoken in the home; not all children of school-age actually attended school.

Poor as these people were in a material sense, they did not show the apathy and lack of community feeling that Oscar Lewis describes as characteristic of the "culture of poverty" (*13*). On the contrary, the Navajo culture was fairly well maintained, and included an indigenous curing system run by medicine men, who were highly respected. This gave the Navajos a kind of "regal poverty," in that they were well adapted to the harsh circumstances of the environment.

For the way of life, the disease pattern was predictable (*14*). Windowless, one-room homes, when the winters are bitter cold, favor airborne transmission of tubercle bacilli and other agents of respiratory disease. The scarcity of water, the chance of its contamination in the home, the absence of water at the sites of defecation, the serving of meals on the floor, and the potential of horse dung for breeding flies favor the spread of enteric diseases, skin disorders, and trachoma.

Clinical impressions of the disease pattern were largely derived from what had been seen at the reservation's six hospitals. The diseases just mentioned, as well as the severe burns and traumatic injuries of the sort common to primitive rural living were prominent, as were congestive heart failure, gall bladder disease, and arthritis. Infant mortality and the birth rate were thought to be considerably higher than the U.S. average. All observers agreed that the Navajos were a disease-ridden people whose disorders would be largely preventable within a modern society.

Previous Biomedical Influence

Within the Many Farms–Rough Rock community, there were no physicians in residence, nor, as far as is known, had there ever been. The principal medical influences were a quite rudimentary outpatient facility, which was 14 miles from the southern border of the area and was manned by an elderly physician, a mission hospital 55 miles away, and a government hospital some 90 miles away. At both of these hospitals, limited general surgery could be performed. About half of the births were at the hospitals or en route to them; the other half occurred unattended in the hogans. At various times in the past, solitary public health nurses based outside the community had tried to mount immunization programs in the one boarding school or the two day schools. The latter were held in overheated Quonset huts and similar makeshift structures, with outside temperatures in the winter frequently ranging from −23°C to −29°C. As these public health nurses would be responsible for as many as 10,000 people scattered over 4,000 or 5,000 square miles, the field nursing position was understandably vacant more months than it was filled. Most of the community had received smallpox immunization. Any other immunizations were haphazard, and no program of tuberculin tests had ever been carried out. Thus, the introduction of primary health care through the clinical physician system was a virtually complete innovation when it was introduced to the community on 19 May 1956 (*2*).

Observations

Although the innovation was made suddenly, its early influence was gradual. Accordingly, the results reported are for a period of five consecutive calendar years in the middle of the total 6-year study. Careful checking of the half-year phase-in and phase-out periods indicates that it is not misleading to concentrate on the middle 5 years. The phase-out itself was accomplished smoothly, and the community was not left without an adequate system of medical care.

The disease pattern was determined by: (i) special examination of structured samples of the population; (ii) a review of all deaths and hospital records; (iii) demographic studies, including an annual census of the community; and (iv) rates of the incidence and prevalence of certain of the common conditions in the two-thirds of the population that sought care each year. Studies made in the later years of the project revealed no evidence of significant illness for which care had not been sought.

Table 1. Major acute microbial diseases observed in 5 years.

Episode	Year				
	1957	1958	1959	1960	1961
Pneumonia	132	125	37*	105	98
Diarrhea	220	314	282	359	247
Otitis media	159	239	224	219	95
Measles	22	139	5	86	53
Impetigo	113	142	157	149	106

* A clear relationship existed between pneumonia and measles for the age group 13 months to 10 years. Had antimeasles vaccine been available then, a substantial portion of the childhood pneumonia *after* infancy presumably would have been prevented.

By actual rates of incidence, the five most common diseases in the population as a whole each year were diarrhea, otitis media, impetigo, pneumonia, and burns. The incidence of fractures and head injuries closely followed that of burns. There were nine instances of purulent meningitis in the entire 5-year period. In Table 1, which is arranged by episode, it may be seen how much of the professional time was occupied by pneumonia, diarrhea, and otitis media. In the second year (1958), these three, along with measles and impetigo, represented a total of 958 episodes among the 1362 patients who sought care. Especially noteworthy, however, is the fact that, except for otitis media in the last year (1961), there is no evidence of a significant decrease in the number of these episodes throughout the 5 years. By contrast, the incidence of otitis media during 1961 can be shown to be significantly lower ($P < .0001$) than the incidence during the previous 4 years.

Turning to three major chronic diseases: in a 50 percent sample of the Many Farms population, the prevalence of congenital hip disease, as determined roentgenographically, was about 200 times greater than it is in the general population (*3*). Although there was no change during the 5-year observation period, there was evidence that both genetic and environmental factors are involved and that change could occur over a longer time period. At the start of the study, trachoma was present in 2.9 percent of the school children under age 10. While there were some indications that the situation might have improved very slightly during the 5-year period, there was no definite evidence of a decrease in incidence.

The prevalence of tuberculous pulmonary disease, determined roentgenographically in a 50 percent sample, was 74 per 1000 (*6*), two to three times that generally obtaining in the U.S. population, and 15 times that found in a rural area of southern Scotland which was studied at approximately the same time (*15*). A community of 2000 persons is too small to reveal significant change in the incidence of tuberculous *disease*, yet it is large enough to show change in the incidence of tuberculous *infection*. One-third of the 5-year-old beginners in school were cutaneous reactors to tuberculin when the study was started; 5 years later, in 1961, only 3 of 55 beginners were positive. This constituted evidence that the transmission of tubercle bacilli from one host to another had declined within the community during the study period.

In the present analysis, that portion of the disease pattern that was treated by surgery is considered as an entity; about 25 persons per 1000 of the population received surgical treatment each year. Another 25 persons per 1000

Table 2. Mortality in the Many Farms–Rough Rock community

	Year					5-year experience*
	1957	1958	1959	1960	1961	
Population	1963	2044	2127	2221	2299	
Deaths	20	15	7	9	14	65 (total)
Infant deaths	11	7	2	7	7	34 (total)
Infant mortality†	115.8	70.0	21.3	66.7	76.1	70.0 (average)
Crude death rate‡	10.2	7.3	3.3	4.1	6.1	6.2 (average)

* The U.S. Public Health Service estimate of crude deaths averaged 7.9 for 5 years before 1957. † Infant deaths per 1000 live births. ‡ Deaths per 1000 population.

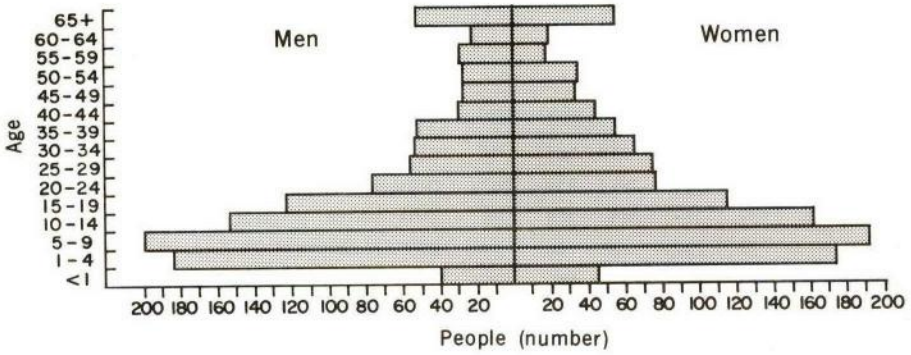

Fig. 1. Demographic profile (1961) of Many Farms–Rough Rock community.

were hospitalized each year for nonsurgical reasons. The surgical conditions involved ranged from cholelithiasis to severe gunshot wounds to hemorrhage and shock complicating pregnancy. Of this total of 50 persons hospitalized per 1000, some 7 to 14 died each year (Table 2). This left 35 to 40 persons per 1000, or 3.5 percent of the total population, who presumably benefited each year from hospital care, whether medical or surgical.

Absent Diseases

The incidence of certain diseases that might be expected was either very low or absent altogether. Credible explanations are at hand for most such cases—for example, coronary heart disease (*5*). The extreme decentralization of the society served as a "firebreak" against the spread of food- or waterborne disease, because the consequences of poor sanitation were largely confined to the individual camp. The absence of tetanus neonatorum is presumably due to the fact that, unlike some other cultures, the Navajos have no harmful practices concerning the umbilical stump. Also not included is the so-called "hidden component" of the pattern—namely, the illnesses recognized as such in the one culture and not in the other. Our observations on this "hidden component" have been presented elsewhere (*2*); suffice it to say that these illnesses presented no real problems in management, largely because they were so well handled by the Navajo medicine men.

Deaths

Examination of mortality affords another measure of the disease pattern at the beginning and throughout the study (Table 3). Two findings are especially noteworthy: 34 (52 percent) of the 65 deaths occurred during the first year of life; and there was only one death beyond the age of 3 that could reasonably be called preventable by contemporary medical science. This polarized pattern of deaths was generally constant; during the fifth year of the study, 50 percent of the deaths occurred in infancy, as had been the case in the first year of this study. Of the 34 infant deaths at Many Farms, 20 were from the pneumonia-diarrhea complex. Thus, the most prevalent disease among the living was also the leading cause of death.

The lack of change in the disease pattern, as revealed by the causes of death, was thus in agreement with the lack of change seen in the most prevalent diseases among the living during the 5-year period (Table 1). However, an important effect of the application of technology might be overlooked if change in the incidence of disease were the principal criterion. The incidence of a microbial disease could remain unchanged, yet the individual episodes could be aborted or readily controlled by specific therapies. It was not possible to measure accurately the therapy-induced curtailment of otherwise self-limited illnesses. From judgments based on well-documented experience with the particular diseases in question, except for otitis, there was no evidence of any widespread effect (*16*).

Table 3. Deaths in the Many Farms–Rough Rock community during 1957.

Age (months)	Deaths	
	Cause	Number
0–12	Pneumonia-diarrhea	8
	Congenital heart	1
	Unknown	2
1–28	None	0
29	Severe trauma	1
46	Post-cholecystectomy	1
46	Myocardial infarction	1
49	Severe trauma	1
75	Anemia, unknown cause	1
81	Congestive heart failure, with pneumonia	1
89	Fractured neck of femur	1
90	Congestive heart failure, with pneumonia	1
91	Pneumonia	1

Change in Crude Death Rates

Theoretically, a measurement of the extent to which lives were saved by the new system would be provided by comparing the crude death rates for the 5-year study period with the rates in the same community for the preceding years. Such rates were indeed determined for the 5 years of the study (Table 2). Unfortunately, however, the only data with which they can be compared are not true rates, but estimates. What is more, they are estimates not for the population of the Many Farms–Rough Rock community, but for the Navajo Tribe as a whole (*17*). The reason for this inadequacy is that, in order to obtain mortality rates, it is necessary to know the size of the population, and no accurate census of the Navajo Tribe by regions or as a whole existed. Because there were no census data and because the recall of infant deaths long afterward is significantly inaccurate, no attempt was made to determine retrospectively the total number of deaths for the community.

The crude death rate for the Many Farms population, calculated from our own exact census data, averaged 6.2 per 1000 population for the 5 years of the study. These data and death rates by individual year are presented in Table 2 (*18*). As may be seen, the Many Farms average and the rates in each of the last 4 of the 5 years were lower than the estimated crude death rates of 7.9 for the whole tribe in the 5 years immediately preceding the study. Our impression is that, in the pre-study period, the Many Farms health situation had been generally similar to that of the tribe as a whole.

Similarly, it is believed that the estimated death rates were probably slightly lower than actual figures because of the known tendency to fail to report the deaths that occurred in the first few days after birth.

This comparison of hard data and estimates based on impressions admittedly leaves the door open for the possibility that the study years were associated with a lowered death rate. Yet without well-established rates for the past, and with the necessity of having very large populations in order for small changes in crude death rates to be significant, it was not possible to establish a significant lowering of overall mortality as a result of the biomedical innovation. A priori, some lives were presumably saved, but there is certainly no clear-cut evidence to that effect (*16*).

The actual data on crude mortality and on infant mortality in the 5 years of the study are given in Table 2. In all but one year, the infant deaths represented at least one-half of the total deaths, and infant mortality averaged 70 per 1000 live births for the 5-year period. As with the crude death rate, the infant mortality rate of 70 was slightly lower than the government estimates for the entire reservation for previous years, but there is no real indication that the rate showed a significant downward trend during the 5 years of the study.

Census

In evaluating the technological effectiveness of a health care system, however, it is not only essential to establish the nature of the diseases prevalent in the community, but also to establish the demographic profile of the community. In order to obtain demographic data about Many Farms, it was necessary to conduct a complete census of the population. This was done by constructing a map that included all households in the area and enumerated every resident therein, and by determining all births and deaths on a continuing basis. The total census was repeated each year.

As may be seen in Table 2, in the first full year (1957) there were 1963 persons in the study area—thus the observed value was close to the estimate of 2000. What had been grossly underestimated, however, was the rate at which the population was growing

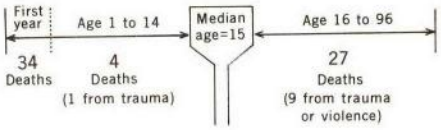

Fig. 2. Mortality in the Many Farms–Rough Rock community (by demographic pattern). Note that 52 percent of all deaths came from 3.7 percent of the population (that is, from infants in the first 12 months).

(Table 4). During the 5 years of the study, the population was actually observed to grow at a rate of 4 percent per year. Observations since the completion of the study have indicated that this extraordinarily high growth rate at Many Farms, and the demographic profile it produced (Fig. 1), were indeed representative of the Navajo population as a whole.

The pool of women in the childbearing period (ages 15 to 44) each year ranged from 363 to 429, and the total live births each year ranged from 92 to 105. The government estimate of the birth rate for the tribe as a whole was 36 for the year 1956 (the present U.S. rate is around 18). The birth rate at Many Farms was 48.4 in 1957 and averaged 45.8 for the 5 years. These sustained high fertility and birth rates resulted in a population with a median age of 15. In any one year, the infants represented only 3.7 percent of the total population, yet they accounted for more than one-half of the total number of deaths and much of the other near-fatal illness (Fig. 2).

Discussion

The 6-year period of this study coincided with a period of "tooling up" for the Public Health Service Indian program and for other tribal and governmental programs in Indian affairs. As a result, during the 8 or 9 years since that time, both Navajo health and certain other aspects of Navajo life, including the quality of life in the Many Farms–Rough Rock community (*19*) have undergone appreciable improvement. During the actual study period, however, there was virtually no change in the living conditions of the people in the Many Farms–Rough Rock community. In these static conditions, with no real change in either the home environment or the level of formal education, the wide application of biomedical science and technology through the clinical physician system resulted in:

1) A definite reduction in the transmission of tubercle bacilli.

2) A definite reduction in otitis media in the fifth year.

3) No reduction in the occurrence of active trachoma.

4) No reduction in the occurrence of the pneumonia-diarrhea complex, which remained the single greatest cause of illness and death.

5) The identification of those individuals who need hospital care (35 to 40 persons per 1000 each year)—that is, the establishment of a medical scan.

6) A possible slight reduction in crude mortality, despite an infant mortality that persisted at three times the national average.

This list of positive and negative accomplishments delineates the "technological substrate"—that is, the fitness of the system's technological component for meeting the disease situation as it actually existed in the community. Thus, an analysis of this list reveals the limits of contemporary biomedical capability in this particular set of circumstances. The first four entities all had a microbial component; two were influenced and two were not. The two that were favorably influenced (tuberculous infection, otitis media) were not in themselves contributors to the total mortality. For this reason, it seems likely that the apparent influence on crude death rate is largely attributable to the health care system's capability for making discriminating use of the hospital facilities. Expressed differently, it appears that items 5 and 6 (hospital referrals and crude death

Table 4. Births in the Many Farms–Rough Rock community.

	Year					5-year average
	1957	1958	1959	1960	1961	
Women (age 15–44)	363	378	390	417	429	395.4
Live births	95	100	94	105	92	97.2
Birth rate*	48.4	48.9	44.2	47.3	40.0	45.8

* Per 1000 population.

rate) bear a direct relationship to each other and are unrelated to the favorable events of items 1 and 2.

The first four conditions on the list have three features in common: they are all microbially linked; they are all especially prominent in various settings of poverty; and they are all either well controlled or actually absent from most of U.S. society. Presumably, therefore, the knowledge of how to control them on a wide scale exists. When this knowledge is analyzed in relation to Many Farms, however, it becomes clear that, depending on their specific biologic nature, diseases vary enormously in their susceptibility to medical management in slum conditions. For example, it has been convincingly demonstrated (*20*) that tubercle bacilli can be transmitted through the air and can remain suspended in the air of an unventilated room for at least an hour or so. At Many Farms, the windowless, one-room dwellings, made of logs chinked against the bitter cold, were ideal transmission chambers. Once tubercle bacilli are introduced to a community with such housing, a self-perpetuating system is set up. The transmission is so widespread that even the small percentage of infected people who ultimately develop the disease represent a large number in absolute terms; and the probability of an encounter between emitter and potential recipients is considerably increased.

The transmission of tubercle bacilli is, thus, greatly facilitated by certain specific characteristics of slum housing. The particular nature of this transmission process, however, is such that it can be easily interrupted without changes in the housing—namely, by exhaustive case-finding followed by self-administered drug therapy.

Before the primary health care system was introduced at Many Farms, the parents of a child with acute otitis understandably tended to try to "sweat it out" before embarking on the long trip necessary for obtaining care. Consequently, ruptured eardrums were commonplace. The advent of primary care would not be expected to alter the incidence of the initial (presumably viral) process, but it would be expected, through antimicrobial therapy, to reduce the incidence of the serious bacterial complication. Such a reduction occurred. Why it was not discernible before the fifth year of primary care is not clear. Possibly it resulted from the frequent practice of administering antimicrobial therapy for the undiagnosed febrile illnesses of children, thereby "curing" some cases of bacterial otitis before they had evolved sufficiently to be clinically recognizable. Such an effect could have been masked earlier by the fact that a substantial, but undefined, portion of the acute episodes were actually exacerbations of chronic otitis, rather than first attacks. With fewer new inputs, this backlog of chronic cases would gradually have grown smaller as the children grew older. The question merits further study because there is a real possibility that the otitis of children can be used as a key indicator of the availability of medical care (*21*).

Trachoma, like otitis and tuberculosis, is caused by a group of microbes that are suspectible to antimicrobial drugs. The beginning of the pathogenic chain could be considered as the multiplication of the trachoma agents in the lesion, which is located in and around the eyes. Theoretically, this pathogenic chain could be severed, as was done with tubercle bacilli, by suppressing the microbe in the lesion with drugs, thus preventing it from being discharged into the environment. Indeed, this was the procedure at Many Farms; but, unlike the situation with tubercle bacilli, the treatment of the active cases of trachoma had little impact on the problem. The reason the chemotherapeutic approach is inadequate is that the transmission of the agents appears to take place by way of the contaminated fingers of those afflicted—usually quite small children. Thus, before the ocular process is brought under final control, the children's fingers are continually contaminated. To decontaminate their fingers (and the communal towels and vessels) would have necessitated a permanent change in such household habits at Many Farms as hand and face washing, the use of soap, individual towels, and precautions in their handling. Experience gained after this study has indicated some promise for the chemotherapeutic approach, but only if it is carried out on everyone in the community simultaneously (*22*).

As in the case of trachoma, there was no reduction in the occurrence of the pneumonia-diarrhea complex, which remained as the single greatest cause of illness and death throughout the 5-year period. The grouping of the pneumonias and diarrheas of early life into a single complex has no biologic justification. Nevertheless, the practice is useful, not only because the two entities frequently occur together, with the pneumonia triggering the diarrhea, but because in every aspect, from genesis to therapy, the nature of the problems presented by these two conditions is essentially the same. The critical feature of the complex is that the syndrome is endemic in the unsanitary home environment; thus recovery from one episode does not mean that another may not occur. It is not always realized that this complex is far and away the single greatest cause of death in economically underdeveloped societies.

The diarrhea, well named "weanling diarrhea" by Gordon and his associates (*23*), has a nutritional component, the precise role of which is unclear. It is definite, however, that, while antimicrobial therapy may be helpful in some instances, it does not predictably and decisively alter the disease. Likewise, acute disease of the respiratory tract (including what has to be rather loosely termed "pneumonia") in this primarily infant age group is caused, in well over 90 percent of the cases, by agents other than the pathogenic bacteria known to be susceptible to the antimicrobial drugs (*24*). Thus, this major portion of the total technological substrate, or potential target of the biomedical technology available for delivery at Many Farms, was largely beyond the capability of that technology to influence in a decisive way.

The sequence of events that make the home environment so hazardous to the infant has been discussed elsewhere (*25*). The remarkable self-correcting mechanisms that maintain physiologic stability at other ages are just in the process of being developed in early infancy, and in primitive home conditions the microbial challenge is virtually constant. In contrast, given the sanitary barriers provided by modern housing managed by educated parents, it is possible both to spread out many of these microbial challenges throughout childhood and adolescence and to artificially substitute warmth special feeding, and fluid and electrolytes for the imperfect homeostasis when the infant is ill. Measures such as these form an essential part of the deliverable technology of modern pediatrics. This technology is hardly deliverable in a house without central heating or insulation against freezing temperatures, with no running water or even a nearby well, and with several other

quite young children requiring the attention of a mother who had only a few grades of primary school education a decade or so ago.

The unique character of the relationship between the infant and its home environment may be seen from the observation at Many Farms that preschool children living in the same homes might fall ill, but fatal illness was extremely rare. In societies with a lower level of health, this phenomenon is less readily perceived because of the continued operation of factors (notably an inadequate supply of protein) that keep both the infant and the preschool child at risk of fatal illness. For example, in Peru in 1968, it was reported that 50 of every 100 deaths occurred in children under age 5, but that only 30 of these 50 deaths occurred during the first year of life (*26*). This contrast between the infant and the 2- or 3-year-old child living in the same sanitarily unprotected home environment merely underlines a highly significant fact: the effectiveness of contemporary medical technologies is far more dependent on the socioeconomic circumstances of the recipient in the case of the infant than it is in the case of older children.

Thus, the delivery of this carefully organized and well-received primary health care system to the Many Farms–Rough Rock community had relatively little influence on disease there. When both the diseases and the demographic profile of Many Farms are examined together, the reason that the accomplishments were only modest becomes evident: it was the nature of the substrate (the particular diseases present in the living and the ages of those afflicted). The high fertility ensured that infants would comprise the major portion of the people that were sick at any one time, and modern medical technology has relatively little to offer infants who are located in an unprotected home environment. It should not be inferred that no attempts were made to change household practices. On the contrary, a variety of programs were conducted for that purpose, and considerable effort was expended in the instruction of mothers in the home. The influence of such programs was sharply limited, however, in the absence of any significant change in the physical environment of the home. The two conditions that did not require changes in household practices for their control—otitis media and the transfer of tubercle bacilli—were significantly influenced, whereas the two that did require such changes were not.

In using the concept of the substrate, emphasis is placed on "disease in the living," because causes of death are imperfect indicators of where medical effort must be expended on a day-to-day basis. The substrate determines the limits of biomedical technology in a community; it also determines how the physician must allocate his time. When a health care system is based on a geographically defined community, it is locked into a situation in which there is no "give" in the matching of technological capability to substrate. Not only was the physician's technology for infants severely compromised at Many Farms, but his technology for the adult population was also limited—because of the population's proportionately smaller size, its relative youth, and certain attributes of rural living (*4*). With the demographic mix of Many Farms, any enlargement of medical coverage to bring in more adults would also have brought in more children in the same high ratio, and there were already enough young children to occupy the major portion of a physician's effort. The mismatches of technology to substrate that occur when a physician's services are allocated on a geographical basis can be managed when a group of physicians with different skills are available. In a rural, economically underdeveloped society, however, such options are not available, and the mismatch causes a waste of precious assets.

Two questions arise: (i) If the technology was of such relatively limited effectiveness at Many Farms, why wasn't the infant mortality much higher, for example, 150 or more?, and (ii) why was the mortality among preschool children concentrated within the first year of life rather than within the first 4 years, as it is in so many other economically underdeveloped areas of the world? The available information simply does not permit of definite answers to these two questions. Nevertheless, it is fairly certain (despite the poor quality of the vital statistics) that in the two decades prior to the study, decades in which there were no significant field health services, the overall Navajo infant mortality had been steadily falling from around 150 to around 85 per 100 live births (*17*). The principal identifiable change in that period is the improved services in the six hospitals that are distributed over the 23,000-square-mile area. In addition, an effective technology, available only in the hospital environment, did exist for important segments of the infant disease pattern. Thus, some potentially effective medical care existed; although it was relatively accessible to some people, it was as far away as 100 miles from others. In much the same way, the low mortality at Many Farms in the second and third years may, to some extent, have been an otherwise unmeasurable result of the primary health service that was innovated there, especially because that service could get the patients into slightly better condition before they were transported to the hospitals (*16*). A generally low mortality in the preschool group was present before the start of the primary health service, however. It is believed that most health professionals with field experience would attribute that low mortality primarily to the fact that the food supply of the community, including the supply of animal protein, appeared to be adequate.

Indeed, a whole combination of circumstances, fortuitous in part, created a situation at Many Farms such that many key health factors could be isolated almost as so many experimental variables, thus permitting inferences concerning the other factors. To a considerable degree, therefore, the situation at Many Farms, in terms of health development planning, was analogous to an "experiment of Nature."

The constant was the presence of unschooled families, with a crude birth rate of 45.8, crowded together in unsanitary premises and grouped in small foci that were scattered over a vast, semiarid land. The observed results could be regarded as characterizing the disease problems that would remain in a rural economically underdeveloped community with unimproved housing *after* there had been introduced (i) an adequate supply of food, including high-quality protein; (ii) control of all protozoan and helminthic diseases such as malaria or hookworm; (iii) a protected water supply at some distance from the home; (iv) effective prevention of cigarette smoking and chemical contamination of the air; (v) community hospital facilities 55 and 90 miles away; and (vi) a system of primary medical care, with a clinical physician, nurses, and indigenous health care workers in residence.

The observed result of "what re-

mained" was an extraordinarily youthful community (median age 15), increasing at an annual rate of 4 percent, with a health status characterized by (i) an infant mortality three times the U.S. average, with the infant deaths representing one-half of all deaths and with other childhood deaths extremely rare; (ii) most noninfant deaths postponed until middle or old age; and (iii) the hemorrhagic complications of pregnancy and the results of trauma representing the principal health problems up to age 45. Once past the first birthday, the individual's prospects for continued health were quite good.

On an ascending scale from the primitive to the modern, the Many Farms pattern of community health is at a relatively high stage. In attaining this stage, the institution of a clinical physician system of primary health care in the community played some role, but clearly not a major one. An analysis of each of the measurable accomplishments of the innovation reveals that these accomplishments could also have been made through a system that did not have a physician to render individual medical care. Such positive achievements as blocking the transmission of tubercle bacilli, reducing otitis media, or starting antishock measures for hemorrhaging patients on the way to the hospital represented activities that did not actually require the presence of a physician. To be sure, the establishment of a medical scan for the community (identifying those individuals who need hospitalization) was presumably more discriminating when conducted by the physician, but the great bulk of patients referred to hospitals were in such obviously acute conditions that they would inevitably have been brought to the hospital, either through nurse referral or patient or family action.

Thus, for Many Farms, a clinical physician system of primary health care was a poor choice, in terms of potential achievement through technology. Some form of the nonclinical or community medicine system, in which the physician did not care for individual patients, would have been more rational. Such a course would be a realistic option for development planners in areas of the world where there are very few physicians and where the economic-ecological situation is such that the attainment of the Many Farms community health pattern would be a tremendous achievement. It must be recognized that, at the Many Farms stage, the community's health would not impede its socioeconomic development; for example, programs to limit family size could be introduced with a reasonable prospect of continued success. However, to attempt to employ a health care system without a clinical physician in a society such as ours, in which physicians are numerous, although not plentiful, would be quite another matter.

It should be emphasized that everyone who participated in the choice of the system introduced at Many Farms was knowledgeable about Navajo health, as seen in the hospitals, and had a store of "conventional wisdom" about it, virtually all of which turned out to be true. All of them were fully confident that the system selected would have a major beneficial impact on the health status of the people. What was not perceived in advance was (i) the extent to which the serious, technologically vulnerable conditions were already being treated in the hospitals outside the community, and (ii) just how much the demographic-disease pattern was skewed toward the diseases of infancy, which are dependent on conditions in the home. In short, the "conventional wisdom" lacked the quantitation essential for such a choice.

Although this article is concerned with technological performance, it should be noted that, in terms of individual and community expectations, the Many Farms experiment was a clear-cut success. The system was set up with full community participation, and there was a mechanism for effective, continued community control. Members of the community repeatedly expressed their satisfaction with the care they received, and the community was left with an operating system. Moreover, it can be safely predicted that, faced with a similar choice today, the community would opt for what was actually introduced there, rather than for a system with a much better technological "fit," if the latter meant no physician in continued residence. And this, the other side of the coin, is wholly understandable.

Popular expectations and misunderstandings of what an individual physician can do operate as a formidable constraint on the rational use of biomedical technology. Indeed, because of the nature of medicine, as a practical matter its technology has to be deployed irrationally. This is largely the consequence of our tradition of having both essentials of medical care—the technology and the human support—administered by the same person, the physician. As a result, the limits on the number of people to whom the physician can offer human support by way of personalized care also largely determine the people to whom he can deliver the technology. Yet important elements of that technology might be more widely useful if applied in some other way.

Thus one of the two essential parts of medicine can act as a significant constraint on the other. This is forming an issue with large implications; clearly, a systematic analysis of both essentials and of who would make their most effective ministers is in order. Yet who can measure the value obtained by those Many Farms parents who could see obviously expert professionals hovering over their child, desperately ill with pneumonia caused by respiratory syncytial virus? They see someone making a fight. To point out that, in the particular circumstances, the penicillin the child is receiving happens to be valueless, in a technological sense, would seem a petty, if not callous, irrelevancy.

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April 23, 1981

Dear Dr. Spencer,

It is a great honor to have the privilege of giving the Shattuck lecture on the occasion of the occasion of the 200th Anniversary of the Massachusetts Medical Society.

I shall provide the information which you have requested in your letter when I have more information on the content and illustrations for my presentation.

Since the lecture will be presented at a luncheon meeting,will it be possible to show slides? I am not familiar with the layout of the grand ballroom of the Sheraton hotel.

Yours sincerely,

John R. Evans
Director
Population, Health and Nutrition Department

Dr. Everett R. Spencer, Jr.
Executive Secretary
The Massachusetts Medical
Society
22 The Fenway
Boston, Mass. 02215

Mr. Jeremy J. Warford, PHN April 23, 1981

John R. Evans, PHN

Shattuck Lecture

Apparently Dr. Relman was in error when he told us that the Shattuck Lecture would coincide with World Health Day sponsored by the World Affairs Council of Boston in conjunction with the Massachusetts Medical Society. Apparently, October 31, 1981 is World Hunger Day.

This does not change the basic purpose of our presentation. It does suggest, however, that anything that we can bring in about nutrition to illustrate the magnitude of that problem and its impact on health would be very valuable. Alan Berg and Dave de Ferranti might have some useful suggestions.

1781 ~ 1981
Two Hundredth Anniversary

THE MASSACHUSETTS
MEDICAL SOCIETY

22 The Fenway, Boston, Massachusetts 02215
(617) 536-8812 WATS (Mass. only) 1-800-952-7418

Executive Offices

April 2, 1981

RHF we ought to reply see p2.

John R. Evans, M.D.
Director, Population, Health
and Nutrition Department
The World Bank
1818 H Street, N.D.
Room N-437
Washington, D.C. 20433

Dear Dr. Evans:

We of the Massachusetts Medical Society are delighted that you have accepted the invitation to present the 1981 Shattuck Lecture in Boston on October 31, 1981, as per Dr. Relman's letter to you on February 17.

This letter is to reconfirm the date and to provide you with pertinent background data.

The lecture will be presented in the Grand Ballroom of the Sheraton - Boston at a luncheon meeting, made up primarily of professional persons. We anticipate that a large number of lay persons will attend as well.

The occasion is a feature of the Society's 200th Anniversary. On November 1, 1781, John Hancock, Governor, signed the legislation granting a charter to the Massachusetts Medical Society. It is the oldest state medical society with a continuous existence. The Medical Society of New Jersey was organized in 1776, but meetings were suspended until 1781, and from 1795 to 1807.

The first Shattuck Lecture was presented in 1890. The Shattuck Fund, however, was established in 1854 when George C. Shattuck, M.D. left $10,000 to the Society, the net income of which was to be applied to the publication of essays on such subjects as the Society might select. In 1888, the Society's Committee on Publications was authorized to provide for a Shattuck Lecture.

The enclosed list of Shattuck Lecturers and Their Subjects is self-explanatory. If my counting is correct, you will be the 90th Shattuck Lecturer. (There was no lecture in 1945.)

Would you please send me the following information:

1. Full name and degrees and titles with which you wish to be identified in the program. M.D,

2. A curriculum vitae. "as on list."

3. The title of your presentation. (The subject being covered by the Society -- in cooperation with the World Affairs Council of Boston -- on that day (October 31, 1981) is World Hunger.)

4. Visuals aids you will require. 35 mm slides

5. Whether or not you wish a hotel reservation, and, if so, the type of room, arrival and departure times and dates. night before

6. A glossy photograph.

Mrs. Evans is, of course, invited to the luncheon. Please let me know if she will accompany you. And you are invited to the dinner that evening. We anticipate a leader of state will address the group.

With my best wishes.

Sincerely yours,

Everett R. Spencer, Jr.
Executive Secretary

ERS:fb

CC: Arnold Relman, M.D.

Shattuck Lecturers and Their Subjects

1890. George Brune Shattuck, Boston. Influenza in Massachusetts.
1891. Edward Cowles, Somerville. Neurasthenia and Its Mental Symptoms.
1892. James F. A. Adams, Pittsfield. The Prevention of Disease in Massachusetts.
1893. William Osler, Baltimore. Tuberculosis Pleurisy.
1894. Thomas Dwight, Nahant. The Range and Significance of Variation in the Human Skeleton.
1895. Robert T. Edes, Jamaica Plain. The New England Invalid.
1896. William W. Keen, Philadelphia. Gangrene as a Complication and Sequel of the Continued Fevers, Especially of Typhoid.
1897. David W. Cheever, Boston. The New Surgery.
1898. Sir William Hales Hingston, Montreal. The Influence of the North American Climate on the People.
1899. James Jackson Putnam, Boston. Not the Disease only, but also the Man.
1900. William Henry Welch, Baltimore. Morbid Conditions Caused by *Bacillus aerogenes capsulatus.*
1901. William Fiske Whitney, Boston. The Alleged Increase of Cancer in Massachusetts.
1902. Frank Billings, Chicago. The Changes in the Spinal Cord and Medulla in Pernicious Anaemia.
1903. Theobald Smith, Boston. The Sources, Favoring Conditions and Prophylaxis of Malaria in Temperate Climates, with Special Reference to Massachusetts.
1904. George Summer Huntington, New York. The Relation of Comparative Anatomy to Medical Education and Practice.
1905. Russell H. Chittenden, New Haven. Some Problems of Intermediary Metabolism.
1906. Victor C. Vaughan, Ann Arbor. A Contribution to the Chemistry of the Bacterial Cell and a Study of the Effects of Some of the Split Products on Animals.
1907. Frederick Cheever Shattuck, Boston. The Past, Present and Future of Tuberculosis.
1908. Frederick Forchheimer, Cincinnati. Some Aspects of Gonorrhea.
1909. Edward W. Taylor, Boston. The Widening Sphere of Medicine.
1910. Frederic Gerrish, Portland, Me. A Crusade against Syphilis and Gonorrhea.
1911. Richard C. Cabot, Boston. Observations Regarding the Relative Frequency of the Different Diseases Prevalent in Boston and Its Vicinity.
1912. David Linn Edsall, Philadelphia. The Clinical Study of Respiration.
1913. Harvey Cushing, Boston. Diabetes Insipidus and the Polyurias of Hypophysial Origin.
1914. Herbert C. Moffitt, San Francisco. The Functions of the Spleen, with Particular Reference to Hemolysis and the Hemolytic Anemias.
1915. Joel E. Goldthwait, Boston. An Anatomic and Mechanistic Conception of Disease.
1916. Theodore C. Janeway, Baltimore. The Etiology of the Diseases of the Circulatory System.
1917. Walter Bradford Cannon, Boston. The Physiological Factors Concerned in Surgical Shock.
1918. Ernest E. Southard, Boston. Shell Shock and After.
1919. Francis G. Benedict, Boston. Energy Requirements of Children from Birth to Puberty.
1920. Allan J. McLaughlin, Washington. Influenza.
1921. Haven Emerson, New York. The Prevention of Heart Disease.
1922. Elliot P. Joslin, Boston. The Treatment of Diabetes Mellitus.
1923. Dean Lewis, Chicago. Some Peripheral Nerve Problems.
1924. C. MacFie Campbell, Boston. Psychiatry and the Practice of Medicine.
1925. Hans Zinsser, Boston. The Study of Immunity in Its Relation to the Problems of Practical Medicine.
1926. William Darrach, New York. The Interrelations of the Physicians and the Hospital.
1927. Philemon E. Truesdale, Fall River. Group Practice.
1928. Walter B. Cannon, Cambridge. The Mechanism of Emotional Disturbance of Bodily Function.
1929. William H. Robey, Boston. Public Instruction in Medicine.
1930. W. Irving Clark, Worcester. Industrial Medicine and Public Health.
1931. Alexander Primrose, Toronto. The Evolution of Modern Surgery.
1932. Frank B. Mallory, Boston. Cirrhosis of the Liver.
1933. Elliot Carr Cutler, Boston. The Origins of Thoracic Surgery.
1934. Warfield T. Longscope, Baltimore. The Importance of Disturbances in Nutrition in Edematous States.
1935. William E. Gallie, Toronto. Sprains and Dislocations.

1936. George Blumer, New Haven. Trichinosis, with Special Reference to Changed Conceptions of the Pathology and Their Bearing on the Symptomatology.
1937. Henry D. Chadwick, Boston. The Diseases of the Inhabitants of the Commonwealth.
1938. David Riesman, Philadelphia. American Contributions to Nosography.
1939. Wilder Penfield, Montreal. The Epilepsies with a Note on Radical Therapy.
1940. Ernest W. Goodpasture, Nashville. Immunity to Virus Diseases: Some Theoretical and Practical Considerations.
1941. E. W. Alton Ochsner, New Orleans. Thrombosis and Thrombophlebitis.
1942. John F. Fulton, New Haven. Medicine and Air Supremacy.
1943. George W. Thorn, Boston. Physiologic Considerations in the Treatment of Nephritis.
1944. Alfred Blalock, Baltimore. A Consideration of Recent Advances in Surgery.
1945. No Meeting.
1946. John B. Youmans, Nashville. Nutrition and the War.
1947. William Dock, Brooklyn. Clinical Significance of Circulatory Peculiarities of Some of the Vital Organs.
1948. C. Stuart Welch, Boston. Surgery in the Aged.
1949. Paul D. White, Boston. La Medicine du Coeur.
1950. Merril C. Sosman, Boston. The Specificity and Reliability of Roentgen Diagnosis.
1951. Sir Charles R. Harington, London. The Role of the Basic Sciences in Medical Research.
1952. Derek E. Denny-Brown, Boston. The Changing Pattern of Neurological Medicine.
1953. Sir Alexander Fleming, London. Twentieth Century Changes in the Treatment of Septic Infections.
1954. James M. Faulkner, Boston. Medical Education and the Physician.
1955. Charles G. Childs, III, Boston. The Portal Circulation.
1956. Chester M. Jones, Boston. Changing Concepts and Practices in the Approach to Diseases of the Digestive Tract.
1957. Leland S. McKittrick, Brookline. The Patient.
1958. William Barry Wood, Jr., Baltimore. The Role of Endogenous Pyrogen in the Genesis of Fever.
1959. Robert E. Gross, Boston. Open Heart Surgery.
1960. Maxwell Finland, Boston. Treatment of Pneumonia and Other Serious Infections.
1961. John C. Whitehorn, Baltimore. The Doctor's Image of Man.
1962. Shields Warren, Boston. You, Your Patients and Radioactive Fallout.
1963. J. Englebert Dunphy, Oregon. The Fibroblast: A Ubiquitous Ally for the Surgeon.
1964. Joseph Garland, Boston. The Proper Study of Mankind.
1965. H. Rocke Robertson, Montreal. An Interest in Surgery.
1966. Robert Higgins Ebert, Boston. The Government and the Private Sector.
1967. John S. Millis, Cleveland. Graduate Education of Physicians.
1968. Robert Q. Marston, Washington. To Meet the Nation's Health Needs.
1969. John R. Ellis, London. Students and Medicine.
1970. C. Rollins Hanlon, Chicago. The Physician and Organized Medicine.
1971. George Himler, New York. The Anatomy of Our Melancholy.
1972. William G. Anlyan, Durham. Will Partisan Politics Determine the Nature and Quality of Health Care?
1973. Daniel E. Rogers, Princeton. A Foundation's View on Health in America.
1974. Elliot L. Richardson, Washington. The Older Order Changeth Yielding Place to the New — Perspectives on the Health Revolution.
1975. Nevin S. Scrimshaw, Boston. Strengths and Weaknesses of the Committee Approach.
1976. William R. Roy, Topeka. An Agenda for Physicians and Legislators.
1977. Franz J. Ingelfinger, Boston. The General Medical Journal: For Readers or Repositories?
1978. Alain C. Enthoven, Palo Alto. Cutting Costs without Cutting the Quality of Care.
1979. Theodore Cooper, Ithaca. In the Public Interest.
1980. Daniel Callahan, Hastings-on-Hudson, N.Y. Contemporary Biomedical Ethics: Theory and Reality.

- Plague - Pepys Diary

Issues - Privilege to give Shattuck lecture upon 200 Anniv of Mass GS
- Grateful - at a time when America is increasingly inward looking in its policies, your society has chosen to look at the best of others. Its good medicine.

1. Economics diff in health standards (USC. + nutrition | 2
and contraception.
- eg. health & nutrition
-

2. Key differences costs
- money
- personnel. : 1:4.
- equipment - needs to be v. good because poor
- admin. ability/appropriate capability — personnel + resources
- dependence on ext. — can't push.

TIME: Evolution over century

3. What can we do to

What not to do.
- high tech
- R&D model — can't afford
- urban concn Shattuck = Public Health
- create dependence

What can we do — Research - Trend
R+D - Trop. Path
- Stage 2 Epid Tech

4. Trend in development
Recent & economic crisis — export promotion
balance of payment
Object of development is — improved standards
other: oil & gas
econ. productivity of pop.

well-being people not balance sheet figures.
Economic prosperity is critical enabling factor for progress
But human resources dev. is. Key element in that
Education, health.
Pop. growth is dimension — closely linked to survival
Eg. Chances of family exposed to health.
Health & Educ. are basic needs of all people - not just affluent or urban.
Optimistic -

1980 speech/lit

DRAFT
JJWarford:veo
March 13, 1981

GLOBAL ECONOMIC PROBLEMS AND THIRD WORLD HEALTH

1. Background

Increased energy costs; inflation and its counter-measures in industrialized countries, leading to decline in export markets for non-oil exporting LDCs; tightening of aid and credit; redirection of such aid toward investments with short-term payoff periods, and parallel constraints to growth in domestic allocation of funds to health sector; problem compounded by rapid population growth; challenge is to maintain even the modest gains made in recent years. (Some comparative statistics on mortality and morbidity and distributional inequities to illustrate.) Preventive versus curative; urban versus rural. Need to be increasingly rigorous in maximizing the net benefits of expenditures in the health sector despite large unknowns, conceptual and empirical data problems. Competition for funds, need to employ appraisal methods used in other sectors.

2. Framework for Investment Decisions

- Sector approach; identify health status; priority problems and causes. Data problems.
- Assess existing targets for improvement in health status, or set such targets.
- Basic needs/productivity aspects.
- Identify cost-effective means of attaining targets, including activities in other than health agencies; e. g. population, water supply, nutrition, housing. Role of appropriate technology, self-help schemes and community participation (i. e. shadow pricing). Conceptual and empirical problems, e. g. physical linkages, behavioral

issues, joint cost allocation.

- Local manufacture/formulation of drugs.
- Assessment of justification of cost-effective solution (e. g. with help of unit cost estimates or possibly some cost-benefit analysis). Role of community participation in maximizing impact and identifying benefits.

3. Mobilization of Resources

Derivation of theoretically desirable solutions insufficient if financial and human resources cannot be mobilized to achieve them. Probably no increase in real terms in Ministry of Health budgets so cost recovery or shifting financial burden from the public to the private sector needed; particularly important in LDCs in which due to low-tax base, and inadequate administrative structure public revenues are at a premium.

- Cost recovery policies, e. g. contribution toward certain health services, pharmaceuticals, water supply, sanitation; may also feed back investment decision.
- Minimization of financial/economic costs by utilizing local labor, community health workers, community participation.
- Exploit private sector resources; role of households in self-help; private company schemes; insurance, social security contributions.

Work to be done includes

- analysis/reform of Ministry of Health and appropriate government organization accounting systems; this is required as indication of how much actually spent

in public sector. Also analysis of private sector expenditure. This may be used inter alia to determine willingness to pay, affordability, and cost-effectiveness of alternative solutions.

- analysis of incentive schemes - note appropriate technology or labor-intensive methods need to be associated with incentive system.

4. Strategy

Politically unpopular decisions/uncertainty in outcomes should not be excuse for lack of systematic, analytical approach. Short-term things that can be done - long-term goals, main research areas.

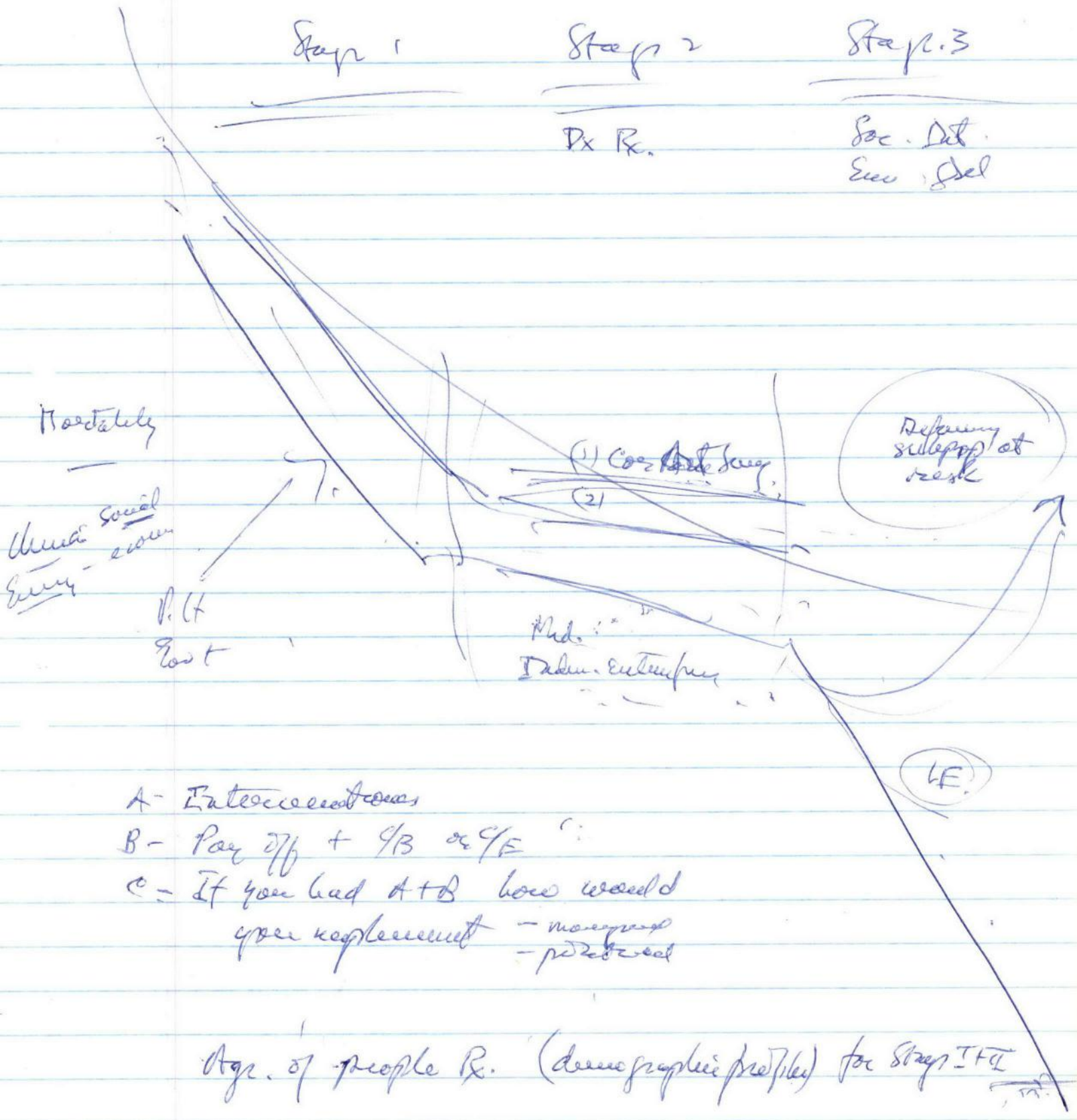
Kilgore | 1. Check dates of ~~recess~~ Belt for SRS.
2. Countries for Bank work.
3. Agenda for North visit

Shattuck Lecture

The importance of (1) institutional development in health / plan analysis - evaluation
~~(2)~~ (2) managerial capability (incl. MIS + evaluation)
(3) Community participation to S/SCT
recognition: cf. decentralization, markets
(3) Financing Systems
(4) Drug systems

Link the political and the technical.
- the ~~planning~~ health/social with the economic
- the ~~eco~~-pro/economic with the epidemiological

Simplicity theme
- HC beneficiary complex - full of difficult social + political + managerial challenges
- Major challenge is simplify + get the first steps clear. Distill out the central actions in proper sequence
(Could use Dr. Schaffer paper for AID (APHA) to illustrate and to simplify.)



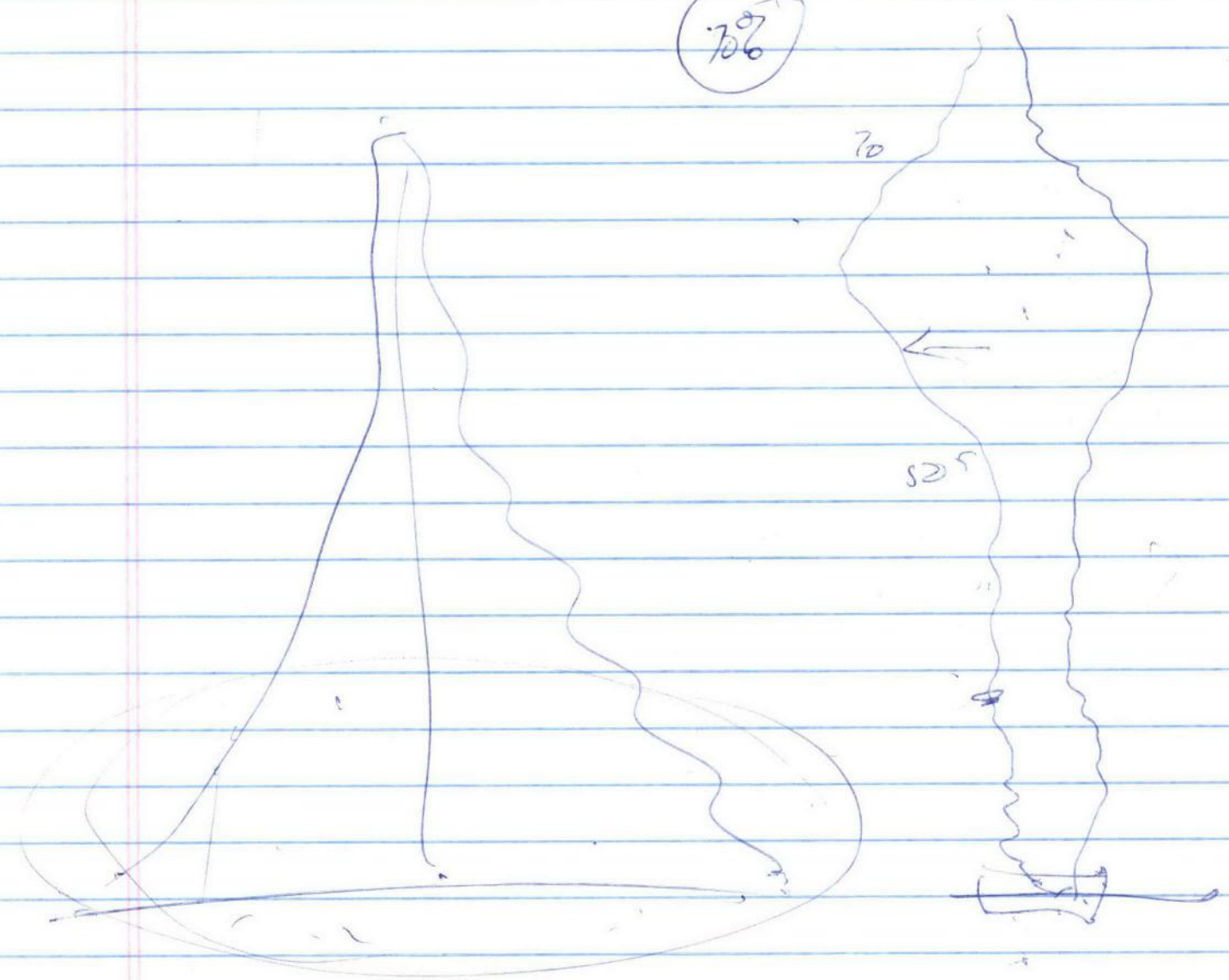
A- Interventions

B- Pay off + %B or %E

C- If you had A+B how would
your replacement - managed
- protected

Age. of people Rx. (demographic profiles) for Steps I + II

in the last group 7 kgs



Scalepoop at work.

BBP

INTRO

Understand LDC-subnations { — Similarities, guidelines for
— Differences in distribution of I & II

Examples of LDC. + H.I.C.

			USA
% of Pop	Strata I	85	12%
	II	15	88%
	? III		

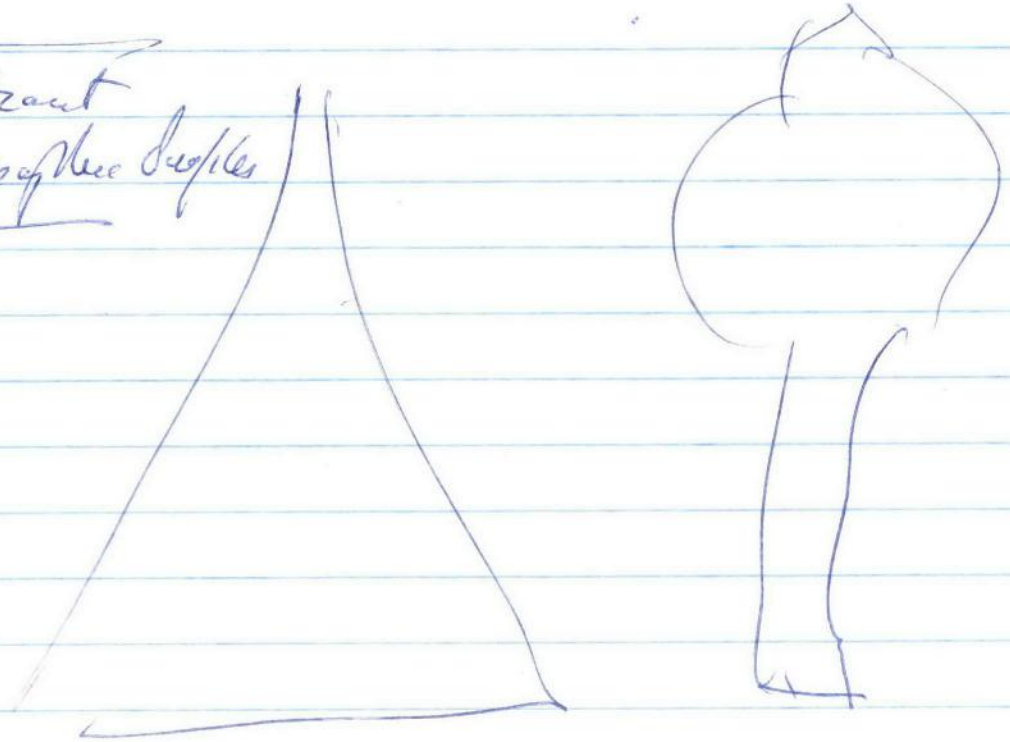
Expenditures on Health

Private

Public I 5–20% } 60 } 10 } 1000
II 80 } 40 } 90

Benefits Examples of exp. on Type I + II in LDC + HIC, by Examples of interventions.

Contrast Demographic Profiles



Conclusions:

What do we know?

What do we need to know?

What do we need to do?

- in LDC's
- Role of HEC partnerships
- Sector Reform
- Int Body / Govt. - Local capability
- Management capability

Health as a Public Sector Activity

① LSE – 100% public - hist

↓

Higher Income: Private Sch.

FORM NO. 75
(9–78)

THE WORLD BANK

ROUTING SLIP	DATE:

NAME	ROOM NO.
John EVANS	N-437
file Shattuck	

	APPROPRIATE DISPOSITION		NOTE AND RETURN
	APPROVAL		NOTE AND SEND ON
	CLEARANCE		PER OUR CONVERSATION
	COMMENT		PER YOUR REQUEST
	FOR ACTION		PREPARE REPLY
X	INFORMATION		RECOMMENDATION
	INITIAL		SIGNATURE
	NOTE AND FILE		**URGENT**

REMARKS:

FROM:	ROOM NO.:	EXTENSION:
N. de Weerdt		

Epidemiology and Community Health, 1979, **33**, 66-73

Prevention of disease in the tropics: questions in health economics

DAVID J. BRADLEY
From the London School of Hygiene and Tropical Medicine

No major problem in the health economics of developing countries has been adequately solved; the vast majority of issues have not even been approached. In this paper, therefore, questions are raised and an agenda provided for research; there is no review of the subject. Many existing economic studies are so slight that detailed review would be unhelpful, and my expertise is not in economics.

The main focus of community health in developing countries is now on an exciting and rapidly—some would say too rapidly—changing field. The first part of this paper is a review of what have been considered the key issues and of the types of economic questions raised by the key issue at each stage. The second part is an attempt to consolidate these issues in a systematic manner. This may appear too general a framework, but it has one specific advantage: the economic data base is defective to an extreme degree in most developing countries, and the more dramatic pieces of bad health economics have resulted from a narrow view of the subject in which precise conclusions have been drawn from imaginary data considered in isolation from broader social, cultural, and institutional issues. No doubt such problems also apply to other countries, but in the tropics, where subsistence agriculture is a major occupation and apparent underemployment is frequent, they loom exceptionally large.

THE SCALE OF THE HEALTH PROBLEM

To compare medical problems in developed and developing countries is not easy, because a main feature of underdevelopment is the absence of statistical data. However, some countries do at least have information on deaths in relation to age and the resulting picture is shown in Fig. 1. If we compare survival of 100 babies born in a rich western European country with that of a similar group born in an impoverished African nation, the difference is striking. If deaths show this variation, morbidity and sheer misery are likely to be equally extreme, as well as disability and effects on productivity. A closer comparison of age-specific mortality ratios in the 1960s between Sri Lanka and Sweden underlines the discrepancy and the particularly large differences in the first few years of life (Fig. 2).

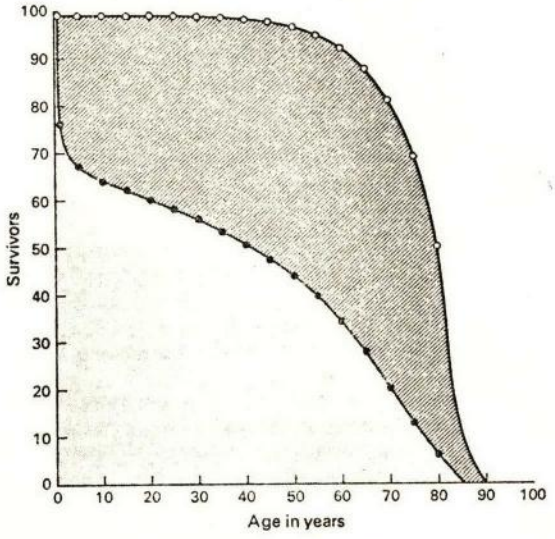


Fig. 1 *Survivorship curves for 100 live-born babies in a prosperous industrial country (open circles) and a poor developing country (solid circles).*

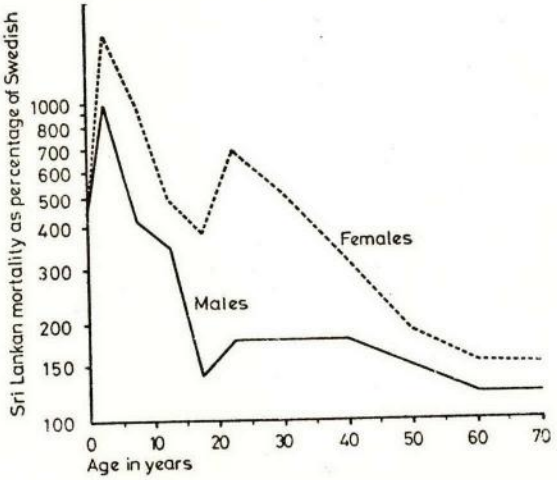


Fig. 2 *The ratio of age-specific mortality in Sri Lanka to that of Sweden.* (Myrdal, 1968).

If the area between the two survival curves in Fig. 1 represents the tropical health problem, what are its causes? Two predominate: infectious disease and malnutrition. The bulk of tropical problems fall within these two broad categories, though the measures for their control and prevention are varied.

NATURE OF THE HEALTH PROBLEMS

The countries referred to in this paper are variously known as 'tropical' or 'developing'. Neither term is strictly correct, but each points to one major aspect of the health problems involved. Tropical countries, because of the high ambient temperature, can support many disease agents with a life cycle that involves an obligatory stage or stages of development outside the the human body, either in the physical environment or in the bodies of invertebrate animals. This external development is usually called the 'extrinsic cycle'. For it to occur, warmth is required to keep the invertebrate host from dying, or for development within a reasonable period in the soil. Such diseases include malaria (which kills up to 10% or more of all babies born in West Africa), other protozoal infections such as sleeping sickness and kala-azar, yellow fever, and the chronic warm climate infections such as schistosomiasis, hookworm, and filariasis. So there are numerous acute and chronic major infectious diseases specific to warm climates.

The diseases of poverty constitute the other great group of health problems in developing countries. A list of the predominant diseases in an English town during the industrial revolution would closely resemble those seen in a tropical outpatient department today. With the exception of malaria, the predominant tropical infections would be severely reduced by raising living standards in a balanced manner. Gastroenteritis, typhoid, cholera, many intestinal worms, infective skin disease, inflammatory eye disease, and dysentery, can all be controlled by improvements in water supply and sanitary excreta disposal rather than by medical action. Similarly, malnutrition can be prevented by food, education, and an adequate income far more effectively than it can be treated, no matter how good the health care facilities.

It has been usual to group together the Third World countries as 'tropical' or 'developing', and certainly the majority of developing countries—or 'less developed countries' as Myrdal (1968) would correctly insist on calling them—are in warm climates. But the position is rapidly approaching where differences between them are more apparent than similarities. The oil-rich Arab countries are clearly a special case, but between the poorest African states and India, or either of these and southern America, there are profound differences.

THE DEVELOPMENT OF COMMUNITY HEALTH ISSUES

Changing issues in tropical health

Extensive traditional health care systems have existed in tropical countries for many centuries; these will be referred to below. The early colonial era is a more relevant starting point for the purposes of this paper. Initially, the function of the few medical officers provided was to care for the health of expatriates: traders, the military, and administrators. Aims were clear, the medicine was largely curative, often unsuccessfully so, and the continuous complaint of inadequate funds was the chief economic issue.

The end of the nineteenth century was characterised by the establishment of the germ theory of disease and by a series of massive outbreaks of epidemic disease among the indigenous colonial populations on a scale too great for administrations to ignore. Sleeping sickness killed a third of the people of Uganda, kala-azar killed hundreds of thousands in India, plague and cholera led to devastating epidemics, and famine was a recurrent emergency. Research was both a necessity and, often, a cheap substitute for medical action. Funds were made available on a small scale and interest focused on minimising the budget rather than on formal health economics. As administrations consolidated, the medical officer allocated to each district (of perhaps half a million people) extended his concern from expatriates to the local population, and exiguous curative services at the district hospital were augmented by rural dispensaries and basic public health measures of water supply and sanitation for the headquarters settlement.

The first steps leading to current issues in health economics arose from the successful development of drug treatment for a few of the major tropical disorders, particularly yaws and sleeping sickness in western Africa. Injections of bismuth and then the dramatically effective penicillin for yaws led to the development of itinerant teams of health workers who would travel through endemic areas without any organised health services, examining each village population and giving a single penicillin injection to each person with clinical signs of yaws. Devastating sleeping sickness epidemics were wiping out whole villages in northern Ghana and Nigeria, and these were tackled similarly, though the task was more sophisticated. Here it was necessary to examine people clinically, to puncture enlarged lymph glands, to carry out smears to look for trypanosomes, and to put a needle into the spinal canal to look for

trypanosomes in the cerebrospinal fluid. This procedure requires a rigorous sterile technique and ideally should be carried out in hospital. Those who were infected needed a course of intravenous injections of toxic medicine. The teams carried out all these procedures in remote villages with notable success. The teams comprised local, often illiterate, people who were given meticulous training in precisely defined procedures with a clear division of labour. The result was a cheap, effective, service to combat a single major disease. When the disease became rarer, visible returns on investment were reduced and the workload fell. Other less dramatic diseases were added to the work of the teams but morale was harder to maintain and the pressure for a more sedentary life increased.

Perhaps the most dramatic campaign against a single disease is just ending. Smallpox eradication was such an effort. Originally the aim was to raise vaccination levels in populations to a level at which herd immunity would end transmission. The later and effective strategy involved case-finding and vaccination of all contacts. Workers were diverted from other health services, the cost was very great, and extreme measures were employed such as rewards for case detection, use of helicopters, and single-minded pursuit of contacts for vaccination. World eradication now appears to have been achieved, the annual savings to countries maintaining port and airport quarantine and inspection facilities are now immense, and few would doubt the benefits of the programme.

Malaria eradication and health economics

The attempt at world malaria eradication has been even more wide-ranging and expensive. This again derived from a technical advance, the discovery of the long-lasting insecticidal properties of DDT, and the observation that after several years of vigorous malaria control by DDT, if the spraying programme ceased, the malaria might not return (it had died out) although the mosquitoes did. In the 1950s the administrative and technical design of an eradication programme was elaborated. Its nature, with a capital budget for a time-limited programme, perfection of execution necessary in terms of population covered, and staff wholly committed to the malaria programme, has conditioned the main lines of debate in tropical health care for the 1960s and early 1970s. The programme was distinct from other Ministry of Health operations in most countries: it was separate from a very high level downwards, and its budget was autonomous. The programme had a variable success: there is now no indigenous malaria in Europe and the United States of America and it has been eliminated from many other countries. On the other hand, eradication never got under way in Africa for good biological reasons. More important in the present context, it was relatively successful in India, Sri Lanka, and other parts of south-east Asia, but then collapsed, partly because insecticide resistance developed among the vector mosquitoes, but mainly because the health service infrastructure was unable to support the immense task of regular surveys of the possibly infected people in the later stages of the campaign. A vertically structured capital programme collapsed as the result of general deficiencies in the health care sector.

This historical account has been given because it explains much of the present situation in health economics of the tropics. Before and during the malaria eradication programme, tropical health administrators rarely thought consciously in terms of economics. There was a health budget to be eked out. It was so minute in size compared with the health needs of the population that the feel for what was practicable dominated expenditure, and maintaining services during the slump period was a matter of daily exigencies rather than economic planning. It was different with malaria eradication. The sums required were vast. They were certainly not available from health budgetary savings, and they were capital, not the recurrent sums needed for ordinary control. The programme relied on international expertise and depended on the World Health Organisation (WHO) for leadership. The proponents of malaria eradication found themselves having to convince the Treasury, not the Health Ministry, because extra-budgetary funds were needed. So economic rather than humanitarian arguments were needed, and the WHO had the strongest of motives for costing malaria as highly as possible. Thus a pattern of economic justification was set for single disease programmes which has taken such deep roots in that organisation, and hence in health economics in developing countries, that even today it is difficult for many in the WHO to perceive more than this crude form of cost and benefit calculation when the words 'socioeconomic aspects' are used!

The costing of disease, especially malaria, in the tropics has much earlier beginnings in the hands of Ross and especially Watson at the beginning of the century. Mosquitoes had been shown to carry malaria; drainage could keep down mosquitoes. Malaria was exacting an immense toll in absenteeism, disability and death. Commercial interests in Port Swettenham were at stake. Watson was talking to planters, mine owners, and merchants about their labour forces. The Ross Institute, which he subsequently directed, continued to do so. A straightforward calculation was needed to show that to include malaria control in the balance sheet would

raise profits. This was performed, appropriate action was taken, and profits rose. The actions required—drainage and oiling of swamps—were engineering jobs and were technically relatively self-contained. Malaria was so predominantly the hazard that many of the sophistications of health economics could be by-passed. Such arguments also prevailed on the Zambian copper belt in the 1930s. At that time, also, Sinton made his calculations on the cost of malaria to India, while examples accumulated of good land made uninhabitable because of malaria and of dramatic rises in land prices following malaria control.

There was thus a tradition upon which the economic case for malaria eradication could be erected. Furthermore, in those places where the programmes were planned, malaria was an acute fever producing disability comparable in some ways to an influenza epidemic, and a clear mortality. The calculations were made and the funds voted. With the exception of smallpox, the economic issues are unlikely again to appear so simple. Other diseases raise more complex problems and malaria also is now seen to be less straightforward in the long term. It may be helpful to illustrate some aspects of the problems raised by single disease questions before examining the broader issues of health care and combinations of the two.

Costs of diseases and their control

In many endemic areas malaria kills small children on a large scale. Therefore once eradication was in sight, analysis of the demographic consequences was undertaken, particularly in Sri Lanka, where only 16 people got malaria in 1963. Large consequences were found, with adverse long-term economic results following from the increase in population.

The second disease for which energetic attempts at costing were made illustrates practically all the difficulties that malaria work contrived to avoid. Schistosomiasis is a disease caused by a helminth, which is a sort of worm. Many of those infected have mild symptoms, or symptoms which, though distressing, do not prevent the person from working, or no symptoms at all. A proportion, difficult to measure, go on to cause permanent damage to various body tissues and as a result some people die of the disease. Evidence on the working capacity of those apparently without symptoms is conflicting. Several parasite strains exist and possibly people vary in their susceptibility to late effects. People have differing worm burdens which depend on exposure to infection and on immunity, which is ill-defined in man, and these worm burdens greatly affect the disease risk. The economist therefore has extremely complex, uncertain material as a starting point. He also has to face the difficulty of costing misery, and partial disability in a subsistence economy.

In both malaria and schistosomiasis the initial impetus for study tended to be advocacy: 'Go and show how very important this disease is'. With so many uncertainties in any calculation, the initial cost estimates have been high, followed by an iconoclastic series of publications arguing the contrary. Also, more sophisticated studies have been directed towards areas of lower infection intensity for schistosomiasis.

Recently, similar calculations have been made for *Ascaris*, roundworm infections in Kenya. These have served a useful purpose in drawing attention to an underrated disease problem; but as with the studies of schistosomiasis, there is the difficulty of estimating the large and uncertain cost of the consequences of subclinical and non-specific pathological effects.

With the decreasing enthusiasm for 'vertical' single disease campaigns, there may be less pressure for the preceding types of cost/benefit estimates; the more so, as economists and planners absorb the physicians' scepticism about such data. A more promising subject for economic analysis is onchocerciasis, because blindness is an unequivocal disability and the effects of river blindness on agriculture and even on the habitability of some areas may be influenced. The multinational West African programme of onchocerciasis control is funded by the World Bank (IBRD).

The Development Banks might be expected to be the chief proponents of cost/benefit calculations on disease, but this has not been so. The IBRD, although much concerned about health, does not, at the time of writing, lend money for health projects as such. Its interest is confined to population projects with a bearing on health or development of water resources etc., when such development would affect health. The purpose of the Bank's very large funding of schistosomiasis control has been to prevent ill health resulting from water development, and so to reduce the impact on health of environmental change; it has not been its purpose to provide medical care, so it has not required detailed benefit calculations

Organisation, quality, and coverage of health care services

Malaria eradication at global level failed for many reasons—biological, technical, and administrative. In those countries of South-east Asia, where it almost succeeded but then collapsed, a major cause was the lack of a general health infrastructure of skilled or semi-skilled workers capable of carrying out the demanding task of following up the whole population in the late stages of the campaign when few cases

of malaria remained. Subsequently the WHO transferred its attention to building up the basic health services needed for most attacks on particular diseases. The emphasis was on management and on provision of health centres along with training of health staff. The period coincided with the growth of local medical schools in tropical Africa and an attempt to augment the exceedingly low doctor-patient ratios.

It quickly became clear that there were too few doctors, that to educate doctors was expensive, and that even if enough doctors were trained, there would be inadequate funds to employ them in rural areas, where they had no wish to live.

Preoccupation with the problem of how to cover the population with some form of basic health care system has steadily increased up to the present time. At first the aim was to provide health centres in which preventive and curative medicine could be practised by a health team led by the doctor. The costs of manpower training and employment for different categories of staff were compared and the immense cost of doctors became apparent.

More recently, two developments of the 'coverage' approach have been emphasised. The first is 'country health planning', in which a plan is prepared for development of health services at national level. Such a plan is amenable to economic analysis and rational discussion, even if these do not greatly influence the decisions subsequently taken. The second development is an emphasis on village community health workers (CHWs) and self-help programmes. The CHW is often thought of as someone with little training who may do unpaid or part-time work. Nevertheless the CHW is expected to do a great deal with very limited support. Programmes based on CHWs have had considerable success on a small scale, and in particular political contexts on a larger scale. Their promotion is being strongly urged by the WHO but their use raises several points relevant to this paper.

The value of CHWs at national and village levels has been studied, but their value at intermediate levels, and especially that of the district, has been neglected. Programmes which have not been institutionalised at district level will not continue or be replicable. A variety of economic questions arise: how does one cost a community health worker and assess the benefits of his or her work?; are the numerous calculations valid that show a very high cost-effectiveness of community-based programmes compared with hospital programmes? Among other questions which have scarcely been studied are the optimum allocation of funds between the tiers of the health hierarchy; the issues surrounding remuneration of CHWs; and the allocation of funds as between staff, preventive activities, and medicines. At every level of the health service, measures of the output of health improvements are neglected, and most economic work has to be based on measuring the utilisation of facilities. One exception is the work of the Ghana Health Ministry planning unit, as yet unpublished, which is discussed below.

Environmental health costs

Analyses of improvements in water supply and the disposal of excreta lie somewhere between single disease studies and the economics of the whole health sector, although extending beyond the health field itself. Recently several efforts have been made to estimate the economic benefits of improvements in health resulting from improvements in water supply, especially partial ones. The problems have been great. In particular, the medical data on the relation of infection to disease, and on the likely benefits of improvements when assessed in medical terms, are inadequate as a basis for serious economic analysis. More successful attempts have been made to compare public health engineering changes with immunisation and treatment for particular water-related diseases, notably typhoid.

Health and development

It has been increasingly realised that health cannot be considered in isolation from other problems in developing countries, and this has led to integrated rural and urban development projects often funded now by international banks such as IBRD. Disaggregation of the health component for economic analysis is difficult, without heroic assumptions.

The converse problem, of deteriorating health as a result of economic development, is widespread. It is most clearly seen in water development projects, especially man-made lakes and irrigation schemes. Health costs need to be added to the other costs of development, although in practice the matter has been handled—if at all—by setting aside an arbitrary sum for mitigating undesirable effects of the development. In addition, design modifications have been made to reduce disease transmission, provided the cost was low. Thus the economics of health as a component of development have not been handled in a systematic manner, partly for the good reason that too many medical as well as economic uncertainties are involved.

THE BASIC QUESTIONS

Data available and needed

In the preceding section I have outlined the history of the major preoccupations of community health and hinted at the economic issues which have been raised but remain unanswered. If the subject is to

progress, more co-operative work will be needed between the economist and the epidemiologist. The tendency has been for policy to be based on utilisation of facilities and not on measured health improvements. In the present climate of opinion, when issues of coverage overshadow those of quality of care, it is clearly essential for economics to be based on the actual changes in health status if understanding is to be improved.

If resources are minute, and the total health budget of several developing countries is below £1 per head per annum, complete solutions to many problems of disease control are not feasible. Therefore economic choices are harder, and the need for epidemiological understanding much greater, than in developed countries: if there are funds only to improve either access to water *or* its quality, then the demand for epidemiological knowledge is very great indeed. How much will diarrhoea decrease if standpipes replace the local pond as a water source? What further reductions will there be as a result of doubling the number of standpipes, compared with moving to single household taps?

Methods for determining costs of diseases and their control

The malariologists' approach to disease economics —namely, adding up the total social cost of a disease and treating that sum as the benefit from eradication—is relevant only to eradication, if then. Where a disease will be controlled or its frequency somewhat reduced, a different approach is needed. If we consider a complex helminthic disease such as schistosomiasis, the risks of infection, of transition to a series of disease states, and of death, may all be set out, and disability and economic consequences estimated for each. A second method attempts to bypass the medical issues and to compare economic productivity in those infected with a control group which is uninfected. Where such productivity is measurable, bias is introduced, because the workforce is usually a selected group and may well exclude all those seriously affected by the disease under study, as has been shown with onchocerciasis in Uganda. To obtain appropriate control groups for comparative purposes is also difficult. Where a disease is curable, the best approach is likely to be a comparison of two groups, with and without the disease, both before and after the affected group has been treated. Economic extrapolation from such studies to the whole community requires some heroism, but where subsistence agriculture and apparent unemployment dominate the rural scene, problems of design are not readily solved.

Working out the costs of actual control procedures is a great deal easier, although it is not often done. It raises problems familiar to the economist for which acceptable approaches exist. The cost of treatment can also be worked out. The major difficulty with most endemic diseases is that the straightforward costs of this type are small, relative to the intractable level of disability which forms the largest component of total social cost; I would almost assert that the standard deviation of the estimates of disability often exceeds the total of other costs, so that what is reliably measurable in many diseases is relatively trivial.

The many methods devised in developed countries for estimating the cost of loss of life and disease have been sporadically applied to tropical diseases. Some achieved notoriety, as when the enormous cost of diarrhoeal disease in one calculation was shown to be due to loss of earnings by the sick, calculated as days × GNP per head per day despite the fact that most of the sick were under three years old. In a recent attempt in Ghana, the mean days of life lost from each disease by each age group compared with the mean expectation of life of that age group in Ghana have been calculated. This approach is of course vulnerable to criticism, but it has been used in health planning, and except for a tendency to over-value life in the newborn, it appears to be really useful.

Health economics for planning

In the Ghana planning unit, Nimo, Morrow, Smith, and others have used the relative importance of different diseases, calculated as described above, in assessing priorities. The unit has also estimated the changes in lost-days-of-life from various intervention strategies and thereby assessed the cost-effectiveness of several approaches to health care improvement. The results strongly support a primary health care strategy as against the alternatives. Although the authors of this planning method would be the first to admit its limitations, it appears to represent a considerable advance on the way in which plans have been developed in other tropical countries.

It is clear that in developing countries, where lack of funds severely limits the range of health care activities, as informed an analysis as possible is needed as a basis for planning. The same questions are being asked as in the United Kingdom, but they need to be tackled in a very different way. It is hoped that continuing discussion will clarify the most helpful lines of progress.

Comment: NICHOLAS M. PRESCOTT
Magdalen College, Oxford

My comments will be addressed primarily to a fundamental question which Bradley touches on but does not

confront directly: what is the appropriate approach to health sector resource allocation in developing countries (LDCs)?

Bradley correctly suggests that the application of economic analysis to health in LDCs has been limited and sometimes of questionable value. What he did not say was that few of these applications have been made by economists. This is not a trivial observation. The enormity of the health problems in LDCs and the extreme scarcity of resources available to deal with them give an importance to efficient resource allocation which is not well served by much of the LDC health economics practised in the past. How can economics improve the efficiency of resource allocation in the future? Few would disagree in general terms with the answer contained in Bradley's concluding comment that '. . . as informed an analysis as possible is needed as a basis for planning'. But it begs the questions both of the type of economic analysis that is needed for health planning and of the nature of the relevant information.

One possible planning approach follows from the currently fashionable 'basic needs' approach to development (Ghai *et al.*, 1977), the latest product of the shift in emphasis from growth to distribution as the objective of development planning. This approach is distinguished by its emphasis on meeting the basic needs of the poor in the shortest possible time, say 15 to 20 years. Health is one of the five commonly identified elements of the core bundle of basic needs; the others are food, education, housing, and water supply and sanitation. A natural interpretation of the basic needs strategy is that it implies a cost-effectiveness approach to health planning: targets for basic health needs are specified somehow and the planning problem is reduced to identifying the least-cost techniques for meeting them. There are evident difficulties with this approach. For example, what are the basic needs in health? Should they be formulated in terms of resource inputs or of health status outputs? Who decides and on what basis? Abstracting from these difficulties, it is natural to ask what might be the cost of a 'reasonable' basic needs stategy in health? To illustrate the possible orders of magnitude the World Bank has attempted to estimate the cost of an input plus quasi-output strategy for meeting basic health needs by the year 2000: extension of primary health services to the urban and rural poor, and eradication of four of the major tropical parasitic diseases—malaria, schistosomiasis, onchocerciasis, and African human trypanosomiasis (Burki and Voorhoeve, 1977). The results indicate that the marginal costs of meeting basic health needs so defined would lie in the region of US $2 to $3 at 1975 prices per caput per year over the period 1980 to 2000, perhaps a doubling of government health expenditure per caput in many LDCs. The crudity of this figure should not be underestimated but it does suggest that meeting basic health needs will require reallocation of domestic and international resources on a scale that is unlikely to be achieved in the near future. The implication is that choices have to be made even between basic health needs in many LDCs—choices which are bypassed by the basic needs approach. These choices can be resolved rationally only by explicit and systematic comparison of the benefits and costs, the net contribution to social welfare, of alternative health programmes.

Yet the use of cost-benefit analysis to improve the efficiency of resource allocation is hindered by misunderstanding of the nature of the information that is relevant for planning. Two observations will suggest areas where substantial progress is required.

The first observation is that economic analysis has been widely misinterpreted to be concerned only with the aggregate income benefits that may result from health status improvement while ignoring the social value of the aggregate health benefits themselves. This misinterpretation has led to the perverse distinction often drawn between the 'economic' and the 'humanitarian' benefits of disease control; it is also reflected in the term 'socioeconomic development'. In so far as health status improvement is itself an ultimate objective of development planning, the question is not whether but how aggregate health benefits should be integrated with aggregate income benefits in the appraisal of health programmes. This raises the problem both of quantifying, and of valuing relative to a common numeraire, the different types of aggregate health benefit. Much remains to be done to develop the pioneering attempt by Feldstein *et al.* (1973) to aggregate income and health benefits in a single objective function for health sector planning in LDCs. The attempt by the Ghana planning unit to quantify the aggregate health benefits of alternative planning strategies appears to be a valuable step in this direction. In addition it will often be appropriate to attach a distributional premium to income and health benefits accruing to beneficiaries in the lower income groups.

The second observation is that past attempts to evaluate the benefits of disease control by estimating the 'economic loss' due to disease have tended to assume implicitly that disease would be completely and instantaneously eradicated. This assumption ignores the choice that exists in the technology of disease control. The expected benefits of control depend fundamentally on the expected changes in mortality and morbidity, and their distribution by age, sex, and income class, in future periods. These factors vary with the choice of control technique and the scale at which it is operated. Yet the possibility of identifying the optimal choice of technique and scale of control (the objective of which may fall far short of eradication) is at present precluded by the lack of a solid epidemiological basis for predicting the dynamic response of disease prevalence to different kinds of intervention; this problem is well illustrated by Bradley's example of choice of technique in water supply. Among the major tropical parasitic diseases, only schistosomiasis has been the subject of epidemiological modelling in a planning framework—but one of cost-effectiveness analysis (Rosenfield *et al.*, 1977).

In summary, the cost-effectiveness approach exemplified by the basic needs strategy cannot resolve health sector choices in the face of the severe scarcity of resources in many LDCs. Furthermore, cost-benefit analysis cannot significantly improve allocative efficiency until future research has established the basis for predicting, quantifying, and valuing the expected aggregate health

benefits of alternative health programmes. These are substantial requirements which call for close collaboration between economists and epidemiologists. But they are essential for rational planning of the health sector in pursuit of the objectives of economic development.

Reprints from Professor David J. Bradley, Director of the Ross Institute of Tropical Hygiene and Professor of Tropical Medicine, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT.

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Meeting basic needs in Asia, Part I: government capacity and performance

DENNIS A. RONDINELLI
The Maxwell School of Citizenship and Public Affairs, Syracuse University

MARVIN B. MANDELL
The Maxwell School of Citizenship and Public Affairs, Syracuse University

SUMMARY

Questions concerning the distribution of income and wealth, and access to services have attracted increased attention during the 1970s to complement the earlier emphasis on the promotion of macro-economic development. This article provides a comparative review of service needs in Asia. It presents an inventory of the types of services provided by, or through, government, and assesses their adequacy for rural development. It explores problems with mobilizing resources and delivering services, and it identifies arrangements that appear most effective. The article emphasizes the problem of extending the coverage, and increasing the quality, of social and productive support services for vast rural populations and it stresses that more appropriate ways must be found of delivering services that are needed. A second article, to appear in the next number of *Public Administration and Development*, reviews ways of improving the capacity of governments and local communities to provide services needed by rural populations.

Experience with development over the past quarter of a century suggests that the success of developing nations in stimulating and sustaining economic and social progress and in transforming themselves from subsistence to productive societies depends on two crucial factors. One is government's ability to design and carry out strategies for macro-economic growth. The other, and equally as important, is its capacity to provide those services needed to increase the productivity and fulfil the basic needs of a majority of its population in an equitable fashion. The two factors are closely related. Attempts to distribute income and wealth more equitably, increase participation in economic activities and expand the coverage of social and productive support services are often futile in stagnant economies. But macro-economic growth policies that ignore distributive issues or that fail to build local capacity to provide services often result in highly concentrated and inequitable patterns of development.

A great deal of experience with alternative development policies for achieving growth-with-equity has been gained in East and Southeast Asia over the past

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Professor Rondinelli is Director, and Marvin Mandell a Member, of the Faculty of the Graduate Program in Development Planning, The Maxwell School, Syracuse University, Syracuse, N.Y. 13210, U.S.A.

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DENNIS A. RONDINELLI

three decades. Socialist governments in Burma, Sri Lanka and the People's Republic of China emphasized distribution over growth and found that equity was achieved primarily by reducing the entire population to a standard of living just above the subsistence level. Moreover, policies primarily concerned with distribution have led to relatively low levels of productivity in the agricultural and industrial sectors and to severe problems of sustaining the economy over long periods of time (USAID, 1979a; USAID, 1979b). Other countries such as India, Pakistan, Indonesia, the Philippines and Thailand sought macro-economic growth without considering distribution and found that large numbers of people remain in dire poverty despite overall economic progress. Some Asian countries such as Bangladesh and Nepal have neither been able to promote macro-economic growth nor to mobilize resources for local service delivery (USAID, 1979c, USAID, 1980a). Only a few nations such as South Korea, Taiwan and Malaysia have been relatively successful at both (Rao, 1978; Ranis, 1978; Lee, 1977).

Although most countries have given highest priority to promoting macro-economic development, international assistance agencies and some governments in developing nations are now paying greater attention to issues of distribution. They are seeking ways of generating resources within local communities to provide services that fulfill basic needs, increase employment and output and distribute the benefits of development more equitably. The approaches to development that emerged during the 1970s attempted to refocus attention on factors largely ignored during the 1950s and 1960s. 'While these strategies have in common a rejection of economic growth alone as a sufficient means of achieving broad-based development and alleviating poverty in the developing countries, they recognize that rapid growth is an essential element of any development strategy for poor countries', one analyst correctly observes. Concisely stated the issue is not 'between advocates of growth and advocates of no growth or slow growth; it is between advocates of maximum growth in GNP regardless of how it is achieved and advocates of a growth path which puts to productive use the now underutilized labor of the poor' (Paolillo, 1976). In Asia, poverty is most severe in rural areas, and given its magnitude and extent and the paucity of national resources, the only realistic approach to alleviating massive rural poverty is through building the capacity of local governments, and of non-governmental organizations, to mobilize community resources for social and productive-support services (Rondinelli and Ruddle, 1977b). In its initial stages however, a local resource mobilization policy requires substantial support and commitment from the national government and a willingness on the part of policymakers to invest national resources in local capacity-building programmes.

Relatively little effort has been made, thus far, to survey service needs in Asia, compare experiences with trying to fulfil them and assess government capacity to mobilize resources for service delivery. Nor have the reasons for successes and failures been examined, the implications for increasing the capacity of local governments to mobilize resources for community services been explored or successful programmes and projects that could be replicated elsewhere been identified. Thus, this paper will inventory the types of services provided by or through national and local governments in Asia, assess their adequacy for rural development, explore problems with resource mobilization and service delivery and identify the arrangements that seem to be most effective.

THE ROLE OF SOCIAL AND PRODUCTIVE SERVICES IN RURAL DEVELOPMENT

Many development theorists argue that the poor remain indigent in large part because they lack access to social services, public facilities and productive resources required to meet basic human needs and to increase their income. The provision of services has, therefore, become an important component of rural development policies. Increasing the access of the rural poor to social and productive-support services is seen as a means of increasing their overall standard of living, as a way of increasing the participation of those people who had previously been excluded from productive activities, as a means of stemming the tide of migration out of rural areas and at the same time relieving population pressures on large cities, and as a way of increasing the productivity and output of rural labour.

The arguments for expanding services in rural areas

In nearly every society standards of living are measured in part by access to services that fulfil basic human needs. Although definitions vary among cultures, the International Labor Office contends that 'basic needs' usually consist of two components: minimum requirements for private consumption such as adequate food, shelter, clothing, and household equipment; and essential community services such as safe drinking water, sanitation, health and educational facilities, and public transport (ILO, 1976). Economic systems that do not extend access to these services to a large majority of the population are considered underdeveloped and inequitable.

Others contend that access to these, and to commercial and productive resources such as land and credit, is not only a basic human right but is indispensible for increasing productivity and alleviating poverty in the developing world. The staff of the World Bank, for instance, contends that the rural poor not only suffer 'because they have little access to technology and services' but also because 'the institutions that would sustain a higher level of productivity are lacking,' (World Bank, 1975a, p. 21). Providing services in rural areas of Asia is important because most poor countries in that region are, and will remain for the foreseeable future, agricultural societies. Their best hope for economic progress is in developing agriculture and agriculturally related industries. This depends, however, on increasing the productivity of agricultural labour, which in turn requires the extension of those social and productive support services that will increase the output of rural people. The U.S. Agency for International Development's Working Group on the Rural Poor insists that access to appropriate social services is essential for increasing productivity in rural areas. 'Emphasis should be placed on environmental sanitation, preventive medicine, eradication of endemic diseases, improved nutrition and family planning based on rural health clinics, para-professionals and traditional health practitioners', USAID analysts suggest. 'Transport investment should focus on the development of low-cost rural transportation networks with the objective of providing farm to market access . . . (USAID, 1973, p. 30). These services, they argue, are not only private consumption goods for individual households, but

they have social 'spillover' effects that create an environment conducive to increasing productivity and making economic development more equitable.

Another argument often made for expanding services in rural areas is that they are needed to reduce the high rates of rural-to-urban migration that both drain rural areas of their best human resources and create additional pressures on the limited supply of services, facilities and employment opportunities in cities. Recent World Bank studies of migration note that economic factors and potential job opportunities are the primary forces pulling people from rural areas to the cities but that 'other attractions such as better living conditions, better educational opportunities, or a wider variety of shopping, social and recreational activities may also be important' (Yap, 1975, p. 19). The lack of social and productive services in rural villages encourages outmigration and swelling populations in Asian cities create severe pressures on already inadequate urban services. In a recent study for the Asian Development Bank, Prakash notes that services in most Asian cities have been deteriorating during the past decade and that the costs of providing even minimum levels of water, sewerage, housing, health and education services for the increasing numbers of urban dwellers over the next two decades would cost betwen $147 and $210 billion in 1976 dollars. He argues that 'the scale and rapid growth of urban population translates into enormous capital investment requirements resulting in long-run recurring costs', and predicts that even if total savings could be mobilized to provide housing and infrastructure for the additional urban population, the amounts would be insufficient. 'But these resources', he points out, 'are also urgently needed elsewhere (Prakash, 1977, p. 6). Service needs have increased in Asia because both urban and rural populations have been growing rapidly over the past two decades and the expected pressures on rural land over the next two decades will keep migration to the cities at high levels unless employment, income and service needs can be met in rural regions.

The integrated approach to rural service delivery

Development theorists and analysts within international assistance agencies contend, however, that social and productive support services must be combined and integrated at the local level in order to have an impact on the rural poor. Single services or limited development programmes simply cannot meet the massive needs in rural areas. USAID's Working Group on the Rural Poor has argued that the extreme complexity of rural systems and the diversity of problems in rural areas demands an integrated approach to development. Social, cultural, economic, political and historical forces have all combined to create and perpetuate the current adverse conditions in rural areas and therefore 'the interactions and dependencies of these complex elements make it highly unlikely that any single intervention such as increasing small farmer credit or introduction of a new technology will be effective in isolation'. To the contrary, the Working Group insisted, 'it is the capacity of the system as a whole rather than isolated parts which must be the focus of attention in planning' (USAID, 1973, p. 8).

Experience has consistently shown, however, that provision of adequate services in rural areas depends on the existence of—or the ability to create—a

broad range of supporting political and administrative conditions.[1] These include national political commitment to a growth-with-equity policy, domestic and foreign trade policies that are favourable to agriculture, a strong willingness and capacity within national bureaucracies to deliver social services effectively in rural areas, adequate budgetary support for rural services and facilities, and effective administrative arrangements at the field level for implementing local service delivery programmes. Moreover, there must also be political commitment at the local level and ways to overcome the frequent opposition from elites to increasing the participation of the poor in economic activities. An equitable distribution of land ownership is a crucial factor in raising income levels to pay for services and providing an adequate tax base to finance recurrent costs. Local government's financial and administrative capabilities must be improved in most countries and local project management units created to oversee the daily operations of service delivery projects. Private and cooperative organizations have been found to play a crucial role in supporting government efforts. These factors, taken together, form an environment conducive to providing an integrated set of social and support services in local communities that can increase the productivity of the rural poor and raise their standards of living (Rondinelli and Ruddle, 1977a; Rondinelli and Ruddle, 1978b). Where local resource mobilization and service delivery have been successful in Asia—specifically in Korea, Taiwan, Malaysia and the People's Republic of China—all or most of these conditions supported a strong self-help effort at the local level (Asian Productivity Organization, 1978).

Within this political and administrative context, the services considered essential for increasing productivity and income are: marketing and credit, irrigation, agricultural extension, roads and utilities. In addition, health, family planning and social services, elementary and vocational education, and basic commercial and financial services—especially those that support small-scale industrial development—are usually components of integrated rural development projects.[2] The poor in towns and smaller cities require housing, sanitation, water and utility services, and they share with rural people the need for better access to public transportation (Rondinelli and Ruddle 1978c, Chapters 5, 7; Rondinelli, 1979–80).

THE PERFORMANCE OF ASIAN GOVERNMENTS IN PROVIDING SOCIAL AND PRODUCTIVE-SUPPORT SERVICES

Although the ability of governments to provide this combination of services varies widely among developing countries in Asia, a comparative review of needs indicates that in all Asian LDCs services for rural development and resources for local service delivery are inadequate. Three generalizations can be made about services provided by Asian governments.

First, the quantity of services provided in nearly all countries is substantially smaller and coverage is less extensive than in more economically advanced

[1]For a more detailed discussion see Rondinelli (1979) and Rondinelli and Ruddle (1978b).

[2]A more detailed discussion is found in Rondinelli and Ruddle (1978c) Chapter 4.

societies. Governments in all Asian countries recognize the inadequacy of services, measured by either international standards or indigenous norms. Coverage is more extensive in those countries that have had higher rates of economic growth over the past decade, but in the poorer and slower growing economies a large percentage of the population does not have effective access to most services.

Second, the services that are provided are often inappropriate to the needs of the vast majority of the population. In health, for instance, too much emphasis is placed on high-cost curative medicine. The most pressing health problems in developing countries involve infectious and parasitic diseases resulting from inadequate supplies of drinkable water, poor sanitation facilities and lack of vector control (World Bank, 1975b, Abel-Smith and Leiserson, 1978). Widespread malnutrition is not only a leading cause of death among children, but contributes to the general prevalence of diseases by impairing normal body responses to infection (World Bank, 1975b, Abel-Smith and Leiserson, 1978). These problems, in turn, contribute to the health risks attending high fertility rates in rural areas, and, in combination, lower overall standards of living and individual productivity. Curative medical services are either ineffective or extremely inefficient in combating these problems. Yet a large amount of the limited resources available for health are allocated to services provided by trained physicians and hospitals using sophisticated and costly equipment. Only recently has attention been given to more appropriate alternatives such as preventive health programmes, maternal and child care services, extension of piped water supplies and sanitation facilities, and the creation of vector control programmes. Health and nutrition training programmes could reach a vastly larger number of people than the curative services required to deal with diseases caused or exacerbated by poor health and nutritional practices (WHO, 1978a).

Third, in all of the developing countries of Asia services are inequitably distributed. Substantial disparities in access to social and productive-support services exist between people living in urban and rural areas. Indeed, many of the rural poor have virtually no access. In Korea, less than 50 per cent of the population lives in urban centres, yet over 80 per cent of the physicians and medical facilities are concentrated in the larger cities. In India, four-fifths of the physicians also live in urban centres, but the 80 per cent of the population living in rural villages has little or no access to them (WHO, 1978b). Large disparities can also be found among geographical regions within nearly every country, and people in different income groups differ significantly in their access to services.

An assessment of the performance of Asian governments in providing services must therefore consider a number of crucial factors: the *quantity* and *coverage* of services that are available, their *quality* and *appropriateness* in meeting the needs of various groups within the population, and the degree of *equity* in the distribution of services. Quantity, coverage and distributional equity can generally be assessed more easily than quality and appropriateness, both because of the paucity of general information on quality and because of the variation in standards that are acceptable and feasible in countries at different levels of social and economic development.

Indeed, the developing nations of Asia differ markedly in their levels of economic development, pace of economic growth, political ideology, government

structure and cultural traditions. These factors explain much about differences in the capacity and willingness of governments to mobilize and invest resources in social and productive-support services and to build local capacity to deliver and maintain them. Thus, in this assessment Asian nations are divided into three categories of development to compare records of performance in providing services. Comparisons are made among newly industrializing countries, transitional developing economies and poor countries.

Newly Industrializing Countries

Three nations—Taiwan (Republic of China), South Korea and Malaysia—have achieved substantial success in promoting economic growth and extending basic services to a majority of their people. All three are relatively small in population size and land area and they have all placed strong emphasis on macro-economic development through export production. Taiwan and Korea specialized in export manufacturing and Malaysia invested heavily in agriculture and agro-industrial development. Yet, all three countries have also pursued deliberate policies to increase participation in economic activities, create parity between the agricultural and industrial sectors and spread the benefits of development among rural as well as urban populations. As a result, they have created a relatively equitable pattern of economic development. Annual growth rates in industrial production averaged 17 per cent in Korea from 1970 to 1977, a little over 12 per cent in Taiwan and more than 9 per cent in Malaysia. Average growth rates in GNP during the same period were about 5 per cent in Malaysia and Taiwan and more than 7 per cent in Korea. By 1978, *per capita* GNP exceeded $1000 in all three countries and approached $1500 in Taiwan. Secondary and tertiary sectors contributed about 75 per cent of Gross Domestic Product (GDP) in 1977, and more than half of the labour force was employed in non-agricultural work (see Table 1). About half of the populations of Taiwan and Korea and one-third of Malaysians were urban dwellers in 1975.

Although significant differences in income and wealth remain between urban and rural populations generally and among occupational groups in all three countries, standards of living tend to be relatively high and, compared to other countries in Asia, income is equitably distributed. Basic needs have been met for the vast majority of the population and access to social and productive-support services is improving. Both Taiwan and Korea have nearly universal adult literacy. Population growth rates were reduced to 2 per cent a year between 1970 and 1977 in Korea and Taiwan and total fertility rates in 1977 were below 3.0. These achievements are attributable in large part to highly successful family planning programmes in both countries. The average annual population growth rate in Malaysia during the 1970s was about 2.7 and the total fertility rate in 1977 was 3.8. Life expectancy in 1977 was 63 years in Korea, 67 in Malaysia and 72 in Taiwan (see Table 2).

Infrastructure and support services have been widely distributed in Korea, and Rao (1976) points out that

> Korea's villages enjoy an unusually high level of basic services . . . All villages have easy access to primary schools and most villages to middle

schools as well. Family planning material is widely disseminated—as evidenced by the fact that rural fertility rates have declined about as fast as urban rates. About 91% of all households have access to electricity. More than half of the legal villages have community telephones. Almost all villages are connected by roads, although there is still much room for improvement in the quality of rural access roads.

Table 1. Basic economic indicators for selected developing countries of East and Southeast Asia

	Population 1978 (millions) *	GNP per capita 1978 ($) *	Growth rate of GNP 1970–1977 (%) *	Average annual growth rate of production† 1970–1977		
				Agriculture	Industry	Services
New industrializing countries						
Korea	36.6	1160	7.6	5.0	17.0	8.5
Malaysia	13.3	1090	4.9	5.4	9.3	8.6
Taiwan	17.1	1400	5.5	1.5	12.2	4.5
Transitional developing countries						
Philippines	45.6	510	3.7	4.8	8.7	5.6
Thailand	44.3	490	4.1	4.4	10.3	6.8
Poor countries						
Bangladesh	83.6	90	−0.2	1.0	4.2	4.5
Burma	32.2	150	1.3	3.0	3.7	4.3
India	643.9	180	1.1	4.1	2.6	—
Indonesia	135.9	360	5.7	4.2	12.9	4.5
Nepal	13.6	120	2.4	—	—	—
Pakistan	77.3	230	0.8	1.8	3.6	5.1
Sri Lanka	14.3	190	1.3	1.6	2.8	4.3

	Distribution of gross domestic product† 1977 (per cent)			Sectoral distribution of labour force† 1977 (per cent)		
	Agriculture	Industry	Services	Agriculture	Industry	Services
Newly industrializing countries						
Korea	27	35	38	45	33	22
Malaysia	26	29	45	44	20	36
Taiwan	12	46	42	34	27	39
Transitional developing countries						
Philippines	29	35	32	51	15	34
Thailand	27	29	44	77	8	15
Poor countries						
Bangladesh	55	13	32	78	7	15
Burma	47	11	42	55	19	26
India	37	25	38	73	11	16
Indonesia	31	34	35	60	12	28
Nepal	68	9	23	93	2	5
Pakistan	33	23	44	58	20	22
Sri Lanka	39	21	40	54	15	31

*World Bank (1979a).
†World Bank (1979b).

Table 2. Basic social indicators for selected developing countries of East and Southeast Asia

	Percentage rural population, 1975	Life expectancy at birth (years), 1977	Adult literacy rate, 1975	Percentage of population in dependent age groups, 1977	Total fertility rate, 1977	Percentage population with access to safe water, 1975	Population per physician, 1976	Child death rate (ages 1–4), 1977
Newly industrializing countries								
Korea	51	63	91	40	2.8	62	1680	5
Malaysia	70	67	60	46	3.8	62	4350	3
Taiwan	49	72	82	37	2.5	—	1590	1
Transitional developing economies								
Philippines	66	60	87	49	5.0	38	3150	7
Thailand	86	61	82	48	4.5	22	8460	6
Poor countries								
Bangladesh	91	47	22	49	6.5	53	11350	23
Burma	75	52	67	45	5.5	17	5410	15
India	79	51	36	45	5.0	33	3140	18
Indonesia	82	48	62	44	4.9	12	16430	19
Nepal	96	45	19	45	6.5	9	38650	23
Pakistan	74	51	21	50	6.7	29	3780	17
Sri Lanka	76	69	—	42	3.6	20	6230	2

Source: World Bank (1979b).

Attempts were made to maintain equitable participation in economic activities and distribution of the benefits of economic growth during the 1970s with a vigorous rural development programme, the *Saemaul Undong* (New Community) Movement.

Similar policies in Taiwan contributed to relatively equitable development and widespread access to social and productive services there. A strong emphasis on rural industrialization strengthened the rural economy at the same time that agriculture was being developed, which became a crucial factor in raising rural household incomes. Well-organized agricultural cooperatives provided a vehicle for mobilizing resources in rural areas for self-help projects, supported in large part by the Joint Commission for Rural Reconstruction (JCRR).[3]

Since the mid-1950s, Malaysia's government sector has been large, with central, state and municipal expenditures totalling more than 40 per cent of GNP during the 1970s, a level approximating that of some European welfare states. Malaysia's post-Independence governments have strongly emphasized investment in productive support services in agricultural and industrial sectors, transportation, and social services with developmental or productive impact such as education, health and family planning. In 1973, for example, about 23 per cent of total Federal expenditures went for agricultural, industrial, transportation and rural development, and nearly 30 per cent for education, family planning, health and community services. Private consumption services have been made available through public enterprises at or near cost and have been accessible to a majority of the population (Meerman, 1977).

The problems that remain in all three of these newly industrializing countries are of maintaining existing services under conditions of rapidly rising costs in economies that are experiencing high rates of inflation, of increasing the quality of services provided in societies with rising expectations concerning overall standards of living, and of extending the coverage of appropriate services to lower income groups and economically lagging rural regions in order to maintain equity in the distribution of development benefits.

In all three countries rural populations generally receive lower quality services than those living in cities, especially in health care and education, and have less access than urban dwellers to such services as piped water, sewerage, electricity, housing and transportation. Meerman notes that in Malaysia, rural schools 'have poorer facilities and less qualified teachers. Poverty is associated with lack of parental education and home environment is extremely important in determining success in school. However, village financial resources must also contribute substantially to this outcome—far more than is the case in the developed countries' (Meerman, 1977, p. 14). Moreover, the lowest income groups in all three countries have less access to services, no matter where they live, and the costs of obtaining the services that are available tends to be more burdensome than for higher income groups. In Malaysia, for example, where public education is provided free, the supplementary costs for books, fees, uniforms and supplies were estimated to be about 18 per cent of total family income for the poorer households in the mid-1970s, a substantial burden on the poorest 40 per cent of

[3]The background of the community development effort in Taiwan is described in Huang (1977).

the population. Meerman concluded that 'this factor is a major reason for the rapid decreases in enrollment rates as incomes fall irrespective of level' (Meerman, 1977, p. 8).

Transitional developing economies

The Philippines and Thailand are in a transitional stage of development; they have maintained respectable rates of economic growth during the 1970s, averaging 3.7 per cent in the former and 4.1 per cent in the latter from 1970 to 1977. Industrial growth rates during the same period averaged 8.7 per cent a year in the Philippines and 10.3 per cent in Thailand. *Per capita* GNP reached about $500 in each country in 1978. Industry contributed about 35 per cent to GDP in the Philippines and 24 per cent in Thailand. Both countries still have agricultural economies, with half the labour force of the Philippines and 77 per cent of Thailand employed in the agricultural sector (see Table 1). A large share of industrial capacity and urban population are concentrated in the national capitals—Bangkok and Manila—which dominate the national economies and spatial systems of these countries. Large disparities in income, wealth, productive capacity and quality of services are found between rural regions and the national capitals. High levels of poverty in rural areas offer a strong challenge to policies promoting equitable growth.

Although Thailand has had two decades of relatively stable growth and was at about the same income level during the 1970s that the newly industrializing countries of Asia had reached during the 1960s, nearly 25 per cent of the population in Thailand still lives in absolute poverty. Large segments of the rural population lack access to many of the social and productive services needed to fulfil basic human needs and increase agricultural output. Although 80 per cent of the adult population has completed the fourth grade, only 14 per cent of the workforce has an education beyond that level, and the relatively high literacy rate is based on a limited ability to read and write. The country as a whole still suffers from high morbidity rates, the number of population per physician is relatively high, and the utilization rate for curative facilities is low. Many provinces lack professional health services (USAID, 1980b). About 86 per cent of the population in Thailand lives in rural areas and nearly half of the population is in the dependent age groups of below 14 and over 65 years old. Less than a quarter of the country's population has access to safe water (see Table 2).

As in Thailand, the macro-economic statistics that show the Philippines better off than most of the poorer countries of Southeast Asia mask the extensiveness of poverty. A large majority of the rural population lacks access to services and productive resources. Difficulties in meeting basic human needs in rural areas are attributable in part to the high population growth rate during the 1950s and 1960s. Although the growth rate dropped by 25 per cent during the past decade, population increased by 2.5 per cent a year at the end of the 1970s. Rural people have less access to family planning services and make less use of those available than urban dwellers. Average rural family size remains at more than 6 members.

A little more than 40 per cent of the families in the Philippines suffer from

some form of undernourishment. Only about 38 per cent of the population has access to safe water, and in rural areas the weaknesses in health and sanitation services and the lack of drinkable water supplies perpetuate high incidences of water and airborne diseases. Gastro-intestinal infection, bronchitis, influenza, tuberculosis and pneumonia are frequent causes of death, and a high percentage of deaths occur without medical treatment. Many rural health clinics lack equipment, supplies and staff and are physically inaccessible to most rural people because of inadequate transportation services and lack of rural roads in many provinces. Although primary and secondary schools are widespread throughout the Philippines, the quality of education in rural areas tends to be low and enrollment increases have created textbook and teacher shortages in many rural provinces (Cheetham and Hawkins, 1976, chapters 10–12). As in the other developing countries of Southeast Asia, the dependency ratio in the Philippines is high. Over 40 per cent of the population is 14 years old or under.

Disparities in access to services remain a serious problem in both countries, and one that government must come to grips with during the 1980s if development is to become more equitable. Large differences in quantity and quality of services are evident between urban and rural areas generally, and among specific geographical areas in the Philippines.[4] In Thailand access to social and productive services within regions is highly correlated with degree of urbanization. The USAID Mission in Thailand notes that the rural poor have 'higher dependency ratios, less schooling, more deaths from communicable disease, housing without water, toilets or electricity, lack radios and private transportation and are more victimized by crime (USAID, 1980b, p. 12). The incidence of absolute poverty in Thailand is highest in the North and Northeast regions where in 1976 more than one-third of the population had incomes below the poverty level compared to 12 per cent in the central region and Bangkok. The Northeast and Northern regions are predominantly rural and have about half of Thailand's total population. *Per capita* income in the Northeast region was only 42 per cent of the national average in 1977 and has been declining in relative terms over the past decade. During the mid-1970s access to telephone and other communications services were much lower for those living in the north and northeastern parts of the country than for those residing in the Central and Southern regions. Only 9 per cent of the villages in the Northeast had electricity and less than 20 per cent of the houses had toilets. Whereas almost 80 per cent of the central region's population had access to piped water, less than 6 per cent of the Northeast region's population were served. Moreover, government expenditure *per capita* in 1976 for all public services was only $20 in the Northeast compared to $47 in the Central and Southern regions (USAID, 1980b).

Poor developing countries

Among the remaining non-Communist countries of Asia, Bangladesh, Burma, India, Indonesia, Nepal, Pakistan and Sri Lanka have extensive poverty and relatively low rates of economic growth. Only Indonesia has experienced

[4]A detailed description of inter-regional inequalities in the Philippines is found in Rondinelli (1980).

significant economic progress during the 1970s, with a 5.7 per cent average annual growth in GNP and a 13 per cent growth in industrial production between 1970 and 1977 (see Table 1). The growth rate in GNP for Bangladesh has been negative, and less than 2 per cent for all of the other countries except Nepal. *Per capita* GNP for all of the countries except Indonesia has been less than $250.

All of these nations have agricultural economies. The agricultural sector employed over 50 per cent of the labour force, with about 70 per cent or more of the labour in Bangladesh, India and Nepal engaged in agriculture. Industrial workers constitute less than 20 per cent of the labour force in all seven countries. Agricultural contribution to GDP is substantially lower than the sector's share of the labour force, and average annual growth rates in agriculture have been extremely low during the 1970s in all countries except India and Indonesia, where they reached about 4 per cent. More than three-quarters of the population in these countries live in rural areas.

Pakistan, India, Indonesia and Bangladesh have the world's largest concentration of people living in absolute poverty (World Bank, 1975b). The rural poor consist largely of subsistence farmers, landless labourers, tenants and small-scale non-farm entrepreneurs, whose access to social and productive services is minimal. Only Burma and Sri Lanka—two small socialist welfare states—have been able to provide basic social services to a large segment of the rural population, but even in these countries the overall impact on standards of living and levels of productivity have not been great. Distribution of income and wealth, and thus access to social and productive services, tends to be highly inequitable in most of the poor countries of Asia. The poorest 40 per cent of the population receives less than 18 per cent of income in Bangladesh, India, Pakistan and Sri Lanka, with the richest 20 per cent receiving nearly half of the income in these countries (ILO, 1977, pp. 19–25).

The limited access to social and productive services in these countries is reflected in basic social indicators (see Table 2). Life expectancy in all of the countries except Sri Lanka was about 50 years or less in 1977. No more than a quarter of the adult population was literate in Bangladesh, Nepal and Pakistan and only about one-third of the adult population in India was considered literate in 1975. Fertility rates range from 3.6 in Sri Lanka to 6.7 in Pakistan. Less than a third of the population has access to safe drinking water in any of the countries. In Pakistan, less than half of rural school-age children are enrolled in schools and only a quarter of them complete the fifth grade. Only 22 per cent of Pakistan's population is literate. Population growth rates in Pakistan averaged 3 per cent during the 1970s and fertility rates exceeded 6.7. The Government's *per capita* expenditure on health and education are extremely low at $1.62 and $4.04, respectively. About 20 per cent of houses are built of durable construction materials and the government estimates a shortage of more than one million housing units. Only a quarter of the population is served by drinkable water and only 10 per cent by sewerage facilities (USAID, 1979d). Moreover, the government's commitment to providing needed services in rural areas is rather weak. The USAID Mission in Pakistan observes that 'government investment in rural areas for education, electricity, extension, seed production and other input distribution have been ill-planned and minimal. *Status quo*,

subsistence agriculture continues in much of the country and most farmers are unaffected by government programs' (USAID, 1979d, p. 30).

Similar conditions exist in Nepal, where life expectancy is 44 years, infant mortality is 152 per thousand and the fertility rate is more than 6.5. Less than 10 per cent of the population has access to safe drinking water. Foreign assistance analysts point out that 'because of constraints of the terrain and absolute scarcity of facilities, staff and supplies, usually health posts and hospitals are not easily accessible to villagers. In addition to these system delivery problems, the most serious basic health problem probably is the exceedingly low level of sanitation' (USAID, 1979c, p. 4). Population growth rates are high and continue to rise. Only about 5 per cent of the population in the child-producing age group accepted contraceptive methods in 1978. More than 20 of every one thousand children in Nepal die before the age of 5. Less than a third of school-age children are enrolled in primary school and only about 19 per cent of the population—including only 4 per cent of the women—were literate in 1975. Access to markets and market information is extremely limited for Nepalese farmers and their dependence on traditional farming methods has kept agricultural production and rural incomes low.

The relatively high rate of industrial production in Indonesia during the 1970s has done little to overcome the pervasive poverty and extreme inequality in the distribution of income and wealth among regions in that country. Recent studies indicate that 90 million Indonesians, about two-thirds of the total population, live on less than $200 a year and that many of their basic needs cannot be met on this subsistence income (USAID, 1979e, p. 1). Nearly 70 per cent of the rural population lives on incomes below the poverty line, and rural people continue to have large families (6 or more members). The inadequacy of water and sanitation services promotes diarrhoeal diseases that together with high levels of malnutrition and respiratory diseases account for more than 90 per cent of all deaths of children under 5 years old. Indonesia's child death-rate of 19 per thousand is one of the highest in Asia. Life expectancy remained about 48 years in 1977. Moreover, educational attainment continues to be low, with few rural children advancing beyond the fourth grade. In 1976, less than 1 per cent of the Indonesian population over the age of 10 had completed secondary school.

The situation in Bangladesh is equally grim. More than 90 per cent of the country's population lives in rural areas. Life expectancy is about 47 years, only 22 per cent of the adult population was literate in 1975 and 23 of every thousand children die before they reach the age of five. While basic social and productive services are available to higher income groups the majority of the poor have only minimal access. 'In general, health services available in most villages consist of the village midwife (dai), the local health practitioner and occasional visits by field based health and family planning workers', foreign aid analysts in Bangladesh report. 'Doctors and hospitals are so remote as to be considered only at times of serious need and even then are likely to be out of reach' (USAID, 1980a, p. 16). Only about 15 per cent of the children in Bangladesh advance beyond a fifth grade education and the quality of that education is extremely low.

Only two of the poor and transitional countries in Southeast Asia—Sri Lanka and Burma—have a somewhat better record of providing basic social services.

Both socialist welfare states have had low rates of economic growth during the past two decades, however, and their economic capacity to extend coverage and increase the quality of service is limited. At least 20 per cent of Sri Lanka's population lives in dire poverty and a majority live in relative poverty. More than 80 per cent of Burma's population has income below the poverty level (USAID, 1979a, pp. 2–6). Little attempt has been made until recently to increase the levels of productivity in these stagnant economies.

In Sri Lanka, infant mortality and birth rates are relatively low, life expectancy and adult literacy are high for the population as a whole, but these statistics mask regional disparities and the low quality of services provided to many areas of the island. Moreover, in recent years the government has encountered severe problems of maintaining services because of the low levels of economic growth. A high percentage of those people seeking treatment at Sri Lanka's rather widely dispersed health clinics suffer from diseases attributable to the lack of safe water supplies, sewage disposal and vector control. Gastroenteritis is a main cause of infant deaths. One-third of the urban population and almost 95 per cent of rural people lack access to piped water. One study reports that 'although recorded rates of literacy and school enrolment are impressively high in Sri Lanka, deficiencies in facilities, teaching quality and curriculum as well as economic pressures on low income families have caused an increasing drop-out problem. It is estimated that only 58 per cent of entering students complete the fifth grade (USAID, 1979b, p. 14). Housing quality in both Colombo and on the estate sector is recognized by the government as being poor—overcrowding and deterioration are widespread. The emphasis on social welfare during the past two decades clearly has been at the expense of productive investment, and the government's ability to sustain social services has been deteriorating during the late 1970s. Rural areas lack adequate roads, transportation, electrification and marketing services and facilities.

Similar but more serious problems plague Burma's government. The USAID Mission concisely describes the situation when it referred to Burma as 'an impoverished country, of extensive natural resources, whose population lives in shared deprivation without the pervasive, dire, grinding poverty of the subcontinent' (USAID, 1979a, p. 3). Although the government has made a deliberate attempt to provide basic social services to the majority of the population, quality remains low. About two-thirds of the adult population is marginally literate, but children generally receive only a fourth or fifth grade education and there is a tendency for rural people to lose their literacy as they grow older because of a lack of reading material. Health services are available at clinics in most larger towns, but evaluators have discovered that 'such facilities are overcrowded [and] unsanitary . . . , medicines from government sources are in short supply and consequently have to be purchased on the black market at prices that tax the family's ability to afford them' (USAID, 1979a, p. 3). Health centres are scattered among rural villages but they are chronically short of supplies and staff. Malnutrition and intestinal and pulmonary diseases are widespread in rural areas. Less than 15 per cent of the rural population has access to drinkable water. The vast majority of rural people also lack access to agricultural extension, credit or marketing services and basic technology and productive support services such as transportation and irrigation equipment that

could increase their income and agricultural output. Severe financial problems and low levels of capital formation make provision of even basic social and production services increasingly difficult.

As in the newly industrializing and transitional countries, large disparities in the quantity and quality of services available to different geographical regions and income groups are serious problems to be overcome in Asia's poorest societies in the coming decades. In Pakistan, for instance, strong urban-rural disparities exist in service coverage and quality. Recent studies estimate that *per capita* income in urban areas in 1978 was about 90 per cent higher than in rural areas, thus expenditure levels were more than 70 per cent higher in cities, as was total share in consumption. Literacy in rural regions was only 14 per cent compared to 41 per cent in cities. About 14 per cent of the rural population, compared to 61 per cent in cities, had access to drinkable water and less than one per cent of the rural population had access to sanitation facilities. About 8 per cent of the houses in rural villages were built of durable construction materials compared to 54 per cent in urban areas. More than 80 per cent of the hospital beds and 60 per cent of the dispensaries are located in urban centres, and a vast majority of the rural poor cannot make use of them.

The USAID Mission points out that in Indonesia:

> Health care services and personnel are both insufficient and extremely maldistributed in favor of urban areas. Only 13% of the rural population has direct access to safe drinking water, and only 20% of Indonesians have sanitary toilets. Less than half the 4,300 public health centres are staffed by a physician; only 20–25% of the population utilizes these facilities. The distribution of the 10,000 physicians in Indonesia ranges from 3.18 per 10,000 population in Jakarta to 0.19 in rural areas. The country's 45,000 nurses, 17,000 midwives and 5,000 sanitarians are also located primarily in urban areas (USAID, 1979e, p. 12).

Other services are also poorly distributed: less than 10 per cent of rural households have access to electricity and piped water and the lack of rural roads limits government's ability to extend services efficiently outside of towns and cities.

Large disparities also appear among different income groups. Those individuals and families that have accumulated wealth or who are in the upper income groups, even in rural areas, have greater access to services than lower income groups. Aid officials in Bangladesh point out that 'with status and economic well-being come regular access to such social resources as education, health care and institutional credit. Similarly, local political offices and local decision-making are primarily in the hands of the influential maliks and the nonagricultural elite who live in the rural towns.' The combination of higher income and greater access to political influence give the elite a stranglehold over the distribution of services to lower income groups. 'Efforts by those occupying the lower portion of the social hierarchy to obtain access to resources and services without the assistance of an influential person are ordinarily met by demands for bribes and concessions' (USAID, 1980a, pp. 12–13).

Thus, the poorest countries in Asia must not only extend the coverage and increase the quality of social and productive-support services for a vast rural population, but also find more appropriate ways of delivering the services that are needed. Means must also be found of reducing the large disparities in coverage and access to services among geographical regions and income groups. The problems of resource mobilization and service delivery will be examined in Part II of this study, which will also explore issues and directions for improving the capacity of governments and local communities to meet basic human needs and provide productive support services.

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for Shattuck

The PHC importance of community participation emphasized by many eg. Cuba. But success influenced by local factors. Resolution of resp. to local community organization not likely to bring positive results unless local organizations already established strong, credible to most of the community (not balkanized) and able to mobilize volunteers, resources in kind and money to support the PHC. programs.

Multisectoral aspects of health care (PHC) readily recognized. Agencies relationships NOT to other agencies. Multisectoral implementation likely to be difficult and inefficient unless there are established cooperative programs or a rules decision implementation agency to which resp. is delegated

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Karen

FROM: Karen Hall	ROOM NO.:	EXTENSION:

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

June 18, 1981

MEMORANDUM

TO: Distribution

FROM: DS/HEA, David Dunlop DD

SUBJECT: Workshop on the Political and Administrative Constraints to Health Project Development by Professor Thomas Bossert

I am sorry that you were unable to attend Professor Bossert's presentation this morning on the political and administrative context of primary health care programs. Dr. Bossert described his research project and laid out a number of the practical implications of his work. The discussion following was very useful. I feel that this project will make a substantial contribution to AID's work in the promotion of P.H.C.

Enclosed are copies of two papers which were distributed at the meeting. The first, shorter paper outline, this morning's presentation and summarizes the basic research model to be used. The second paper provides background and a more detailed view of the overall project. This is a first draft, representing the preliminary phase of a final report which is to be submitted in September. Your comments, criticisms, and suggestions will therefore be greatly appreciated.

Thank you for your interest in this project.

Correspondence may be addressed to:

David W. Dunlop, Ph.D.
Office of Health, DSB
Room 301 RPE

Distribution:
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World Bank:
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Draft for Working Session
June 18, 1981

Thomas J. Bossert, Ph.D.
David A. Parker, M.P.A.

A Preliminary Framework and Hypotheses for Analysis of Political and Administrative Context of Primary Health Care Policies

I. Objectives

The primary objective of this project is to develop a framework for analyzing the impact of political and administrative characteristics on the effectiveness of primary health care policies. The framework is designed to provide a set of hypotheses about political and administrative variables that can be tested by a variety of research methods, including cross-national aggregate data analysis. Equally important, the hypotheses are presented as as a state-of-the-art, "best guess", so that project managers and other AID officials may currently account for political and administrative factors likely to influence the effectiveness of primary health care policies.

II. Background to the Problem

In recent years, concern with the politics of primary health care (PHC) has rapidly expanded. A growing literature, based on increasing experience and experimentation with rural health care programs in developing countries, along with advances in policy analysis and public administration in the developing world, has provided a substantial base of knowledge. Nevertheless, this material remains largely inaccessible for use in the planning and management of PHC and other development programs. Part of the reason for this lack of accessibility is that information on factors responsible for program outcome has been fragmented and anecdotal and, even when systematically available, it

is often not transmitted to other interested organizations on a regular basis. Points of commonality and difference between programs in various fields - PHC, family planning, water supply, etc. - have also not been systematically explored for more general applications. As a response to many of these problems, the present project reflects an initial survey and synthesis of findings regarding factors responsible for PHC program "success" and "failure".

How and why programs "work" is highly specific to the design of the intervention, as well as to the environment in which it is undertaken. "Successful" programs are the outcome of a sensitive, specific, and finally unmeasurable balance between program design and its context. This balance is often identified in terms of elements that are lacking in a given case: when programs do not "work", the reasons can usually be traced to one or more aspects of the program's relationship to country policymaking, administrative, or service delivery processes. For example, the absence of a budgetary commitment to cover recurrent project costs, and the shortcomings of supply systems are frequently cited causes for the failure of programs to meet their objectives.

It is the objective of this project to attempt to systematize this fragmentary information in order to develop and to test generalizations about the relative effectiveness of alternative program strategies and the performance of PHC projects in different political and administrative settings. The knowledge generated from this effort will sensitize decision makers in international agencies to the nature of the political and administrative context and its implications for project success.

III. Literature Overview

Although there are numerous studies made of politics in developing countries, until recently few of these focused attention on the operation of the policymaking

process. During the 1970s, recognition of the problems of economic development and awareness of the special difficulties faced by social programs led to the production of a growing literature on "political development", policy-making, and bureaucracy. Montgomery (18) and others, drawing on the emerging field of policy analysis began to develop analytical means to examine the features of policy formulation and implementation in developing countries. Case material in various fields also began to emerge, in partial remedy to the earlier absence of documented studies. A collection of cases edited by Winikoff (28), for instance, focused on national policies for nutrition. The literature on political aspects of family planning programs grew dramatically as well (25), as a result of the strong international focus on population problems.

In addition to the work on policy formulation and implementation, research into the administration of economic development programs has also increased in recent years. The widespread adoption of basic needs strategies and integrated approaches to rural development (IRD) placed new demands on country administrative structures, and revealed the presence of significant constraints on program effectiveness. Honadle (14) and a group at the World Bank (22) have recently completed reviews of organizational considerations in implementing integrated development projects. The importance of local participation in community services has been underscored in many studies; means of promoting participation and maximizing its contributions have been examined by Uphoff and others (27).

The extension of this political and administrative research into the health field has been ongoing, but incomplete. A number of social scientists, including Ugalde (24), have studied aspects of health care politics and programs in a variety of settings. In addition, much of the general literature on development

activities has incorporated cases or sections on health services. The strongest regional emphasis in this work has been on Latin America; Crosby and Lindenberg (8) are among the researchers who are particularly concerned with program management in that region. Overall, studies of the administration of health services have been specific to countries or projects. Comprehensive examinations of programs, which provide the best basis for an understanding of administrative dynamics, are also emerging; the work by O'Connor (19) on basic health services in Afghanistan is one recent example.

Cross-national research on health systems has been carried out for some time, with a primary focus on Western Europe and the United States. Elling (10) and Roemer (21) have developed frameworks for analysis and published a wide range of descriptive studies of country health systems. Altenstetter (2) has suggested approaches to the comparative study of health service administration as a part of the selective international research sponsored by the Fogarty Center. The body of actual comparative analysis in the health field is limited, however. Leichter's study of health policies in developed countries (15) is among the most detailed. For a group of developing countries, Dunlop and Caldwell (9) have examined characteristics of health planning processes. Bossert (5) has analyzed country health politics using case studies from Latin America. In general, aggregate analysis has been difficult because of the unavailability of data corresponding to the research frameworks that have been proposed. Broad social and political indicators, in contrast, do not allow sufficient precision to yield meaningful findings about individual country health services. For example, using a regression model Haignere (12) examined the relationships of economic, political, and health system variables to health status indicators, reaching inconclusive results.

The only large-scale international study of country decision-making in the health sector has been that conducted over the past two years jointly by the World Health Organization and UNICEF (29). This research was designed to provide information in support of the WHO/UNICEF promotion of Primary Health Care and "Health for All by the Year 2000". Case studies of health care policy-making in seven countries in various regions of the world were prepared by individual country teams. While the study suggests useful hypotheses about process of adopting PHC policies, few of the countries had implemented the programs long enough to evaluate them.

In summary, the literature to date contains useful elements of a general framework of policy analysis, scattered hypotheses about political and administrative constraints on health and other human development projects, and some preliminary examples of cross-national data analysis. The following section will draw on this literature to develop a more systematic approach of direct relevance to health policy makers. It will permit a more comprehensive incorporation of factors proposed in descriptive studies, and at the same time broaden the range of variables that may be included in aggregate analyses. The propositions will be organized as a set of hypotheses concerning the determinants of health program outcomes, which may then be tested using a variety of measures.

IV. Analytic Model

The central concept underlying the analysis is that program "success" is the product of a satisfactory "fit" between the design (or content) of the program and its relevant environments (or context). This perspective carries with it three basic requirements for understanding. The first concerns the characteristics of the PHC program itself, and their implications for program

strategies. The second area is the distinction between the political elements impinging on the "formulation" of policy and those affecting the "implementation". The third concerns the structural characteristics of the political and administrative context. For our purposes the structural analysis will focus on the "national", "institutional", and "local community" level structural characteristics.

A. Program Characteristics: "Content" Factors

It is useful to distinguish political implications of a policy's content (i.e. inherent to the type of program) from those of its context (i.e. the different environments which approve and implement a specific program). The literature on human resource programs in general and PHC in particular suggests certain elements which are favorable to adoption and implementation and others which are unfavorable.

Program content factors which are likely to be favorable to adoption and implementation of PHC include:

1) low resource requirements. PHC programs generally demand fewer resources than do other health and human resource programs, making them attractive to policy makers.

2) simple technology. PHC is viewed as an appropriate technology for areas with few human and physical resources.

3) distributive rather than redistributive. PHC programs are generally viewed not as zero-sum situations in which one group must lose for another to benefit.

4) low salience. This characteristic is useful for reducing opposition, however, it also reduces potential support.

Factors of PHC that are likely to be unfavorable to project adoption and implementation include:

1) low demand from potential beneficiaries who tend to seek curative care.

2) inherent conflict with traditional healers.

3) difficulty of reaching dispersed rural population.

4) passive and active physician opposition.

5) beneficiaries lack political power.

These content factors have been emphasized by much of the literature on health and human resource programs (11A., 16A., 27). They are important factors for comparing health programs to other types of policies which can be chosen and for a general understanding of the inherent political constraints of PHC. However, they are not particularly amenable to manipulation by policy makers except in relatively unusual contexts (e.g. when rural poor have political power).

B. Policy and Program Stages in Primary Health Care: Dependent Variables

Since political factors related to the formulation of policy are often different from those related to the carrying out of policy, we have found it useful to follow the usual policy analysis distinction between two general stages in the policy process: "formulation" and "implementation". (Sometimes these stages are considered two elements of the "project cycle").

The stage of "policy formulation" consists of the identification of problems for attention, the promotion of interest in responding to the problems among groups in the population, the mobilization of decision-makers' support, and the initial allocation of resources to treat the problems. The outcome of these steps may include the articulation of a policy regarding the problems, the selection of a program strategy to serve the policy objectives, and/or the

commitment of specific budgetary funds for the effort. The second stage, "program implementation", consists of the determination of program components, the identification of administrative mechanisms, the enlistment or development of infrastructure to provide necessary resources, and the delivery of services in the community. Outputs of this phase include detailed program plans, the development of program resources, and the actual provision of health services under varying degrees of local organization.

These two stages reflect an essential division of activities found in the experience of PHC programs, for example, the WHO/UNICEF study (29), and social sector interventions more broadly, e.g. Knight (16A.). They are groups of necessary steps towards the ultimate provision of PHC services, rather than an exact sequence of operations. Incremental development, over a period of years, is accomplished through a process of successive revision and the simultaneous conduct of multiple activities. In their application to PHC, however, it is judged that the categories represent discrete sets of actors, environments, and interests. Policy formulation occurs primarily at the central level, involving major public decision-makers and private and public interest groups; policy decisions are large-scale choices about the use of national resources. In contrast, implementation takes place at the administrative and community levels; bureaucratic as well as local political considerations are at play. These aspects of implementation might be separated in further analysis, but due to the difficulty of distinguishing their outputs, they are combined here.

The effectiveness of PHC policy formulation and program implementation is measured in the present study by the achievement or existence of certain outputs at each stage. These are listed as "dependent variables" in Table 1. The adoption of a national policy for PHC is indicated by the presence of:

1) a health plan with clearly stated PHC goals and strategies;

2) increases in agency budgets for PHC or rural health services;

3) donor funding for PHC programs or projects; and

4) at minimum, pilot projects or other introductory PHC services.

Program implementation is indicated by the levels, and increases in the levels, of a range of PHC elements:

1) resources for PHC, including health workers, health posts, and related basic community services;

2) expenditures for PHC or rural health services;

3) access to the target population; and

4) community support for PHC.

It will be noted that we have chosen policy "output" measures, i.e. evidence of the delivery of services and promotion of health activities in a target population, rather than policy "outcome" variables, such as measures of health status. As noted in Bloom, et al (4A.), the link between health policies and identifiable changes in general health status has yet to be established. Our objective here is to identify those constraints which affect the delivery of service; it is beyond the scope of this analysis to determine whether or not the service itself has the desired impact on health status.

These sets of indicators are not exhaustive, but they provide general evidence of national commitment and efforts toward PHC goals. Their relative importance will vary between countries, as will the meaning of different values or findings. On balance, however, each is a necessary and observable component of PHC "success".

In summary, then, we have identified two sets of dependent variables corresponding to the outcomes of two stages in the policy process. The first set marks the adoption of a PHC policy, or the end of the "policy formulation"

stage. Our hypotheses in the following section will identify the national level political context which facilitates or constrains the adoption of a PHC policy. The second set of dependent variables identifies the end of the second phase and are intermediate measure of the "success" of the implementation of the PHC policy.

C. The Primary Health Care Context: Independent Variables

Characteristics of the policy and implementation environments relevant to PHC policy-making and operations are chiefly drawn from analyses of contextual factors influencing the performance of human service programs in developing countries overall. Among the most prominent of numerous discussions are those by Montgomery (18), Cleaves (7), Grindle (11A.), Uphoff (26), and Knight (16A.). The conclusions from specific studies of national PHC programs, such as the WHO/UNICEF survey (29), and a review by the World Bank (11), are also included.

As noted above, we expect certain political variables to be more important at the formulation stage - largely those related to national level politics - while other variables - i.e., those related to the organizational aspects of the implementing agency and to the local community level - will be more important in the implementation stage. This distinction between stages is to facilitate the presentation of our analysis and is not meant to be rigid since, for instance, it is expected that national level politics impinge on the implementation as well as the formulation of policy. In the following section, we will briefly present the hypotheses associated with each structural level of the political system: national, agency, local community. The hypotheses are presented not as null hypotheses but rather indicating the relationship expected in the literature. This method of presentation is to suggest current state-of-the-art for use by AID officials in considering political and administrative constraints for

present policy decision-making.

It should also be noted that for this presentation we have limited our attention to national political and administrative variables. In the final version we will also present variables relating to the economic, social, and cultural "background", as well as the international agencies which participate in PHC formulation and implementation.

The hypotheses and their policy implications are listed below. Suggested operationalization of the variables is presented in Table 2. Arguments to justify the hypotheses are to be amply presented in the final report. Selected hypotheses will be discussed in the oral presentation.

I. Policy Formulation: National Level Characteristics

I.A. Regime Type: Regime characteristics determine the overall likelihood that a government will consider adopting a policy for PHC.

Hypotheses:

1. Unstable regimes, particularly those oriented toward maintaining the status quo, view PHC as a means of obtaining popular support and extending government control in rural areas.

2. Regimes with a progressive ideological orientation, particularly those that are relatively stable, view PHC as a component of social welfare.

3. Governments with greater economic capacity and political autonomy are more likely to have the financial and political resources necessary to adopt and implement PHC.

Policy Implications:

1. AID should view unstable, status quo-oriented regimes as targets of opportunity for PHC programs.

2. Governments with greater extractive capacity are likely to need less AID support in PHC programs beyond initial seed money. Governments with less extractive capacity are likely to require continuous external support for PHC programs.

I.B. Interest Group Politics: The presence of conflicting interests and interest groups influences the political feasibility and importance of health services for the rural poor.

Hypotheses:

1. Dominance of rural elites in the national government limits the political support base for PHC.

2. The more the electoral and economic importance of the rural population in a country, the greater will be the political significance of PHC.

3. The greater the unchallenged influence of the national physician's association, the more likely PHC programs will be severely limited in scope and financing.

Policy Implications:

1. AID should focus its PHC programs in countries where rural elite control

is eroding or has been severely limited and where rural lower class population is a growing political force. PHC programs in nations where rural elite control is strong are not likely to be successful in efficient delivery of service and are not likely, alone, to contribute to change in national power relationships.

2. In countries where physician associations are strong, AID should find countervailing elite level interest groups to support PHC or not promote PHC in those countries.

I.C. Bureaucratic Politics: The availability of national planning, legislative, and health sector support for PHC will influence the scope and direction of health policy.

Hypotheses:

1. The presence of a strong and influential planning ministry increases the likelihood that PHC will be promoted as an element of national development and will be included in development plans.

2. A strong legislature will provide political support for PHC if there is electoral significance in rural areas.

3. Greater budgetary and administrative autonomy of the health ministry implies a greater political influence of the health sector, and increases the chances of PHC inclusion in national development plans.

Policy Implications:

1. PHC should be promoted after significant national planning efforts have been established.

2. In pluralistic regimes with effective legislatures, the legislature provides an alternative to executive branch as an arena for formulating and adopting PHC.

3. AID should promote and support efforts to strengthen the budgetary and administrative autonomy of ministries of health, contingent on institutional capacity of ministry of health (see below).

II. Program Implementation: Institutional and Local Levels

II.A. Institutional Capacity

II.A.1. Professional, planning and management orientation of ministry of health reflect the degree of preparation possible for PHC, and the probable ease of administration.

Hypotheses:

a. A stronger PHC and public health orientation wihin the health ministry provides a greater support base for PHC programs and increases the significance of PHC in health sector plans.

b. A longer duration and greater scope of active health planning will lead to better preparation for new and continuing PHC services.

c. Better management information and greater budgetary authority will permit more responsive decision-making concerning PHC.

d. More flexible and merit-based management increases ministry implementation capabilities.

e. Fragmentation and lack of organization in rural health activities impedes the efficient implementation of PHC programs.

Policy Implication:

a. Successful implementation of PHC may be contingent on prior, or simultaneous, efforts to increase public health professional training for ministry officials, significant health planning projects, improved management information and budgetary authority, more flexible and merit-based management systems, and greater integration of all ministry PHC activities into one management system. AID should design PHC projects to improve these capacities where they are absent.

II.A.2. Operating Environment: PHC implementation is strongly influenced by the health ministry's relations to other agencies.

Hypothesis:

a. Although PHC is a multisectoral strategy, limited coordination with other agency is likely to result in more efficient implementation, except where there are clearly defined interagency linkages, a history of integrated activities, an autonomous IRD agency operating in the country, and/or other successful vertically organized programs.

Policy Implication:

a. Multisectoral PHC projects should be limited to those rare situations where major IRD projects are in process.

III.A.3. Agency Structure: Decentralization of health agency structure is contingent on general national administrative capacity, degree of citizen participation and centralization of political power.

Hypotheses:

a. Decentralization without development of administrative capacities at lower levels inhibits effective implementation of PHC.

b. Decentralization in countries with greater citizen participation in regional level policy-making encourages effective implementation of PHC.

c. Health agency decentralization in political systems with centralized political power inhibits implementation of PHC.

Policy Implication:

a. Decentralization of ministry of health activities should be encouraged when low level administrative capacities are developed, citizen participation at regional level is significant, and the general political system is decentralized.

II.B. Local Community Structures

II.B.1. Community Organizations: The presence of community organization and support is an important element of successful PHC operations.

Hypotheses:

a. Local social service networks, including NGO projects, programs of other government agencies, and mothers' clubs, provide an effective vehicle for PHC service delivery and support.

b. Local contributions to PHC activities, in the form of fees or donated labor, broaden community investment in programs and support ongoing PHC financing.

c. The training and utilization of local individuals as PHC workers contributes to the sense of community responsibility for health services.

Policy Implication:

a. Devolution of authority and responsibility should be designed into projects only if local organizations exist, are strong, and are able to provide community resources, both financial and human, to PHC programs.

II.B.2. Local Conflict: Conflictual barriers at the local level condition the delivery of PHC in the community.

Hypotheses:

a. Ethnic, religious, and other cultural barriers between the government and the target population impede the overall effectiveness of PHC service delivery, and potentially limit program acceptability.

b. Local ethnic and religious cleavages limit the degree of community support for PHC, and may reduce access to the local population.

c. Dominance of landlords in local politics will impede the strength and administrative effectiveness of PHC programs in the community.

Policy Implications:

a. No general policy implications. Local conditions in each case must be analyzed in terms of the degree to which and process by which local barriers can be overcome.

Empirical indicators for these variables are proposed in the tables. As was the case for the dependent variables, the relative importance of various independent variables will be different across countries. Additionally, other variables, as well as other indicators, will prove to be useful. The present set of hypotheses represents a minimum for analysis, based on previous research. This organization reflects the anticipated structure of the model to be employed.

V. Methodology

There are three general methodological issues remaining to be addressed in the course of this study, concerning the availability of data, the choice of techniques for aggregate analysis, and the framing of generalizations across countries. The first of these, data availability, is an immediate problem. Tables 1 and 2 provide a preliminary catalogue of data sources for the indicators that are proposed, and they contain a brief assessment of data availability and quality. Limitations on data for different countries require the selective adoption of indicators, and identification of related measures for which data can be obtained. A survey has been made of the most probable sources of information for this project, among U.S. agencies and organizations, the published literature, and international organizations. This has revealed that much of the essential data are already available for many countries, although it is frequently not in convenient form and thus lead to difficulties of consistency and reliability. Informal sources, particularly interviews, must be further examined as an alternative to in-country collection of other data items.

The techniques to be used for analysis of these data and testing of hypotheses have not yet been fully decided upon. Methods for cross-national research of social and political questions have been considered in the political science

literature for some time (13). Most studies in this field have tended to focus on limited macro-level topics. Major comparative studies of socio-economic development have been conducted using regression methods, however, such as those by Adelman and Morris (1). Research in comparative administration is not so far advanced, owing to a lack of consensus about the scope and objectives of analysis (18, 26). Studies of development agency decision-making and programs have also not proceeded far beyond the descriptive level (23). Aggregate analysis faces continual problems relating to multiple causation and conditional outcomes that severely limit the power of standard regression techniques. Data problems also limit the applicability of economic research methods to other social science fields. The separation of PHC into policy and program stages, and the discrete analysis of other factors or variables, is expected to provide some greater specificity in the findings, but a number of methodological issues remain unresolved.

A third problem to be addressed is related to the preceding one, and concerns the form of generalizations that may be drawn about country PHC programs. Approaches to the analysis of national health systems have been discussed by Elling (10), among others, in a number of works. Models for socio-political research on health care have also been considered for some time, for example, by Litman and Robins in the early 1 70s. However, this literature has not clarified the validity of conclusions reached about different types of countries; specifically, the comparison of widely diverse countries may yield few meaningful findings about the determinants of health system performance. Debate over the relative usefulness of contrasting, as opposed to similar, case studies for making cross-national generalizations is ongoing. Marmor (17), for instance, strongly favors the comparison of

similar cases only. Research on family planning programs has utilized both of these approaches (25). The resolution of this question for PHC will be dependent upon the nature and magnitude of differences found in country PHC policy and program experiences.

The major methodological and country case literature on primary health care has been identified, and a detailed assessment of its applicability to this study is under way. Problems of data collection in the WHO study of country PHC policies will provide a guide to further data collection and analysis. The hypotheses and indicators outlined in this paper will serve as a basis for the next stages of the proposed research. These steps will include the assembly of available data, the determination of valid and feasible analytic techniques, and the development of a framework for relating PHC policy and program factors through useful generalizations.

In summary, PHC program "success" and "failure" are not unitary concepts; rather, they refer to a broad range of design and operational factors which are specific both to the objectives of primary health care, and to the processes by which PHC is adopted and implemented in different countries. This proposed research represents an attempt to improve understanding of the systematic relationship between the stages of PHC and their varying contexts. It is expected that the findings will have implications for the design and management of ongoing, as well as future, interventions in this area.

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Table 1

DEPENDENT VARIABLES: MEASURES OF ADOPTION AND IMPLEMENTATION

PHC STAGE	VARIABLES	DATA AVAILABILITY	SOURCES	QUALITY
I. Policy Formulation	(Measures of Policy Adoption)			
	1. Health plan with clearly stated goals and strategies to reach rural poor through primary health care.	ly available from collections of national health plans.	USAID, WHO, PAHO, and World Bank files.	Good.
	2. Change in approved MOH or other responsible government agency budget(s) for primary health care and/or health services to rural areas.	Probably not available without in-country study; approximations may be available from published budgets.	Country case studies; USAID, WHO, PAHO, and World Bank files.	Variable; inconsistent reliability.
	3. Increase in donor funding for primary health care programs.	Generally available from national health budgets and donor agency budgets.	Same as above; also, budgets of other donor agencies.	Good.
	4. Presence of pilot project(s) or other initial primary health care programs in country.	Generally available from health sector reports and budgets.	Same as above.	Good.
II. Program Implementation	(Measures of Program Implementation)			
	1. Resources a. No. and change in number of health workers trained. b. No. and change in no. of health posts placed. c. No. and change in no. of latrines and water supply improvements	Available from health sector d country case studies, and occasionally government information, all in varying degrees.	Above agency files; country case studies.	Variable quality(fair) incomplete.

Table 1, cont'd.

PHC STAGE	VARIABLES	DATA AVAILABILITY	SOURCES	QUALITY
(II. Program Implementation)	2. Expenditures a. Percent of approved PHC budget expended by end of year. b. Change in PHC budget expenditure rate.	Available from health sector budgets, although probably not directly; must identify relevant PHC budget items.	Budget reports in above agency files; in-country studies.	Good but inconsistent.
	3. Access a. Percent of rural population reached by PHC service. b. Utilization rates for health posts. c. Number of health workers per 1,000 population, and change. d. Availability of necessary drugs and supplies at health posts. e. Proportion of referral visits at higher-level facilities.	Summary data available from health sector reports and plans; other information from case studies and mission reports.	Above agency files; consultant reports and case studies.	Variable; inconsistent and incomplet
	4. Community support a. Existence and duration of local health committees. b. Presence of related services locally--family planning, water supply, nutrition, etc.	Probably not available without in-country study; health sector reports for some countries.	Case studies; reports and interviews locally and through donor agencies.	Variable; judgmental and incomplet

Table 2

INDEPENDENT VARIABLES: DETERMINANTS OF PHC ADOPTION AND IMPLEMENTATION

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILIT
I. Policy Formulation	A. Regime Characteristics			
	1. Regime Instability	a. Terrorism and/or guerilla activity. b. Mass mobilization. c. Age of regime.	Political science literature; U.S. Govt. reports.	University or Wash. DC
	2. Progressive Ideological Orientation	a. Govt. leader declarations. b. Social programs in related sectors. c. Academic judgment.	Country documentation; U.S. Govt. reports.	"
	3. State Capacity	a. Percent GNP as govt. revenue. b. State capability to support strikes.	Budget data; pol. sci. literature.	"
	B. Conflicting Interests and Interest Groups			
	1. Rural Elites Not Dominant in Nat. Govt.	a. Concentration of landholding. b. Percent GNP as rural export products. c. Income distribution (Gini coefficient).	Country case materials; U.S. Govt. reports.	"
	2. Importance of Rural Population	a. % population in rural areas. b. % GNP non-industry/service. c. competitive elections	Country materials; econ. reports ; political sci. lit.	"
	3. Importance of Physician's Association	a. % physicians in association b. evidence of active lobbying	country materials interviews	in-country information

Table 2, cont'd.

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILITY
(I. Policy Formulation)	C. Resources for PHC			
	1. Importance of Planning Ministry	a. Budget of planning ministry. b. Staffing of planning ministry. c. Longevity and growth of planning ministry. d. Role in budgetary process.	Country case materials; interviews.	U.S.; may require in-country information.
	2. Autonomy of Legislature	a. Strength of legislature. vs. executive. b. Amount of time legislature meets.	Pol. sci. lit.; country case materials.	"
	3. Power of Ministry of Health vs. Planning Ministry.	a. MOP changes in MOH budget proposals. b. MOP changes in MOH plans. c. MOP or Finance checkoff on loans & grants to MOH.	Country case materials; interviews.	"
II. Program Implementation				
	A. Institutional Capacity			
	1. Professions, Planning and management			
	a. PHC orientation of Ministry of Health	a. Presence of school of public health. b. Public health training of MOH decision-makers.	Country reports; case materials.	"

Table 2, cont'd.

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILITY
(II. Program Implementation)	b. Planning Capacity of MOH	a. Years of planning. b. Yearly programming exercise. c. Presence of program budget. d. Scope and detail of health plan. e. Internal evaluation effort. f. Planning training of staff.	Country case materials; health plans.	U.S.; probably requires in-country information
	c. Management Capacity	a. Presence of MIS extending to service level. b. Possible MOH reallocations between budget categories.	Country case materials; health plan.	"
	d. Management Flexibility	a. Management training of staff. b. Hiring and promotion based on merit or education. c. % non-MD's in management and administration. d. % staff with public health training.	Country case materials.	"
	e. Lack of Fragmentation	a. Presence of agency division that controls rural health activities. b. Structured training for village PHC workers. c. Public health training of rural conscripted doctors.	Country case materials.	"

Table 2, cont'd.

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILITY
(II. Program Implementation)	2. Relation to Operating Environment			
	a. Limited Coordination with Other Agencies. (Except under conditions where coordination may be effective--clearly defined interagency linkages, history of integrated activities, well-funded, autonomous IRD agency, other vertical programs.)	a. % of MOH budget transferred to other agencies. b. % of rural health budget received from other agencies c. Involvement of other agencies in PHC planning. d. Use of staff from other agencies in PHC operations.	Country case materials and reports.	U.S.; probably requires in-country information.
	3. Agency Structure			
	a. Decentralization (Except under certain conditions, when centralization may be appropriate--modern administration, little citizen participation, small country size, non-federal national system.)	a. In federal system, presence of intermediate-level health agency with separate budget authority. b. Intermediate-level discretion to approve budget changes. c. Intermediate-level discretion to hire and fire. d. Capacity of intermediate-level personnel.	Country case materials; interviews.	"

Table 2, cont'd.

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILITY
(II. Program Implementation)	B. Local Community Structures			Some U.S.; in-country probably required.
	1. Community Organization			
	a. Presence of Local Social Service Networks	a. Activity of NGO's. b. Local programs of ministry of education or agriculture. c. Local mothers' clubs, etc. d. Activities of traditional healers.	Country case material; interviews.	"
	b. Community Contribution to PHC	a. Fees charged for PHC services. b. Local contribution of labor or PHC staffing.	Country case materials; reports.	"
	c. Local PHC Workers	a. Local person trained as [illegible]ge PHC worker. b. Other local people trained for PHC work.	Country case [illegible]terial; reports.	"

Table 2, cont'd.

PHC STAGE	FACTORS	VARIABLES	DATA SOURCES	AVAILABILITY
(II. Program Implementation)				
	2. Local Conflictual Barriers			
	a. Few Cultural Barriers	a. Major ethnic barriers between ruler and target population. b. Literacy rate in rural areas c. Single religion in country. d. Limited traditional resistance to PHC elements (e.g., family planning). e. Limited traditional resistance to modern medicine.	Country reports; case studies.	U.S.; possibly requires in-country information.
	b. Limited Local Cleavages	a. Ethnic consistency in country or within regions. b. Consistency of religion within regions.	Country data; case material.	U.S.; possibly in-country.
	c. Power of Poor vs. Rural Landlords	a. Concentration of landholding. b. Control over local politics. c. Responsiveness of bureacracy to poor.	Country case materials.	Some U.S.; in-country probably required.

DRAFT

June 18, 1981

Political and Administrative Context of Primary Health Care Policies

Thomas Bossert, Ph.D.
David Parker, M.P.A.

Discussion Summary

I. Objectives:

Develop an analytical framework and set of hypotheses for analyzing the political and administrative constraints on the effectiveness of primary health care policies (PHC).

Suggest methods of researching the hypotheses, including aggregate data cross-national approaches.

Suggest current "state-of-the-art" policy implications of political and administrative factors.

II. Analytical Framework

1. "Content" and "Context" of Policy: PHC programs have political implications due to inherent characteristics of the programs. Some aspects are favorable to successful adoption and implementation, while others are unfavorable.

2. Process: It is useful to distinguish those political and administrative variables that impact primarily on the formulation stage from those affecting the implementation stage in the policy process.

3. Structure: The political and administrative variables impacting on policy success are examined in terms of the national government structures, institutional capacities of implementing agency, and local community level structures.

III. Dependent Variables: General measures of successful adoption and implementation are identified:

Adoption: 1) inclusion of PHC in health plan
2) increases in agency budgets for PHC
3) donor funding for PHC
4) at minimum, pilot projects or other introductory PHC services.

Implementation: 1) human and physical resources for PHC
2) expenditures for PHC
3) access to target population
4) community support for PHC.

IV. Hypotheses and Policy Implications

I. Policy Formulation: National Level Characteristics

I.A. Regime Type: Regime characteristics determine the overall likelihood that a government will consider adopting a policy for PHC.

Hypotheses:

1. Unstable regimes, particularly those oriented toward maintaining the status quo, view PHC as a means of obtaining popular support and extending government control in rural areas.

2. Regimes with a progressive ideological orientation, particularly those that are relatively stable, view PHC as a component of social welfare.

3. Governments with greater economic capacity and political autonomy are more likely to have the financial and political resources necessary to adopt and implement PHC.

Policy Implications:

1. AID should view unstable, status quo-oriented regimes as targets of opportunity for PHC programs.

2. Governments with greater extractive capacity are likely to need less AID support in PHC programs beyond initial seed money. Governments with less extractive capacity are likely to require continuous external support for PHC programs.

I.B. Interest Group Politics: The presence of conflicting interests and interest groups influences the political feasibility and importance of health services for the rural poor.

Hypotheses:

1. Dominance of rural elites in the national government limits the political support base for PHC.

2. The more the electoral and economic importance of the rural population in a country, the greater will be the political significance of PHC.

3. The greater the unchallenged influence of the national physician's association, the more likely PHC programs will be severely limited in scope and financing.

Policy Implications:

1. AID should focus its PHC programs in countries where rural elite control

is eroding or has been severely limited and where rural lower class population is a growing political force. PHC programs in nations where rural elite control is strong are not likely to be successful in efficient delivery of service and are not likely, alone, to contribute to change in national power relationships.

2. In countries where physician associations are strong, AID should find countervailing elite level interest groups to support PHC or not promote PHC in those countries.

I.C. Bureaucratic Politics: The availability of national planning, legislative, and health sector support for PHC will influence the scope and direction of health policy.

Hypotheses:

1. The presence of a strong and influential planning ministry increases the likelihood that PHC will be promoted as an element of national development and will be included in development plans.

2. A strong legislature will provide political support for PHC if there is electoral significance in rural areas.

3. Greater budgetary and administrative autonomy of the health ministry implies a greater political influence of the health sector, and increases the chances of PHC inclusion in national development plans.

Policy Implications:

1. PHC should be promoted after significant national planning efforts have been established.

2. In pluralistic regimes with effective legislatures, the legislature provides an alternative to executive branch as an arena for formulating and adopting PHC.

3. AID should promote and support efforts to strengthen the budgetary and administrative autonomy of ministries of health, contingent on institutional capacity of ministry of health (see below).

II. Program Implementation: Institutional and Local Levels

II.A. Institutional Capacity

II.A.1. Professional, planning and management orientation of ministry of health reflect the degree of preparation possible for PHC, and the probable ease of administration.

Hypotheses:

a. A stronger PHC and public health orientation wihin the health ministry provides a greater support base for PHC programs and increases the significance of PHC in health sector plans.

b. A longer duration and greater scope of active health planning will lead to better preparation for new and continuing PHC services.

c. Better management information and greater budgetary authority will permit more responsive decision-making concerning PHC.

d. More flexible and merit-based management increases ministry implementation capabilities.

e. Fragmentation and lack of organization in rural health activities impedes the efficient implementation of PHC programs.

Policy Implication:

a. Successful implementation of PHC may be contingent on prior, or simultaneous, efforts to increase public health professional training for ministry officials, significant health planning projects, improved management information and budgetary authority, more flexible and merit-based management systems, and greater integration of all ministry PHC activities into one management system. AID should design PHC projects to improve these capacities where they are absent.

II.A.2. Operating Environment: PHC implementation is strongly influenced by the health ministry's relations to other agencies.

Hypothesis:

a. Although PHC is a multisectoral strategy, limited coordination with other agency is likely to result in more efficient implementation, except where there are clearly defined interagency linkages, a history of integrated activities, an autonomous IRD agency operating in the country, and/or other successful vertically organized programs.

Policy Implication:

a. Multisectoral PHC projects should be limited to those rare situations where major IRD projects are in process.

III.A.3. Agency Structure: Decentralization of health agency structure is contingent on general national administrative capacity, degree of citizen participation and centralization of political power.

Hypotheses:

a. Decentralization without development of administrative capacities at lower levels inhibits effective implementation of PHC.

b. Decentralization in countries with greater citizen participation in regional level policy-making encourages effective implementation of PHC.

c. Health agency decentralization in political systems with centralized political power inhibits implementation of PHC.

Policy Implication:

a. Decentralization of ministry of health activities should be encouraged when low level administrative capacities are developed, citizen participation at regional level is significant, and the general political system is decentralized.

II.B. Local Community Structures

II.B.1. Community Organizations: The presence of community organization and support is an important element of successful PHC operations.

Hypotheses:

a. Local social service networks, including NGO projects, programs of other government agencies, and mothers' clubs, provide an effective vehicle for PHC service delivery and support.

b. Local contributions to PHC activities, in the form of fees or donated labor, broaden community investment in programs and support ongoing PHC financing.

c. The training and utilization of local individuals as PHC workers contributes to the sense of community responsibility for health services.

Policy Implication:

a. Devolution of authority and responsibility should be designed into projects only if local organizations exist, are strong, and are able to provide community resources, both financial and human, to PHC programs.

II.B.2. Local Conflict: Conflictual barriers at the local level condition the delivery of PHC in the community.

Hypotheses:

a. Ethnic, religious, and other cultural barriers between the government and the target population impede the overall effectiveness of PHC service delivery, and potentially limit program acceptability.

b. Local ethnic and religious cleavages limit the degree of community support for PHC, and may reduce access to the local population.

c. Dominance of landlords in local politics will impede the strength and administrative effectiveness of PHC programs in the community.

Policy Implications:

a. No general policy implications. Local conditions in each case must be analyzed in terms of the degree to which and process by which local barriers can be overcome.

V. Methodology and Data

Aggregate data analysis is a feasible methodology for an initial test of the hypotheses. However, its usefulness will be limited by the availability and quality of the data for many of the variables. Other methods, including selected case studies, are also appropriate. In any case more developed political and administrative data should be a component of all project papers and evaluation.

For Shattuck Lecture (Ref: "Rising Infant Mortality in the USSR in the 1970s" by Christopher Davis and Murray Feshbach, U.S. Bureau of the Census, Series P.95 No. 74, September 1980)

The authors review fragmentary evidence to show that the rapid advances in health in the Soviet Union since the revolution plateaud in the 1960s and has deteriorated since. Infant mortality increased by more than a third between 1970 and 1975. Fragmentary evidence suggest that IMR could be close to 40,000 now compared with western Europe and United States of approximately 13,000. Similarly, in nearly every adult age group mortality figures increased in 1975 over the corresponding figures for 1960. Death rates jumped 20% for people in their 50s and more than 30% for those in their 40s with more striking increases in men and women. Male life expectancy has declined from over 66 to 62 and women from 73 to 68. The current figures are closer to Costa Rica, Jamaica, Malaysia, Mexico and Sri Lanka than to Western Europe and the United States.

The causes are difficult to identify but some of the more important aspects seem to be:

1. Rate of alcoholism - now the third most frequent cause of illness in women. A report from Lithuania connects excessive drinking on the part of mothers and mothers-to-be with half or more of infant deaths.
2. Increased incidence of respiratory disease due to air pollution.
3. Claims are that birth defects in the USSR rising by 5 to 6% per annum and this is attributed to a variety of forms of pollution. Misuse and overuse of pesticides and fertilizers, the careless release of industrial waste and heavy metals into the waters and radiation from poorly safeguarded nuclear facilities.
4. Self-inflicted trauma may be on the rise but the data are difficult to obtain, however accidents in factories and agriculture account for a substantial part of the rise in death rates in men in their late 30s.
6. Influenza which is under control in the rest of the industrial world kills tens of thousands babies each year. Many of the victims appear to have nutritional deficiencies such as rickets.

Soviet investments in health have been primarily in the expansion of capital facilities rather than upgrading of existing facilities or investment in human resources. Other budget pressures have reduced the

share of GNP devoted to health from 6.6% in 1965 to 5.2% in 1978.

The support of aspects of life in the Soviet Union is breaking down, family unity is less strong, the high death rate of children in day care centers, the frequency of abortion (4 times the number of live births), the high absenteeism rate in industry and the poor quality of personal services all suggest alienation, depression, debilitation of the work force and demoralization of the population. Does this represent an example of the third stage in the evolution of the health services?

cc: Mr. Warford

THE EPIDEMIOLOGIC TRANSITION
A Theory of the Epidemiology of Population Change

ABDEL R. OMRAN

Although demography continues to be the most prominent discipline concerned with population dynamics, involvement of other disciplines is highly desirable. The case for a multidisciplinary approach to population theory has been aptly stated by Kurt Mayer: "Any meaningful interpretation of the cause and effects of population changes must . . . extend beyond formal statistical measurement of the components of change, i.e. fertility, mortality and migration, and draw on the theoretical framework of several other disciplines for assistance."[1] In noting that the "analysis of the causal determinants and consequences of population change forms the subject matter of population theory," Mayer inferentially acknowledges the epidemiologic character of population phenomena, for as its etymology indicates, (*epi,* upon; *demos,* people; *logos,* study), epidemiology is the study of what "comes upon" groups of people. More specifically, epidemiology is concerned with the distribution of disease and death, and with their determinants and consequences in population groups. Inasmuch as patterns of health and disease are integral components of population change, epidemiology's reservoir of knowledge about these patterns and their determinants in population groups serves not only as a basis for prediction of population change but also as a source of hypotheses that can be further tested to correct, refine and

build population theory. Furthermore, many epidemiologic techniques that have heretofore been limited to the examination of health and disease patterns can be profitably applied as well to the exploration of other mass phenomena, such as fertility control.

A theory of epidemiologic transition, sensitive to the formulations of population theorists who have stressed the demographic, biologic, sociologic, economic and psychologic ramifications of transitional processes, was conceived by this author less than four years ago. Recognition of the limitations of demographic transition theory and of the need for comprehensive approaches to population dynamics stimulated the development of this theory.[2]

FOCUS OF THE THEORY OF EPIDEMIOLOGIC TRANSITION

Conceptually, the theory of epidemiologic transition focuses on the complex change in patterns of health and disease *and* on the interactions between these patterns and their demographic, economic and sociologic determinants and consequences. An epidemiologic transition has paralleled the demographic and technologic transitions in the now developed countries of the world and is still underway in less-developed societies. Ample evidence may be cited to document this transition in which degenerative and man-made diseases displace pandemics of infection as the primary causes of morbidity and mortality.

The major precepts of the theory of epidemiologic transition are presented below. Smoothed data from the United Nations Model Life Tables,[3] representing a "pooled" cross-cultural view of mortality patterns at various life expectancy levels, provides a useful introduction to the basic propositions.* The longitudinal view added by historical and contemporary data from several countries provides further documentation; data from individual countries also serve to illustrate some of the peculiar variations

*Data for the U.N. Model Life Tables are gathered from a number of countries around the world, with some unavoidable over-representation of countries that are now developed because their vital statistics are more complete and more accurate than those for less developed countries.

of the transition and to support three models that differentiate distinctive patterns of the epidemiologic transition. These models are the Classical or Western Model, as represented here by England and Wales and Sweden; the Accelerated Transition Model, as represented by Japan; and the Contemporary or Delayed Model as represented by Chile and Ceylon.

What begins as an apparently academic exercise, attempting to describe and disentangle the determinants and consequences of changing disease patterns that have accompanied modernization in most western countries, is aimed as well at shedding light on the tenacious population problems of less-developed countries. For example, policy makers tend to see high fertility as the intractable villain, creating acute population pressures and oppressive socioeconomic conditions in developing societies; consequently, programs to treat these onerous problems have been geared almost exclusively to birth control. One of the major practical implications stemming from historical studies of the epidemiologic transition in western countries is that disease control programs may be not only a prerequisite of fertility transition but an effective instrument of socioeconomic development as well.

MORTALITY AND POPULATION DYNAMICS

Proposition One: The theory of epidemiologic transition begins with the major premise that mortality is a fundamental factor in population dynamics. The clearest indication of mortality's dominant role in population dynamics is implicit in theories of population cycles. The cyclic rises and falls in population size that have been observed in animal and pre-modern human populations reflect sequential phases of population growth and decline; disregarding the possible selective influences of migration, these cyclic movements must ultimately be accounted for in terms of the range of variation in fertility and mortality.

Although the absence of continuous information on the

actual levels of fertility and mortality in pre-modern societies precludes deterministic statements about their relative demographic impact, an assessment of the possible range of variations in fertility and mortality does allow probabilistic conclusions. Obviously, the range for fertility is framed by a biologic maximum and a realistic minimum shaped by fecundability, by female survival chances during fertile ages and by marriage and contraceptive practices. Because of the low motivation to limit births and the comparatively ineffective contraceptive methods available in pre-modern societies, the broadest range for fertility was probably about 30 to 50 births per 1,000 population. In contrast, the range for mortality was much greater as there was virtually no fixed upper limit to the death rate. Although 30 deaths per 1,000 population may be a reasonable approximation of mortality's lower asymptote, its upper asymptote in pre-modern societies could have been many times as high in epidemic and famine years. Consequently, even if fertility approached its biologic maximum, depopulation could and did occur as a result of epidemics, wars and famines, which repeatedly pushed mortality levels to high peaks.

The scanty evidence that is available indicates that frequent and violent fluctuations characterized the mortality patterns of pre-modern societies and that the mortality level was extremely high even in the so-called good years. Caught between the towering peaks of mortality from epidemics and other disasters and the high plateaus of mortality dictated by chronic malnutrition and endemic diseases, life expectancy was short and human misery was assured. Several authors have suggested low yet fluctuating life expectancies on the order of 18 for ancient Greece,[4] 22 for Rome, 17 and 35 for medieval Britain,[5] and 22, 26 and 34 in the sixteenth, seventeenth and eighteenth centuries, respectively, for Geneva.[6] With such short life expectancy at birth, populations were typically young, and population growth was cyclic with only small net increments over long periods of time. Thus, more than any other single factor, fluctuating but always high mortality offers the most likely explanation of the slow rate of world population growth until 1650 A.D.

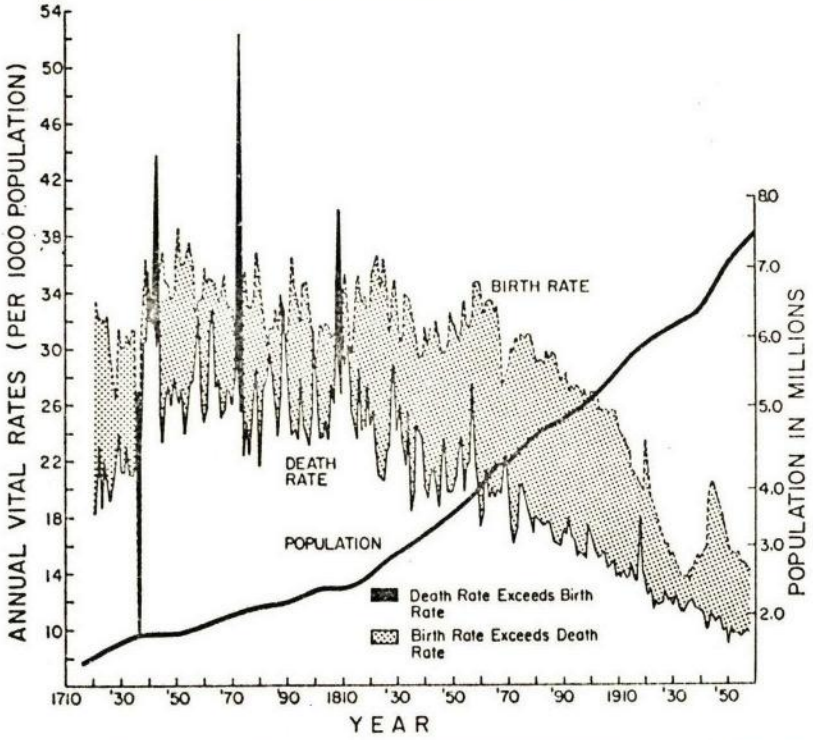
In the modern period after 1650 the growth curve of world population departed from the cyclic pattern and assumed an exponential form. However, mortality continued to be of overwhelming importance in determining population movements before the Industrial Revolution in the west, as is indicated by a number of studies.[7-10] Vital statistics gleaned from several parish register studies show that both fertility and mortality were extremely variable and moderately high and that the range of variation in mortality was significantly greater than in fertility in the early part of the modern era, as shown in Table 1. No secular downward trend in mortality is apparent in any country before the middle of the eighteenth century, about the same time that population growth began to demonstrate an exponential curve. The initial period of sustained population growth in nearly every country for which reliable data are available corresponds with at least two decisive changes in the death rate. First the fluctuations in mortality became less frequent and less drastic. Second, the initial, slow—sometimes imperceptible—decline in mortality gradually gained momentum

TABLE 1. BIRTH AND DEATH RATES FROM THE LATE SEVENTEENTH THROUGH THE EIGHTEENTH CENTURY IN SWEDEN AND ENGLAND

Area	*Period*	*Range of Variation*	
		Birth Rate	*Death Rate*
Narke, central Sweden	1691–1750	28.6–38.1	17.1–41.7
Sweden	1721–1800		
five-year average		31.3–37.1	21.2–32.9
annual		28.7–38.7	18.4–52.4
Worcestershire, England	1665–1780	34.0–47.5	26.9–51.6
Nottingham, England	1700–1795	31.6–46.3	31.2–48.3

Sources: Utterstrom, G. Two Essays on Population in Eighteenth Century Scandinavia, *in* Glass, D. V. and Eversley, D. E. C. (Editors), POPULATION IN HISTORY, Chicago, Aldine Publishing Company, 1965, pp. 523-548; Eversley, D. E. C., A Survey of Population in an Area of Worcestershire from 1660 to 1850 on the Basis of Parish Registers, *Population Studies*, 10, 253–279, 1957; Chambers, J. D., Three Essays on the Population and Economy of the Midlands, *in* Glass and Eversley, *op. cit.*, pp. 308-353; Vielrose, E., ELEMENTS OF THE NATURAL MOVEMENT OF POPULATIONS, Oxford, Pergamon Press, Inc., 1965.

FIGURE 1. THE TRANSITION IN SWEDEN



Source: Vielrose, E., ELEMENTS OF THE NATURAL MOVEMENT OF POPULATIONS, Oxford, Pergamon Press, Inc., 1965.

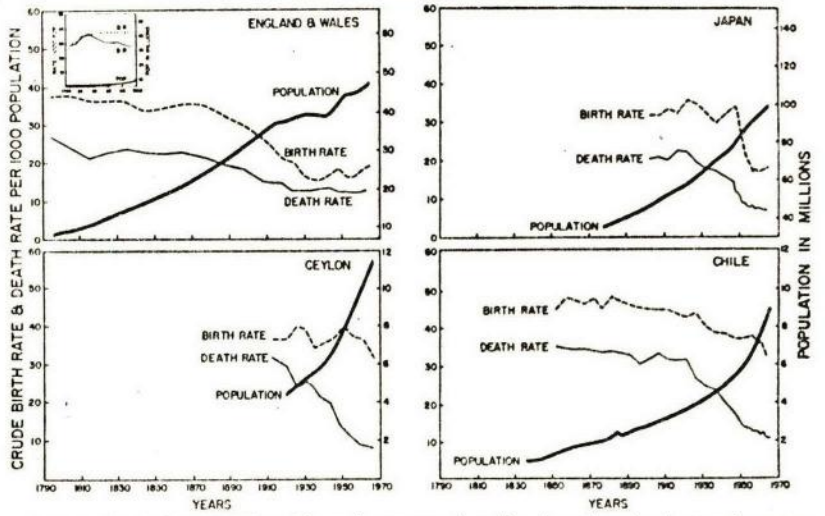
and eventually stabilized at relatively low levels in the twentieth century. Thus steady rises in life expectancy, progressively diminishing death rates and more stable and predictable mortality patterns have accompanied the persistent increments in world population.

The strong association between the level and range of fluctuation in the death rate and the pace of population growth is shown in Figure 1, which is based on annual vital rates for Sweden. As long as perennial epidemics, plagues, famines and wars acted unpredictably and virtually uncontrollably to produce recurring high peaks of mortality, uninterrupted popula-

tion growth was not likely—even when fertility was persistently high. As fluctuations in mortality became less severe and the peaks less frequent, Swedish population began to grow exponentially; this pattern has been shown by historical studies to have occurred in several other geographically and culturally distinct populations.[7-13]

Demographic trends for England and Wales, Japan, Ceylon and Chile are compared in Figure 2. In each country an exponential pattern of population growth accompanies the secular downward trend in mortality. In England and Wales, where the transition from high to low vital rates occurred over

FIGURE 2. DEMOGRAPHIC TRENDS IN SELECTED COUNTRIES



Sources: England and Wales eighteenth century data (inset) and early nineteenth century data (to 1841) are Brownlee's estimates, cited by Glass, D. V., Population and Population Movements in England and Wales, 1700 to 1850, *in* Glass, D. V. and Eversley, D. E. C. (Editors), POPULATION IN HISTORY, Chicago, Aldine Publishing Company, 1965, pp. 221-246; data for 1841-50 and 1951-55 are from Glass, D. and Grebenik, E., World Population, 1800-1950, IN Habakkuk, H. J. and Postan, M. (Editors), THE CAMBRIDGE ECONOMIC HISTORY OF EUROPE, Vol. VI, Cambridge, Cambridge University Press, 1965, pp. 56-138; data since 1955 are from DEMOGRAPHIC YEARBOOK, 1963 and DEMOGRAPHIC YEARBOOK, 1967, New York, United Nations. Data for Japan, 1900-04 to 1958 are from Taeuber, I., Japan's Demographic Transition Re-examined, *Population Studies*, 14, 28-39, 1960-61; data since 1958 from DEMOGRAPHIC YEARBOOK, *op. cit.* Data for Chile, 1850-54 to 1960-64, are from Collver, O. A., BIRTH RATES IN LATIN AMERICA: NEW ESTIMATES OF HISTORICAL TRENDS AND FLUCTUATIONS, Research Series No. 7, Berkeley, Institute of International Studies, University of California, 1965; data since 1962 from DEMOGRAPHIC YEARBOOK, 1967, *op. cit.* Data for Ceylon, 1911-13 to 1936 are from International Vital Statistics, *Vital Statistics Special Reports*, 9, May 2, 1940; 1936-38 to 1946 data from ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1939-1946, Geneva, World Health Organization, 1951; data since 1947 from DEMOGRAPHIC YEARBOOK, 1953, 1963, and 1967, *op. cit.*

two centuries, the exponential growth curve was attenuated only after fertility fell and approached the low level of mortality; this pattern is less apparent for Japan, where an accelerated transition occurred over several decades. Although data concerning the relative effects of mortality and fertility on population growth are incomplete for the early transitional period, it seems likely that a significant though temporary increase in fertility may have added momentum to the population explosion set off by steady improvements in survivorship. The influence of fertility is particularly apparent in the rapid population growth of currently developing nations that have not yet completed their transitions; see for example the graphs for Chile and Ceylon in Figure 2. In most of these developing countries, the death rate has declined rapidly in recent years, especially since World War II, and the birth rate has remained high with minor fluctuations. This sudden widening of the demographic gap has produced unprecedentedly high rates of population growth, as can be seen by comparing the growth curves of the four countries in Figure 2.

SHIFTS IN MORTALITY AND DISEASE PATTERNS

Proposition Two: During the transition, a long-term shift occurs in mortality and disease patterns whereby pandemics of infection are gradually displaced by degenerative and man-made diseases as the chief form of morbidity and primary cause of death. Typically, mortality patterns distinguish three major successive stages of the epidemiologic transition:

1. *The Age of Pestilence and Famine* when mortality is high and fluctuating, thus precluding sustained population growth. In this stage the average life expectancy at birth is low and variable, vacillating between 20 and 40 years.
2. *The Age of Receding Pandemics* when mortality declines progressively; and the rate of decline accelerates as epidemic peaks become less frequent or disappear. The average life expectancy at birth increases steadily from about 30 to about 50 years. Population growth is sustained and begins to describe an exponential curve.
3. *The Age of Degenerative and Man-Made Diseases* when mortality continues to decline and eventually approaches stability at a relatively low level. The average life expectancy at birth rises gradually until it exceeds 50 years. It is during this stage that fertility becomes the crucial factor in population growth.

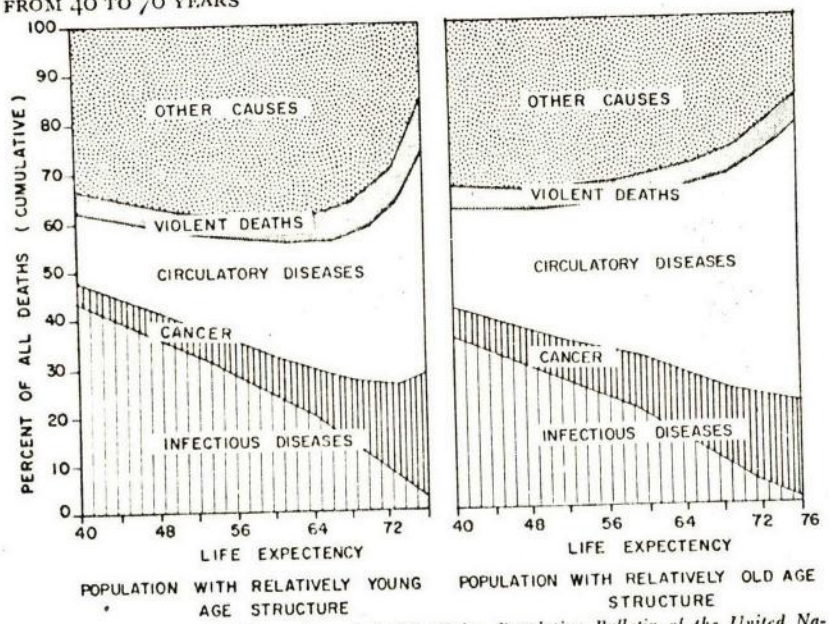
The Age of Pestilence and Famine represents for all practical purposes an extension of the pre-modern pattern of health and disease. In this stage the major determinants of death are the malthusian "positive checks," namely, epidemics, famines and wars. Graunt's study of London's Bills of Mortality[14] in the mid-seventeenth century shows, for example, that nearly three-fourths of all deaths were attributed to infectious diseases, malnutrition and maternity complications; cardiovascular disease and cancer were responsible for less than six per cent.* (See graph for seventeenth century London in Figure 4).

United Nations compilations, which were used to calculate the cumulative cause-of-death ratios for successive life expectancy levels, show that disease patterns change markedly as life expectancy rises.[15] Two sets of data are given according to the preponderant age structure, whether "young" or "old." The trends in the cause-of-death ratio for both population structures are given in Figure 3 and indicate the progressive decline in infectious diseases and concomitant increase in degenerative diseases (as indicated by the cardiovascular and cancer categories) as life expectancy improves.

Similar trends are described by the cause-of-death statistics for a number of individual countries, as shown in Figure 4. The gradual shift in disease patterns characteristic of the classical transition can be seen in the steady decline of infectious diseases (including tuberculosis and diarrhea) and the moderate increase in cancer and cardiovascular diseases in England and

*These figures are quoted only to indicate the relative magnitude of the problem as the deficiencies in reporting and diagnosis are well recognized.

FIGURE 3. PATTERN OF MORTALITY TRENDS (STANDARDIZED MORTALITY) BY CAUSE-OF-DEATH GROUPS FOR EXPECTATION OF LIFE AT BIRTH FROM 40 TO 76 YEARS



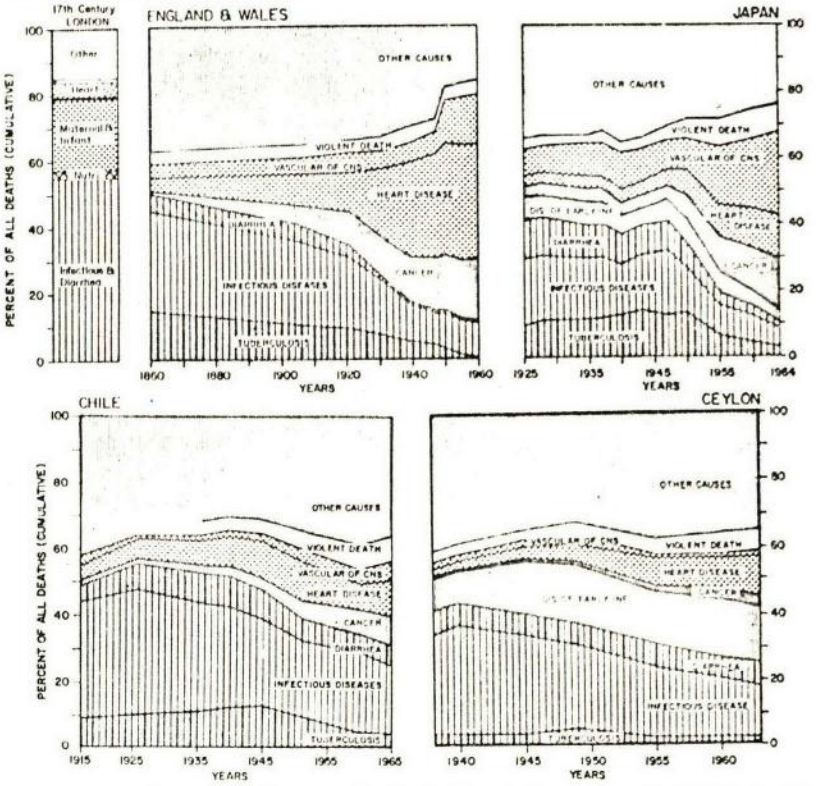
Source: Department of Economic and Social Affairs, *Population Bulletin of the United Nations*, 6, 110-112, 1962.

Wales up to 1920. After World War I, the decline of infectious and rise of degenerative diseases is more distinct, and since 1945 the increase in cardiovascular deaths is particularly striking. The shift from infectious to degenerative disease predominance is more readily apparent for Japan, which has experienced an accelerated transition in only a few decades. Among currently developing nations, the transition from infectious to degenerative disease predominance has started but has not yet been completed, as shown by the graphs for Chile and Ceylon in Figure 4. The recession of infectious diseases that began in Chile in the 1920's has been gradual but discernible. In Ceylon this shift was delayed even further until the late 1940's.

The determinants of the transition from infectious to degenerative disease predominance are by no means simple. Their

detailed treatment is beyond the scope of this paper; however, it may be useful to mention three major categories of disease determinants.

FIGURE 4. TRENDS IN CUMULATIVE CAUSE OF DEATH RATIOS FOR BOTH SEXES IN VARIOUS COUNTRIES



Sources: Data for seventeenth century London in Graunt, J., NATURAL AND POLITICAL OBSERVATIONS MADE UPON THE BILLS OF MORTALITY, Baltimore, The Johns Hopkins Press, 1939 (first published in London, 1662); data for England and Wales 1848 to 1947 from Logan, W. P. D., Mortality in England and Wales from 1848 to 1947, *Population Studies*, 4, 132-178, September 1950; data since 1947 from ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1960, Geneva, World Health Organization, 1963. Data for Japan, 1925, are from REPORT PREPARED BY THE CENTRAL SANITARY BUREAU OF THE HOME DEPARTMENT, Tokyo, 1925; data for 1935 from International Vital Statistics, *Vital Statistics Special Reports*, 9, May 2, 1940; data for 1940, 1960 and 1964 are from ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1939-46, 1960 and 1964, *op. cit.*; data for 1947, 1950, 1955 and 1965 are from DEMOGRAPHIC YEARBOOK, 1953, 1956 and 1967, New York, United Nations. Data for Chile, 1917 and 1926, are from STATISTICAL YEARBOOK OF THE REPUBLIC OF CHILE, 1, 1926; data for 1936 are from *Vital Statistics Special Reports*, 1938; data for 1940-1955 are from ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1939-46, 1950 and 1956, *op. cit.*; data for 1960-65 are from DEMOGRAPHIC YEARBOOK, 1966 and 1967. *op. cit.* Data for Ceylon, 1938-1960, are from ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1939-46, 1950, 1956 and 1960, *op. cit.*; data for 1963-65 are from DEMOGRAPHIC YEARBOOK, 1963 and 1967. *op. cit.*

1. Ecobiologic determinants of mortality indicate the complex balance between disease agents, the level of hostility in the environment and the resistance of the host. More often than not, however, even these determinants cannot be categorically specified. One outstanding example is the recession of plague in most of Europe toward the end of the seventeenth century. The reasons for this recession are not fully understood, although the mysterious disappearance of the black rat may have been a contributing factor. Nonetheless, it is relatively certain that with the possible exception of smallpox, the recession of plague and many other pandemics in Europe was in no way related to the progress of medical science.[16]
2. Socioeconomic, political and cultural determinants include standards of living, health habits and hygiene and nutrition. Hygiene and nutrition are included here, rather than under medical determinants because their improvement in western countries was a byproduct of social change rather than a result of medical design.
3. Medical and public health determinants are specific preventive and curative measures used to combat disease; they include improved public sanitation, immunization and the development of decisive therapies. Medical and public health factors came into play late in the western transition, but have an influence early in the accelerated and contemporary transitions.

The reduction of mortality in Europe and most western countries during the nineteenth century, as described by the classical model of epidemiologic transition, was determined primarily by ecobiologic and socioeconomic factors. The influence of medical factors was largely inadvertent until the twentieth century, by which time pandemics of infection had already receded significantly. The mortality decline in currently developing countries has been more recent and the effect of medical factors has been more direct and more salient, as shown

by the contemporary or delayed transition model. In the Afro-Asian countries in particular, the tremendous impact of imported medical technologies on mortality has been magnified by massive public health programs. Although it would be naive to attempt precise identification of the complex determinants in each case, it does seem apparent that the transition in the now developed countries was predominantly socially determined, whereas the transition in the "third world" is being significantly influenced by medical technology.

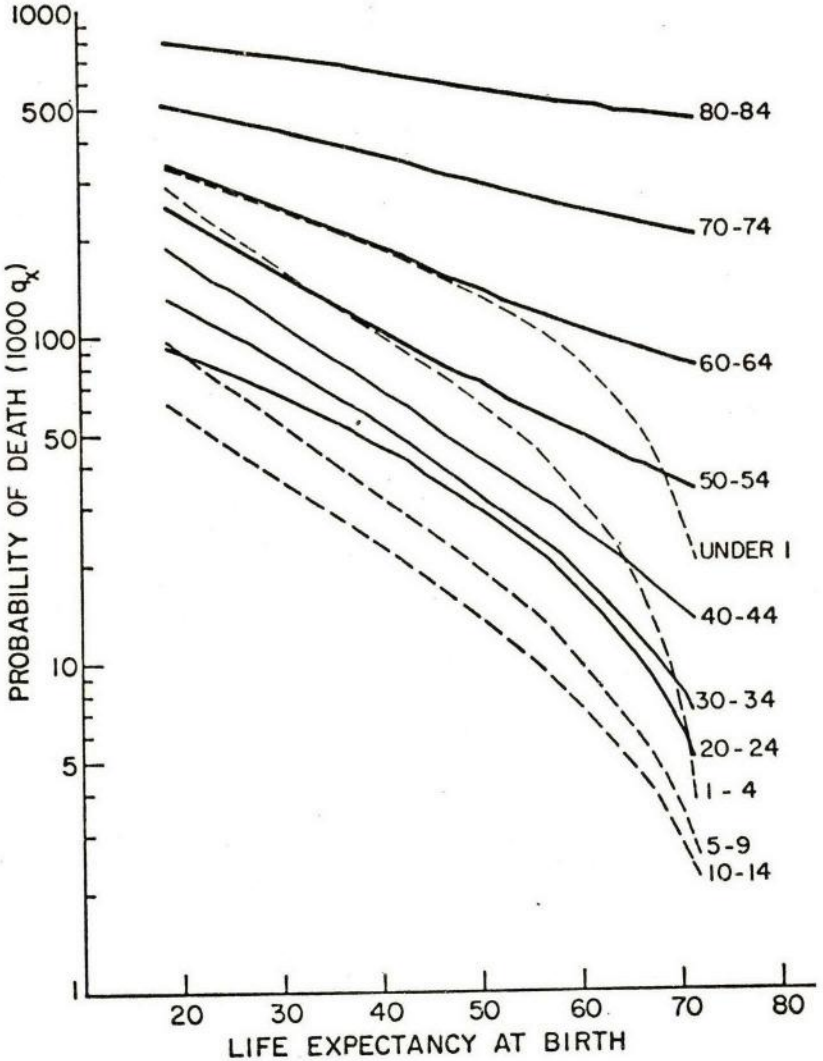
RELATIVE RISKS OF MORTALITY BY AGE AND SEX

Proposition Three: During the epidemiologic transition the most profound changes in health and disease patterns obtain among children and young women. The genuine improvements in survivorship that occur with the recession of pandemics are peculiarly beneficial to children of both sexes and to females in the adolescent and reproductive age periods, probably because the susceptibility of these groups to infectious and deficiency diseases is relatively high.

Childhood survival is significantly and progressively improved as pandemics recede in response to better living standards, advances in nutrition and early sanitation measures and is further enhanced as modern public health measures become available. Data from the U.N. Model Life Tables were used to calculate the trend in the probability of death for various age groups with the transition from life expectancy level 20 to level 74 as shown in Figure 5.

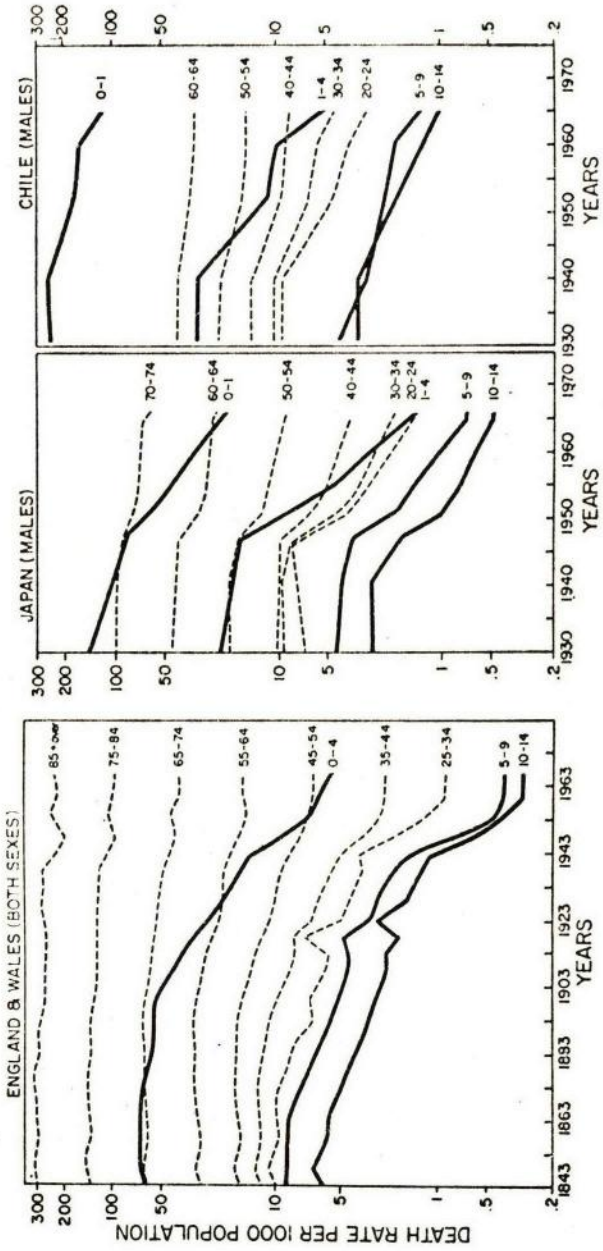
Although all age groups benefit from the shift in disease patterns and the increase in life expectancy, the decline in childhood mortality is demonstrably the greatest, especially in the one to four year age group. The age-specific death rate trends for England and Wales, Japan and Chile, depicted by the three graphs in Figure 6, reflect this phenomenon. The point in time that marks the beginning of progressive improvement in survival of children (0–15 years), differs from one country to an-

FIGURE 5. TRENDS IN THE PROBABILITY OF DEATH (LIFE TABLE MORTALITY) FOR AGE GROUPS WITH INCREASING LIFE EXPECTANCY AT BIRTH (BOTH SEXES)



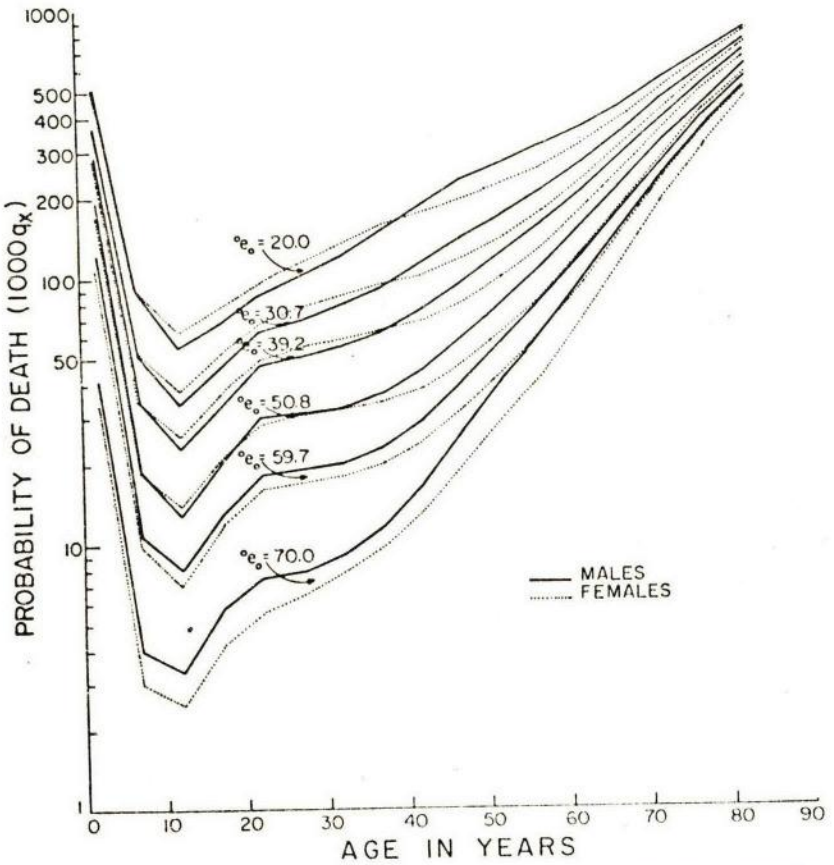
Source: Department of Social Affairs, Population Branch, Age and Sex Patterns of Mortality: Model Life Tables for Underdeveloped Countries, *Population Studies*, No. 22, New York, United Nations, 1955.

FIGURE 6. TRENDS IN AGE-SPECIFIC DEATH RATES IN VARIOUS COUNTRIES (SEMILOGARITHMIC SCALE)



Sources: Data for 1841–45 to 1951–55 are from Vielrose, E., ELEMENTS OF THE NATURAL MOVEMENT OF POPULATIONS, Oxford, Pergamon Press, Inc., 1965 and DEMOGRAPHIC YEARBOOK, 1963 and 1967, New York, United Nations. Data for Japan, 1929–1948, are from *Vital Statistics Special Reports*, 1938; and ANNUAL EPIDEMIOLOGIC AND VITAL STATISTICS, 1939–46, Geneva, World Health Organization; data for 1951–66 are from DEMOGRAPHIC YEARBOOK, 1953 and 1967, *op. cit.* Data for Chile, 1930–32, are from *Vital Statistics Special Reports*, 1938; data for 1940–1965 are from DEMOGRAPHIC YEARBOOK, 1933, 1966 and 1967, *op. cit.*

FIGURE 7. PROBABILITY OF DEATH (1,000 q_x) BY AGE AND SEX AT VARIOUS LEVELS OF LIFE EXPECTANCY AT BIRTH



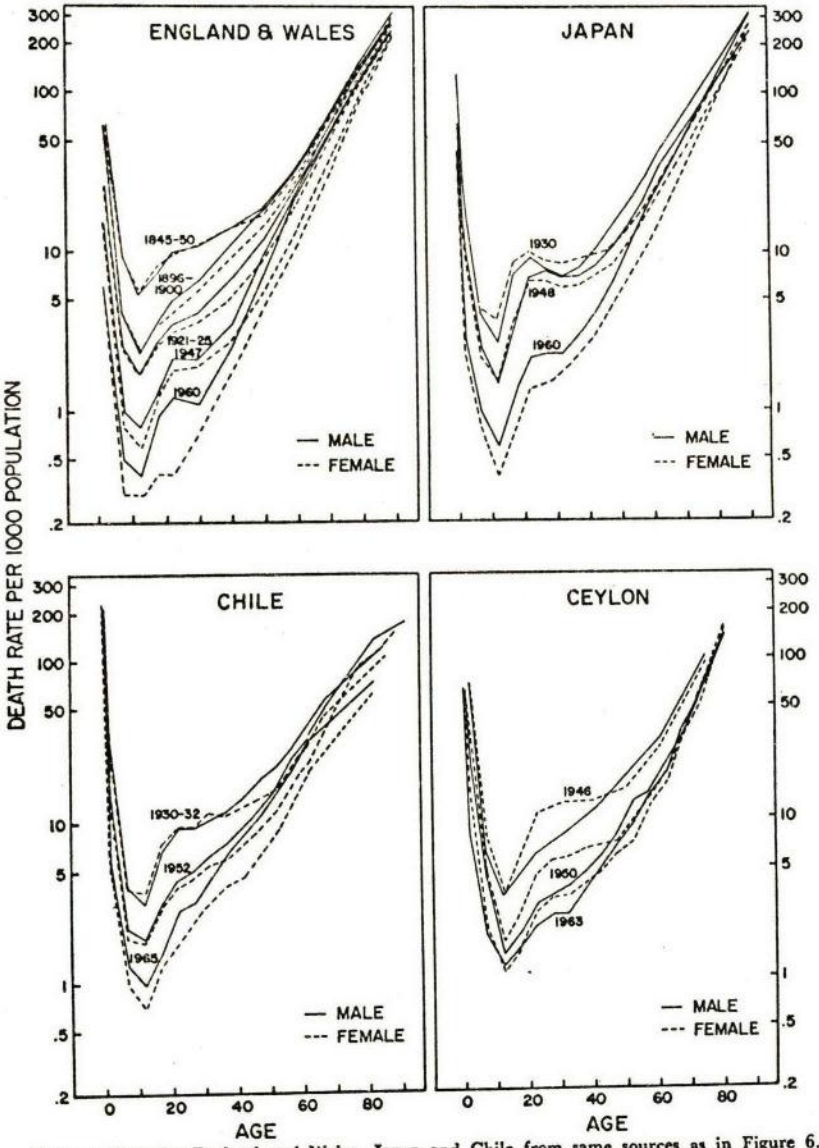
Source: Department of Social Affairs, Population Branch, Age and Sex Patterns of Mortality: Model Life Tables for Underdeveloped Countries, *Population Studies*, No. 22, New York, United Nations, 1955.

other. In England, childhood mortality has obviously been dropping steadily since the late nineteenth century and in Japan since sometime between the two World Wars. In Chile, although measurable drops in childhood mortality have been registered since 1940, the death rates for infants and children still remain very high; for example, the mortality risks of infants (0–1) and young children (1–4) were, respectively, 5.2 and 3.2 times higher in Chile than in Japan in 1965.

Data from the U.N. Model Life Tables are plotted in Figure 7 to show the probability of death by age and sex at different life expectancy levels. Females' risk of dying is less than that for males in the post-reproductive period at *all* life expectancy levels, but females have a higher probability of death during the adolescent and reproductive age intervals at low life expectancy levels. During the transition from infectious to degenerative disease predominance, women switch from a level of mortality in the reproductive years higher than that of men to a level more advantageous, such that the female's higher relative risk of death disappears at about the level of 50 years life expectancy and becomes lower than that of males thereafter.

Age and sex mortality profiles for England and Wales, Japan, Chile and Ceylon are given in Figure 8; in each case the overall mortality risks diminish progressively with time, and the female risk of death, which is greater initially, gradually approaches the male level. The pattern of change in male/female relative risk appears similar for England, Japan and Chile, and although the accelerated timing of the transition in Japan is distinctive, the most recent data for Japan (1960) and Chile (1965) show relative risks that are remarkably similar to that for England in 1947. The phenomenon of superior survival chances for females, which is most strikingly depicted by the English data for 1960 and is typical of western countries, may be replicated in other countries as fertility declines and as modern industrial society develops and places peculiar stresses on male members of society. The pattern of male/female relative risk presented by Ceylon may be typical of many Afro-Asian countries where high fertility and certain cultural factors have been offered in explanation of continued high relative risks for females.[17]

FIGURE 8. TRENDS IN AGE AND SEX PROFILES OF MORTALITY IN VARIOUS COUNTRIES (SEMILOGARITHMIC SCALE)



Sources: Data for England and Wales, Japan and Chile from same sources as in Figure 6. Data for Ceylon are from DEMOGRAPHIC YEARBOOK, 1948, 1949–50, 1959, 1960 and 1965, New York, United Nations.

Proposition Four: The shifts in health and disease patterns that characterize the epidemiologic transition are closely associated with the demographic and socioeconomic transition that constitute the modernization complex.

Interactions with Demographic Changes

The decline in mortality that comes with the epidemiologic transition widens the "demographic gap" between birth rates and death rates and hence affects demographic change by bolstering population growth (see Figure 2). In a more subtle manner, the mortality transition affects demographic movements indirectly through its impact on fertility and population composition.

During the course of the epidemiologic transition, sequential changes occur in the age and sex structure and the dependency ratios of populations. During the Age of Pestilence and Famine infectious disease and chronic malnutrition exact a particularly high toll among children and women in the adolescent and reproductive years; only small proportions of the population survive the high mortality of youth. The young dependency ratio is thus quite high and continues to be so in the early stage of the Age of Receding Pandemics; throughout these periods, the population comprises about the same proportions of males and females or a slightly higher proportion of males. As infectious diseases recede and larger segments of the population survive childhood, the dependency ratio becomes more balanced. Finally, during the Age of Degenerative and Man-made Diseases, the tremendous improvements in survivorship registered among all age groups except the very old are reflected by a more uniform population distribution; at the same time the old dependency ratio increases and the male to female ratio is typically less than unity within the older age groups.

The improvements in female and childhood survival that occur with the shift in health and disease patterns discussed above have distinct and seemingly contradictory effects on

fertility. On one hand, the better health and greater longevity increasingly enjoyed by females of reproductive ages tend to enhance fertility performance. On the other hand, the drastic reduction in risks to infants and young children that occurs in the later stages of the transition tends to have an opposite effect on natality; that is, prolonged lactation associated with reduced mortality among infants and toddlers and parental recognition of improved childhood survival tend to lengthen birth intervals and depress overall reproductive performance.

Calculations derived from two independent simulation models, illustrate the differential effects of changing mortality on fertility as shown in Table 2. In part A of the table, Ridley, *et al.*, present estimates of the probable reproductive performance of women aged 15 to 50 under varying mortality conditions.[18] The REPSIM model from which these estimates were calculated assumed a short postpartum nonsusceptible period after each live birth, thereby "controlling" for the deflationary effect of improved childhood survival on fertility. The REPSIM estimates of the net reproduction rate can be seen to rise steadily with improvements in female survival; *in the absence of contraception,* the enhanced fertility performance simulated by this model can be largely attributed to the increasing probability of surviving the reproductive period.

The data given in part B of the same table are based on Heer's simulation model for estimating the effects of son survivorship on reproductive behavior; this model assumes that each couple continues to have children until they are 95 per cent certain that at least one son will survive until the father's 65th birthday and that birth control is practiced and is completely effective whenever couples cease to "want" children.[19] This model thus shows a decrease in the net reproduction rate as child survival chances improve. Further proof of this is provided by empirical data from Hassan's work.[20]

Because the probability of a female surviving the reproductive period usually increases earlier in the transition than improvements in infant and childhood survival, fertility may rise

TABLE 2. THE EFFECTS OF IMPROVED SURVIVORSHIP ON FERTILITY AS ESTIMATED BY TWO INDEPENDENT SIMULATION MODELS

*Part A: Changes in Fertility Performance with Improvements in Female Survival and in the Absence of Deliberate Fertility Regulation**

Life Expectancy Level	*Per Cent of Women Surviving From Age 15 to 50*	*Estimated Loss in Married Life Due to Mortality*	*Mean Number of Live Births per Woman*	*Net Reproduction Rate*
31	52	11.7 Years	7.1	2.0
41	68	8.2	7.8	2.7
51	80	5.5	8.6	3.3
61	89	3.4	9.0	3.9
71	95	1.5	9.7	4.6

*Part B: Changes in Fertility Performance with Improvements in Survivorship With Completely Effective Contraception When a Couple is 95% Certain that a Son will Survive to Father's 65th Birthday***

Life Expectancy Level	*Probability of Son's Death Before Father Reaches Age 65*	*Number Male Births for at Least One to Survive Father's 65th Birthday*	*Percentage Wives Never Bearing Needed Number of Sons*	*Female Net Reproduction Rate*
20	.695	9	91.4	1.75
30	.551	6	35.3	2.39
40	.435	4	6.1	2.32
50	.323	3	1.6	2.13
60.4	.204	2	0.2	1.64
70.2	.083	2	0.2	1.81

**Source:* Ridley, J. C., *et al.*, The Effects of Changing Mortality on Natality: Some Estimates from a Simulation Model, *Milbank Memorial Fund Quarterly*, 45, 77-97, January, 1967.

***Source:* Heer, D. M., Births Necessary to Assure Desired Survivorship of Sons Under Differing Mortality Conditions, paper presented at annual meetings of the Population Association of America, New York, April 1966.

in the early stage of the epidemiologic transition. The tendency of improved infant and childhood survival to depress fertility in the middle and subsequent stages of the transition can be attributed largely to the following factors:

1. Biophysiologic factors: The increased chance that a live birth will survive infancy and early childhood and result in prolonged lactation tends to lengthen the mother's postpartum period of natural protection against concep-

tion. Another run of the REPSIM model, which simulated both long and short postpartum periods as a function of the probable pregnancy outcome, shows a moderately declining net reproduction rate at higher life expectancy levels. These data also indicate that the interval between births increases progressively at all parities as life expectancy rises. Ridley, *et al.*, concluded that the lengthening of birth intervals, particularly among young, highly fecund, low-parity women, has a deflationary effect on ultimate parity and is a major mechanism linking improved survival and lowered fertility.

2. Socioeconomic factors: The risk of childhood death is lowered by better nutrition and sanitation as socioeconomic conditions improve. As the probability of child survival increases, the desirability of having many children may diminish in response to changes in the social and economic system that cast the child as an economic liability rather than asset. Concomitantly, improvements in birth control technology facilitate the achievement of emerging small family size norms.
3. Psychologic or emotional factors: Improved infant and childhood survival tends to undermine the complex social, economic and emotional rationale for high parity for individuals and hence high fertility for society as a whole. As couples become aware of the near certainty that their offspring, particularly a son, will survive them, the likelihood of practicing family limitation is enhanced. Not only are compensatory efforts to "make up" for lost children reduced, but the investment of parental energies and emotions may take on a new, qualitative dimension as each child in the small family is provided better protection, care and education.

Interaction with Socioeconomic Changes

The interactions between the epidemiologic and socioeconomic transitions are also complex. Whether the epidemiologic

TABLE 3. ESTIMATED EXCESSES IN ECONOMIC CONSUMPTION AND OUTPUT AT VARIOUS AGES

Excess in Consumption During Various Age Periods		*Excess in Output During Various Age Periods*	
0– 1	50	20–25	260
1– 5	225	25–30	300
5–10	332	30–35	350
10–15	450	35–40	350
15–20	350	40–45	320
65–70	350	45–50	290
70–75	400	50–55	260
75–80	500	55–60	215
80+	650	60–65	85

Source: Sauvy, A., GENERAL THEORY OF POPULATION, New York, Basic Books, Inc., Publishers, 1969, p. 250.

transition is effected chiefly by socioeconomic improvements (as in now developed countries) or by modern public health programs (as has been the case in currently developing countries), the lowering of mortality and of infectious disease tends to increase the effectiveness of labor and hence economic productivity, both through better functioning of adult members of the labor force and through an increase in the proportion of children who survive and mature into productive members of society.

A gross assessment of the economic effects of the mortality transition that occurs with the shift in health and disease patterns can be made by subjecting a given set of consumption-production patterns to the varying mortality conditions outlined by the U.N. Model Life Tables. Based on the axiom that a person *consumes* a certain amount of wealth (for food, shelter, clothing and so forth) and *produces* a certain amount, a schedule of consumption-production values was developed by Sauvy to indicate the relative excesses in consumption and output that obtain at various age periods during the life of one man, as shown in Table 3. As indicated by these approximate values, output exceeds consumption in the middle years of life (roughly age 20 to age 65) while the costs of rearing children (providing training and education as well as vital necessities) and the costs

TABLE 1. THE CLASSICAL (WESTERN) MODEL OF THE EPIDEMIOLOGIC TRANSITION

	AGE OF PESTILENCE AND FAMINE	AGE OF RECEDING PANDEMICS EARLY PHASE	AGE OF RECEDING PANDEMICS LATE PHASE	AGE OF DEGENERATIVE AND MAN-MADE DISEASE
DEMOGRAPHIC PROFILE				
Population Growth	The pattern of growth until about 1650 is cyclic, with minute net increments; mortality dominates with crude death rates of from 30 to more than 50/1000 and with frequent higher peaks. Fertility is at a sustained high level of 40 or more per 1000.	Mortality continues high (30-50+/1000) but peaks are less frequent and the general level begins declining. Fertility remains high (40+/1000). The demographic gap widens somewhat, and there is a net population increase which, though small, is cumulative.	Mortality slowly but progressively declines from higher than to lower than 30/1000. Several decades after mortality declines, fertility starts to decline also. Population growth is explosive for most of this period.	Mortality declines rapidly to below 20/1000; then the rate of decline slows. Fertility declines to below 20/1000 (with occasional rises, e.g. the post-World War II baby boom) and becomes chief pace maker of population growth; fluctuation is by design more than by chance. Population growth is small but persistent.
Population Composition	The population is predominantly young, with very large young and very small old dependency ratios, and a slight excess of males (100+M/100F). Residence is mainly rural with a few crowded, unsanitary, war-famine-epidemic ridden cities of small or medium size.	The population is still young, though the proportion of older people begins to increase. The male-female ratio is near unity (100M/100F). Residence is still primarily rural but with a progressive exodus from farm to factory. Selective migration to new colonies relieves population pressure somewhat in home countries but upsets the age-sex composition.	The young dependency ratio goes up as the proportion of children in the population increases; there is a slight increase in the old dependency ratio. Improved female survival results in an excess of females. There is continued emigration to colonies, and a substantial increase in rural to urban migration, with concomitant growth of industrial centers.	There is a progressive aging of the population as fertility continues to decline and more people, especially females, survive to middle and old age. The male/female ratio continues to decrease. There is a high and increasing old dependency ratio, especially for women. Residence is increasingly urban, with excessive growth of cities (megalopolitanism) and alarming slum formation, environmental pollution, and unwieldy social and political problems.
ECONOMIC PROFILE	Subsistence economies characterize predominantly agrarian societies which depend on manual, labor-intensive production methods. Occasional breakthroughs and sporadic rises in wages are largely undermined by low incentives and cosmic catastrophes, while labor efficiency is marred by debilitative and enervative diseases.	Preconditions for economic "take-off" appear: Improvements in agriculture and land-use coupled with modest development of transportation-communication networks encourage industrialization; leading sectors of production, e.g. textiles and lumber, emerge.	"Take-off" to sustained economic growth can often be traced to sharp stimuli such as scientific discovery or political revolution which galvanize business and labor to reinforce gains in gross, real and per capita income through reinvestment and speculation.	Scientific expertise and applied technology covering the gamut of economic activities produce spiralling growth initially. Then a stage of high mass consumption brings tapered growth as production shifts from producer to consumer goods and services; public welfare and leisure spending increase.
SOCIAL PROFILE				
Society	Society is traditional, with a fatalistic orientation sustained by rigid, hierarchical socio-political structures.	A traditional/provincial outlook persists among the lower classes while the upper and emerging middle classes of businessmen adopt "faith in reason."	An era of rising expectations touches nearly all segments of society.	Rational-purposive life styles prevail; bureaucracy and depersonalization foster anomic groups.
Family and Women	Clan or extended family structures with large family size, multiple generation households, and home-centered life styles are dominant. Women are cast strictly in the mother role with virtually no rights or responsibilities outside the home.	Extended family systems and large family size still prevail. The maternal role begins to allow a little involvement in such areas as home crafts.	Extended, large families persist in rural areas; nuclear families prevail increasingly in urban centers. Many women are employed in factories and become more involved in activities outside the home.	Nuclear families and small family size norms become institutionalized. Women are increasingly emancipated from traditional roles and become better educated and more career oriented.
Living Standards	Standards are very low; grossly unsanitary conditions prevail at both the public and private levels, and comforts and luxuries are limited to a few elites.	Standards are still quite low but there is some improvement toward the end of the period.	Hygiene and sanitation improve except in city slums where bad conditions grow worse.	Progressive rises in living conditions are enjoyed by large segments of the population.
Food and Nutrition	Food available to the masses is of poor quality, with chronic and occasionally acute shortages. Children and women in the fertile years are most adversely affected.	Early improvement in agriculture and crop rotation and increased use of the potato improve nutrition a little. Children and women are still at a nutritional disadvantage.	Continued improvements in agricultural technology guarantee better availability and quality of food.	People become extremely conscious of nutrition, especially that of children and mothers. There is, however, a tendency to overnutrition including consumption of rich and high-fat foods which may increase the risk of heart and metabolic diseases.
HEALTH PROFILE				
Mortality Pattern	Life expectancy fluctuates around 20, and childhood mortality is very high: A third of all deaths occur in children from 0-5; 200-300 infant deaths occur per 1000 births and the neonatal to post-neonatal death ratio is small. Proportionate mortality for 50+ ages is low since few reach that age. Females in the adolescent and reproductive years are at a higher risk of dying than males, but at lower risk at older ages. Mortality is somewhat higher in urban than in rural areas.	Mortality remains high but shows signs of declining as fluctuations become less pronounced. Life expectancy increases to mid-20's and early 30's. Females are still at high risk of dying in the adolescent and fertile years. Infant and childhood mortality are high with small neonatal to post-neonatal ratio; proportionate mortality of the 50+ ages increases somewhat. Urban mortality remains higher than rural.	There is considerable change in mortality level and pattern with the recession of pandemics. Life expectancy increases to 30 to 40+. Mortality declines favor children under 15 and women in the fertile years. Infant mortality drops below 150/1000 births and the neonatal to post-neonatal ratio increases progressively. Proportionate mortality of the 50+ ages increases to close to 50 per cent.	Life expectancy reaches an unprecedented high of 70+ and is about three or more years higher for women than for men. Risks for females of all ages decrease, and maternal mortality declines to a minimum. The age profile shows reductions in childhood mortality which account for less than 10 per cent of the total deaths, while deaths at 50+ years increase to 70 per cent or more of the total. Infant mortality is less than 25/1000 and the ratio of neonatal to post-neonatal deaths is large and still increasing.
Disease Pattern	Leading causes of death and disease are the epidemic scourges, endemic, parasitic and deficiency diseases, pneumonia-diarrhea-malnutrition complex in children, and tuberculosis-puerperal-malnutrition complex in females. Manifest famines occur and severe malnutrition underlies disease and death from most other causes.	Leading causes of death and disease are endemic, parasitic and deficiency diseases, epidemic scourges, childhood and maternal complexes. Industrial disease increases. Undernutrition, though somewhat ameliorated, continues to be important.	Pandemics of infection, malnutrition and childhood disease recede; plagues disappear. Cholera sweeps Europe in successive waves before disappearing. Infection remains the leading cause of death, but non-infectious diseases begin to be more significant.	Heart disease, cancer and stroke replace infection as prime killers. Pneumonia, bronchitis, influenza and some viral diseases remain problems. Polio rises, then tapers off. Scarlet fever starts to disappear.
Disease Examples	1) Tuberculosis is more virulent in young females, especially in their fertile years. 2) Smallpox is typically a childhood disease. 3) Heart disease rates are low, with high rheumatic to arteriosclerotic ratio. 4) Deficiency disease symptomatology is typical and highly prevalent.	1) Tuberculosis mortality peaks with industrialization; it is still more virulent in young females. 2) Smallpox is still chiefly a disease of childhood. 3) Heart disease is still low, with a high rheumatic to arteriosclerotic ratio. 4) Death from starvation is less frequent but typical deficiency diseases still occur.	1) Tuberculosis declines but there is still a slight excess in young females. 2) Smallpox starts to occur less in children and more in adults due to vaccination of children. 3) Heart disease increases, and there is a decrease in the rheumatic to arteriosclerotic ratio. 4) Death from starvation is rare, and many deficiency diseases such as scurvy start to disappear.	1) Tuberculosis is low but persists in slum populations and in older disadvantaged individuals, especially males. 2) Smallpox is rare, and when it does occur, it is a disease of adults. 3) Heart disease is high, with a very low rheumatic to arteriosclerotic ratio. 4) Starvation is rare; pellagra disappears; rickets drops off.
Community Health Problems	The leading community health problems are epidemics, famine, undernutrition, childhood disease and maternal death, all aggravated by environmental problems (contaminated water and food, poor housing, insects, rodents) and lack of personal hygiene. There are no medical care systems and few decisive therapies. People have to rely on indigenous healing and witchcraft.	Epidemics, famine, undernutrition, childhood disease and maternal death are important; environmental problems persist, and industrial health problems emerge. There are no medical care systems and few decisive therapies; hospitals are seen as "death traps." People rely on indigenous systems of healing, but personal hygiene and nutrition begin to improve slowly.	Epidemics and famines recede; childhood disease and maternal death decrease. Environmental control--e.g. water filtration, refuse pick-up--is started in cities. Health systems develop but are limited in scope. A few decisive therapies and prophylactic measures are devised. The importance of workers' health is recognized. Personal hygiene and nutrition improve.	Morbidity comes to overshadow mortality as an index of health as degenerative and chronic disease problems prevail and mental illness, addiction, accidents, radiation hazards and other pollution problems become more prevalent. More decisive therapies are available, and health systems gradually become oriented to preventive care and case-finding, although rising medical costs become a stubborn health problem.

of caring for the aged render consumption excessive in the early and later periods of life.

Using the Model Life Table data for males, the appropriate value from Sauvy's consumption-output schedule was multiplied by the average number of survivors within each age period to yield indicators for total excess consumption (C)—the excess consumption of the young (C_y) plus the excess consumption of the old (C_o)—and the total excess output (O) at each of several life expectancy levels. For any population to "break even" economically, the total excess consumption for young and old persons must be at least equalled by the total excess output in the middle years; that is $C_y + C_o = O$ or $C/O = 1$ defines an economic equilibrium.

The ratios of consumption to output (C/O) at various life expectancy levels, which are depicted in Figure 9, illustrate the relative excess in consumption when life expectancy is 20 or 30 years. Conversely, at life expectancy levels of 40 years and above, output exceeds consumption, with the optimum excess in output occurring when life expectancy reaches 50 years. Thereafter, largely as a result of the consumption demands of an aging population, the consumption/output ratio rises, although it remains less than one. The steady rise in the proportion of excess output subsequently consumed by the aged (C_o/O) is indicated by the shaded portion of the graph.

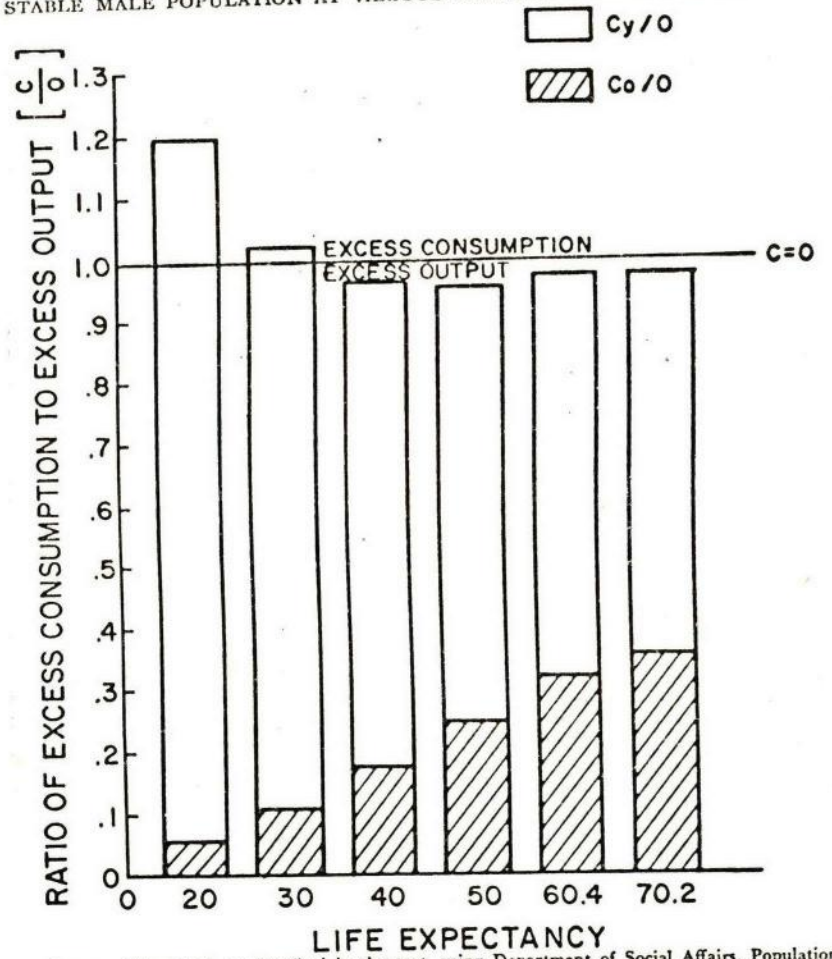
From this rather crude assessment, it may be inferred that the relatively large excess output at life expectancy levels of 40 and 50 represents a surplus over subsistence needs that may be applied to capital and technological development. And, in fact, the economic "take-off" and "drive to maturation" periods in several countries, including England and Wales, Sweden and Japan, correspond to such life expectancy levels.[22]

BASIC MODELS OF THE EPIDEMIOLOGIC TRANSITION

Proposition Five: Peculiar variations in the pattern, the pace, the determinants and the consequences of population change differentiate three basic models of the epidemiologic transition:

the classical or western model, the accelerated model and the contemporary or delayed model. Through the description, analysis and comparison of mortality patterns in many societies and at different points in time, distinctive core patterns of the epi-

FIGURE 9. RELATIVE EXCESSES IN CONSUMPTION AND OUTPUT FOR STABLE MALE POPULATION AT VARIOUS LIFE EXPECTANCY LEVELS



Sources: Calculated, as described in the text, using Department of Social Affairs, Population Branch, Age and Sex Patterns of Mortality: Model Life Tables for Underdeveloped Countries, *Population Studies*, No. 22, New York, United Nations, 1955; and Sauvy, A., GENERAL THEORY OF POPULATION, New York, Basic Books, Inc., Publishers, 1969.

demiologic transition emerge. The fundamental purpose of delineating these models is to visualize the different matrices of determinants and consequences associated with mortality (and fertility) patterns and to elucidate some of the fundamental issues confronting population policy-makers. As illustration, three models of the epidemiologic transition are sketched below.

The Classical (Western) Model of Epidemiologic Transition

The Classical model describes the gradual, progressive transition from high mortality (above 30 per 1,000 population) and high fertility (above 40 per 1,000) to low mortality (less than 10 per 1,000) and low fertility (less than 20 per 1,000) that accompanied the process of modernization in most western European societies. Following a stage of pestilence and famine that prevailed during the pre-modern and early modern periods, a slow unsteady rate of mortality decline gradually gave way to more precipitous declines around the turn of the twentieth century, by which time fertility had already turned downward. Some of the major changes in the population, and in the economic, social and health profiles that occurred in the classical transition are given in capsule form in Table 4. (See also the graphs for England and Wales in Figures 2, 4, 6 and 8.)

It is noteworthy that socioeconomic factors were the primary determinants of the classical transition. These were augmented by the sanitary revolution in the late nineteenth century and by medical and public health progress in the twentieth century. Exponential population growth and sustained economic development were major correlates of the secular downward trend of mortality. In the late phase of the classical transition (i.e., in the second and third decades of the twentieth century) degenerative and man-made diseases displaced infections as the leading causes of mortality and morbidity. A distinguishing feature of this model is that the disequilibrating effects of explosive population growth were minimized, inasmuch as pandemics and famines receded slowly enough for economic growth to become

sustained before low fertility determinants acted to narrow the demographic gap and temper spiralling population growth.

The Accelerated Epidemiologic Transition Model

The Accelerated Epidemiologic Transition model describes the accelerated mortality transition that occurred most notably in Japan. Both the fluctuating mortality in the Age of Pestilence and Famine and the gradual (early) phase of the Age of Receding Pandemics followed a pattern similar to, though later than, the classical model. A major distinction of the accelerated model is that the period taken for mortality to reach the 10 per 1,000 level was much shorter than that for the classical model, as can be seen by comparing the graphs for England and Wales and Japan in Figure 2. The shift to the Age of Degenerative and Man-made Diseases was also much faster (Figure 4). Accompanying this shift were the selective improvement in survival of children under 15 (Figure 6) and of women (Figure 8), typical of the classical model. These changes, however, occurred over relatively short periods of time.

Most of the countries fitting this model had begun a slow process of modernization prior to the drop in mortality in the twentieth century, which was determined by sanitary and medical advances as well as by general social improvements. In these countries, national and individual aspirations favored a controlled rate of population increase and provided the intense motivation needed to lower fertility in a relatively short period of time. Abortion, especially in Japan, has played a major role in the rapid fertility transition depicted by this model.

The Contemporary (or Delayed) Epidemiologic Transition Model

The Contemporary model describes the relatively recent and yet-to-be completed transition of most developing countries. Although slow, unsteady decline in mortality began in some

of these countries shortly after the turn of the century, rapid and truly substantial declines in mortality have been registered only since World War II. Public health measures have been a major component of the imported, internationally sponsored medical package that has played a decisive role in setting the stage for astronomic population growth in these economically handicapped countries. In other words, these programs have successfully manipulated mortality downward while leaving fertility at substantially high levels. Both national and international programs of "population control" designed to hasten fertility decline artificially are prominent features of this model for countries where death control has far outstripped birth control. Despite unmistakable gains in the survival of women and children, infant and childhood mortality remains excessively high in most of these countries and in some, females of reproductive age continue to have higher mortality risks than males in the same age group. Although most countries in Latin America, Africa and Asia fit this model, important differences between these areas suggest the utility of developing submodels, particularly with regard to the varying responses of fertility and socioeconomic conditions to national development programs.

SUMMARY

Despite the inherent difficulties in attempting to structure a matrix that includes all the complex vital factors of population dynamics, the need to do so is urgent. A vast array of social, economic and demographic as well as epidemiologic factors shape the course of population change, and although it is doubtful that *one* comprehensive, all inclusive population theory will ever be formulated, scholars in various disciplines will continue to develop and refine segments of the theory.

The theory of epidemiologic transition, which has been sketched in this brief essay, represents the continuing efforts of this author to crystallize the mechanisms of interaction that characterize the patterns, determinants and consequences of health and disease changes in a variety of social contexts. The basic strategy is not only to describe and compare the mortality transitions of various societies, but more importantly, to lend theoretical perspective to the process of population change by relating mortality patterns to demographic and socioeconomic trends—both longitudinally and cross-sectionally—through the development of models. With elaboration and refinement of such models, comparative analyses of the epidemiologic transition in various population groups can provide information needed to treat at least some of the many problems associated with disequilibrating population movements.

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BOOK REVIEW

POSTPARTUM INTRAUTERINE CONTRACEPTION IN SINGAPORE

D. WOLFERS, EDITOR

Amsterdam, Excerpta Medica, 1970, 200 pp., $14.00 U.S.

Family planning program evaluation methodologies continue to evolve. Primarily this evolution stems from the complex social factors affecting human reproduction and, as well, those programs trying to control it. Planners and evaluators often seem to compound these complexities, occasionally even appearing uncertain about what should be measured. In fairness to them, it is a tough problem. Virtually all facets of human existence touch family planning programs: the family, social stratification, politics, national development, religion, culture, are but a few examples. It is not unexpected that reports describing program effectiveness and/or efficiency are fragmentary and uneven. To compound things further, the dynamics of organizations working in developing societies (such as South East Asia) are difficult to describe to persons unfamiliar with the specific social and cultural situation. Given these many variables, it is not surprising that reports about family planning programs seem inadequate. These evaluation report inadequacies may appear magnified if, in addition, a program's conceptualization and its evaluation methods are not properly grounded. These factors all seem to impinge on this review.

POSTPARTUM INTRAUTERINE CONTRACEPTION IN SINGAPORE is a disappointing evaluation report on a family planning project:

Changing Patterns of Health and Disease during the Process of National Development

Abdel R. Omran, M.D., Dr.P.H.

Several changes occur in patterns of health and disease during the process of national development—a process made up of a complex network of social, economic, cultural, environmental, and health components. The pace, type, and extent of these changes as well as their determinants and consequences are best described in terms of the theory of the epidemiologic transition. The epidemiologic transition accompanies the economic change from low per capita income to high per capita income; it is the transition from high mortality (with famine and infectious diseases as the major causes of death) and high fertility to low mortality (with man-made and degenerative diseases as the principal causes of death) and low fertility. The theory of epidemiologic transition focuses on the complex changes in patterns of health and disease over time and on the interactions between these patterns and their economic, demographic, and sociologic determinants. There can be little doubt that such a transition has taken place in the developed countries of the world and that a transition is still under way in less developed societies.

PHASES IN THE CHANGING PATTERNS OF HEALTH AND DISEASE

Changes in patterns of disease and death that occur during the transition can be characterized as moving through three distinct phases: the Age of

Pestilence and Famine, the Age of Receding Pandemics, and the Age of Degenerative and Man-Made Diseases.

Age of Pestilence and Famine

During the first phase of the epidemiologic transition, the health picture is dominated by the high prevalence of endemic diseases and chronic undernutrition accentuated by frequent severe epidemics of infectious diseases and famines. Under such conditions, mortality is high, and in the face of such high mortality, fertility is sustained at equally high levels and population growth is usually stationary or cyclic. This pattern characterizes premodern and pre-industrial societies, in which communities are tradition-bound, economically underdeveloped (usually with very low per capita income), and predominantly agrarian (with primitive or manual agricultural techniques); in addition, women are of low status, the extended family is common, illiteracy rates are high, and medical care is inadequate or completely lacking. These are the cultural, demographic, physical, and biological prerequisites for the epidemic prevalence of infection and human starvation.

Age of Receding Pandemics

During the second phase of the epidemiologic transition, pandemics begin to recede and famines become less frequent. With concurrent changes in endemic diseases and undernutrition, mortality starts to decline. Fertility during most of this stage continues to be high, resulting in a rising rate of natural population increase as mortality declines—hence the population "explosion." Toward the end of this phase of the transition, fertility begins to decline, lowering somewhat the rate of population growth. It must be added that while pandemics of infection and malnutrition are receding, certain other diseases either increase in incidence and/or increase in their relative contribution to mortality. Examples include emerging industrial diseases, malignancies, cardiovascular diseases, and stroke.

Almost all the developed countries have passed through the Age of Receding Pandemics; almost all the less developed countries are still within this stage. In Western countries, pandemics of infection and widespread chronic malnutrition receded during the eighteenth and nineteenth centuries in response to the agricultural and industrial revolutions, which brought about many societal and environmental changes such as improvement in nutrition and standards of living, increased urbanization, modernization, better education, and improved status for women. Sanitary and medical improvements were few and came too gradually and too late in this stage in most countries to be responsible for the changes in health and disease

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patterns. In the less developed countries, this stage of the transition has come late, for the most part after World War II, and has been triggered by the use of insecticides, antibiotics, chemotherapy, environmental sanitation, and other measures borrowed from or introduced by Western or international organizations.

Age of Degenerative and Man-Made Diseases

Further improvements in social, economic, and environmental conditions—coupled with great strides in science and technology—occur along with economic modernization and increased per capita income during the last stage of the transition. Degenerative and man-made diseases, especially cardiovascular disease, stroke, cancer, radiation injury, occupational hazards, drug addiction, mental illness, and geriatric disease are dominant. Infectious, epidemic, and deficiency diseases recede further; thus degenerative and man-made diseases are responsible for a large proportion of the low general mortality. Fertility also declines, and population growth slows; an exception is the baby boom that followed World War II in many countries now in this last stage of the transition.

MODELS OF THE CHANGING PATTERNS OF HEALTH AND DISEASE

Depending on the pace of change and the particulars of the transition in the modern era, three models of the epidemiologic transition can be delineated: the classical model, an accelerated model, and the delayed model.

Classical Model of Transition

The transition as it occurred in Western societies represents the classical model, in which the transition from high mortality and fertility and low per capita income to low mortality and fertility and high per capita income was slow, taking 100 to 200 years. The classical model of the transition was triggered primarily by the social and economic changes generally known as the industrial revolution.

Accelerated Model of Transition

The transition as it occurred in Japan represents the accelerated model, in which the transition was rapid (taking only a few decades in the twentieth

century) and occurred in response to intensified industrialization. Japan depended predominantly on induced abortion to lower the birth rate.

Delayed Model of Transition

The transition occurring in most of the developing countries of the world can be classified as the delayed model. In these countries, the recession of mortality occurs more in response to medical than to social determinants, and fertility is still high in most such countries, having started to decline in only a few.

SOME DETAILS OF THE CHANGED PATTERNS OF HEALTH AND DISEASE IN DEVELOPED COUNTRIES

The following brief account of specific disease patterns, mortality profiles, and population changes—as they have occurred in the classical epidemiologic transition—will serve as a framework within which to examine these changes as they are occurring or will occur in the developing countries. For the sake of simplicity, the following epidemiologic, social, and demographic profiles of the classical transition are given in Tables 1–4:

Table 1: Population Profile
Table 2: Social and Economic Profiles
Table 3: Mortality and Disease Profiles
Table 4: Community Health Profile

For descriptive purposes, the following periods in the history of the developed countries of the West can be said to have coincided with these specific stages of the transition:

1. The Age of Pestilence and Famine characterized the premodern and early modern (that is, the pre-industrial) period up to about the middle of the eighteenth century.
2. The Age of Receding Pandemics coincided with the period that included the latter half of the eighteenth century and virtually all of the nineteenth.
3. The Age of Degenerative and Man-Made Diseases characterizes the twentieth century, the modern epoch. (See Figure 1.)

The description of each of these profiles for each stage of the classical model of the epidemiologic transition not only shows the progressive changes in patterns of health and disease but also helps to illuminate some of the determinants and consequences of these changes.

The demographic transition—that is, the change in the population

TABLE 1. Population Profile of the Classical (Western) Model of the Epidemiologic Transition

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
Population Growth		
The pattern of growth until about 1650 is cyclic, with minute net increments; mortality dominates, with crude death rates of from 30 to more than 50 per 1,000 population and with frequent higher peaks. Fertility is sustained at	Mortality continues high (30–50 per 1,000), but peaks are less frequent and the general level begins to decline to about 30 per 1,000. Fertility remains high (40+ per 1,000), but several decades after mortality declines, fertility also starts to	Mortality declines rapidly to below 20 per 1,000; then the rate of decline slows. Fertility declines to below 20 per 1,000 (with occasional rises, e.g., the post-World War II baby boom) and becomes the chief pacemaker of population

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TABLE 1. Population Profile of the Classical (Western) Model of the Epidemiologic Transition

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Population Growth	
The pattern of growth until about 1650 is cyclic, with minute net increments; mortality dominates, with crude death rates of from 30 to more than 50 per 1,000 population and with frequent higher peaks. Fertility is sustained at a high level of 40 or more per 1,000 population.	Mortality continues high (30–50 per 1,000), but peaks are less frequent and the general level begins to decline to about 30 per 1,000. Fertility remains high (40+ per 1,000), but several decades after mortality declines, fertility also starts to decline. Population growth is explosive for most of this period.	Mortality declines rapidly to below 20 per 1,000; then the rate of decline slows. Fertility declines to below 20 per 1,000 (with occasional rises, e.g., the post-World War II baby boom) and becomes the chief pacemaker of population growth fluctuation is by design more than by chance. Population growth is small but persistent.
	Population Composition	
The population is predominantly young, with very large young and very small old dependency ratios and a slight excess of males (100 + M/100F). Residence is mainly rural, with a few crowded, unsanitary, war-famine-epidemic ridden cities of small to medium size.	The population is still young, although the proportion of older people begins to increase. The male/female ratio is near unity (100M/100F), but improved female survival tends toward an excess of females. Residence is still primarily rural, but with a progressive exodus from farm to factory. Selective migration to new colonies relieves population pressure somewhat in home countries but upsets the age-sex composition.	There is a progressive aging of the population as fertility continues to decline and more people, especially females, survive to middle and old age. The male/female ratio continues to decrease. There is a high and increasing old dependency ratio, especially for women. Residence is increasingly urban, with excessive growth of cities (megalopolitanism) and alarming formation of slums, environmental pollution, and unwieldy social and political problems.

TABLE 2. Social and Economic Profiles of the Classical (Western) Model of the Epidemiologic Transition

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Society	
Society is traditional, with a fatalistic orientation sustained by rigid, hierarchical sociopolitical structures.	A traditional/provincial outlook persists among the lower classes, while the upper and emerging middle classes of businessmen adopt "faith in reason." An era of rising expectations touches nearly all segments of society.	Rational-purposive life styles prevail; bureaucracy and depersonalization foster anomic groups.
	Family and Women	
Clan or extended family structures with large family size, multiple-generation households, and home-centered life styles are dominant. Women are cast strictly in the mother role with virtually no rights or responsibilities outside the home.	Extended family systems and large family size still prevail, especially in rural areas; nuclear families prevail increasingly in urban centers. The maternal role begins to allow a little involvement in activities outside the home.	Nuclear families and small family size norms become institutionalized. Women are increasingly emancipated from traditional roles and become better educated and more career-oriented.
	Living Standards	
Standards are very low; grossly unsanitary conditions prevail at both the public and private levels, and comforts and luxuries are limited to a few elites.	Standards are still quite low, but hygiene and sanitation improve gradually except in city slums, where bad conditions grow worse.	Progressive rises in living conditions are enjoyed by large segments of the population.
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all segments of society.

	Family and Wo	
Clan or extended family structures with large family size, multiple-generation households, and home-centered life styles are dominant. Women are cast strictly in the mother role with virtually no rights or responsibilities outside the home.	Extended family systems and large family size still prevail, especially in rural areas; nuclear families prevail increasingly in urban centers. The maternal role begins to allow a little involvement in activities outside the home.	Nuclear families and small family size norms become institutionalized. Women are increasingly emancipated from traditional roles and become better educated and more career-oriented.

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Living Standards	
Standards are very low; grossly unsanitary conditions prevail at both the public and private levels, and comforts and luxuries are limited to a few elites.	Standards are still quite low, but hygiene and sanitation improve gradually except in city slums, where bad conditions grow worse.	Progressive rises in living conditions are enjoyed by large segments of the population.
	Nutrition	
Food available to the masses is of poor quality with chronic and occasionally acute shortages. Children and women in the fertile years are most adversely affected.	Early improvements in agriculture and crop rotation gradually bring better availability quality of food, although women and children are still at a nutritional disadvantage.	People become extremely conscious of nutrition, especially that of children and mothers. There is, however, a tendency to over-nutrition, including consumption of rich and high-fat foods.
	Economic Profile	
Subsistence economies characterize predominantly agrarian societies which depend on manual, labor-intensive production methods. Occasional breakthroughs and sporadic rises in wages are largely undermined by low incentives and cosmic catastrophes, while labor efficiency is marred by debilitative and enervative diseases.	Preconditions for economic "take-off" appear. Improvements in agriculture and land-use, coupled with modest development of transportation-communication networks, encourage industrialization; leading sectors of production, e.g., textiles and lumber, emerge.	Scientifiic expertise and applied technology covering the gamut of economic activities produce spiraling growth initially. Then a stage of high mass consumption brings tapered growth as production shifts from producer to consumer goods and services; public welfare and leisure spending increase.

TABLE 3. Mortality and Disease Profiles of the Classical (Western) Model of the Epidemiologic Transition

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Mortality Pattern	
Life expectancy fluctuates around 20, and childhood mortality is very high: A third of all deaths occur in children from 0 to 5; 200–300 infant deaths occur per 1,000 births, and the neonatal to post-neonatal death ratio is small. Proportionate mortality for 50+ ages is low since few reach that age. Females in the adolescent and reproductive years are at a higher risk of dying than males, but at a lower risk at older ages. Mortality is somewhat higher in urban than in rural areas.	There is considerable change in mortality level and pattern with the recession of pandemics. Life expectancy increases to 30 to 40+. Mortality declines favor children under 15 and women in the fertile years. Infant mortality drops below 150 per 1,000 births, and the neonatal to post-neonatal ratio increases progressively. Proportionate mortality of the 50+ ages increases to close to 50 percent.	Life expectancy reaches an unprecedented high of 70+ and is about three or more years higher for women than for men. Risks for females of all ages decrease, and maternal mortality declines to a minimum. The age profile shows reductions in childhood mortality, which accounts for less than 10 percent of the total deaths, while deaths at 50+ years increase to 70 percent or more of the total. Infant mortality is less than 25 per 1,000, and the ratio of neonatal to post-neonatal deaths is large and still increasing.
	Leading Causes of Death	
Leading causes of death and disease are the epidemic scourges, such as plague, smallpox, cholera and typhus, endemic, parasitic and deficiency diseases, the pneumonia–diarrhea–malnutrition complex in children, and the tuberculosis–puerperal–malnutrition complex in females. Manifest famines occur, and severe malnutrition underlies disease and death from most other causes.	Although some epidemic diseases start to recede, the leading causes of death and disease are endemic, parasitic and deficiency diseases, epidemic scourges, and childhood and maternal complexes. Cholera sweeps Europe in successive waves before disappearing. Industrial and other noninfectious diseases increase. Undernutrition, although somewhat ameliorated, continues to be important.	Heart diseases, cancer, and stroke replace infection as prime killers. Pneumonia, bronchitis, influenza, and some viral diseases remain problems. Polio rises, then tapers off. Scarlet fever begins to disappear.

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Changing Epidemiology of Selected Diseases	
Tuberculosis is more virulent in young females, especially in their fertile years. Smallpox is typically a childhood disease. Heart disease rates are low, with	Tuberculosis mortality peaks with industrialization; it is still more virulent in young females. Smallpox starts to occur less in children and more in adults due to vaccination of children. Heart disease increases, and there is a	Tuberculosis is low but persists in slum populations and in older disadvantaged individuals, especially males. Smallpox is rare; when it does occur, it is a disease of adults. Heart disease is high, with a very low rheumatic to arteriosclerotic ratio.

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Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Changing Epidemiology of Selected Diseases	
Tuberculosis is more virulent in young females, especially in their fertile years. Smallpox is typically a childhood disease. Heart disease rates are low, with high rheumatic to arteriosclerotic ratio. Deficiency disease symptomatology is typical and highly prevalent.	Tuberculosis mortality peaks with industrialization; it is still more virulent in young females. Smallpox starts to occur less in children and more in adults due to vaccination of children. Heart disease increases, and there is a decrease in the rheumatic to arteriosclerotic ratio. Death from starvation becomes rare and many deficiency diseases such as scurvy start to disappear.	Tuberculosis is low but persists in slum populations and in older disadvantaged individuals, especially males. Smallpox is rare; when it does occur, it is a disease of adults. Heart disease is high, with a very low rheumatic to arteriosclerotic ratio. Starvation is rare; pellagra disappears; rickets drops off.

TABLE 4. Community Health Profile of the Classical (Western) Model of the Epidemiologic Transition

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
Leading Community Health Problems and Programs		
1. Epidemics are frequent and devastating; famines are frequent in certain areas. 2. Endemic infections and parasitic diseases are prevalent. 3. Chronic malnutrition and manifest deficiency diseases are widespread. 4. Maternal and child health problems are severe. 5. Environmental problems are appalling; these include contaminated water supplies, human waste problems, prevalence of insects and rodents, reservoirs of infection, poor food sanitation, and poor housing. 6. Health problems are prevalent in both rural and urban areas. 7. Accidents occur mostly in the home.	1. Epidemics and famines continue to be major problems, but their magnitude progressively declines. Heart disease and cancer increase, but are still overshadowed by infection. 2. Endemic infection and parasitism also recede to some extent toward the end of the period. 3. Occupational health problems arise in industrializing areas. 4. Maternal and child health continues to be problematic, especially at beginning of this period. 5. Sanitary environmental hazards start to show signs of receding toward the end of this period. 6. Urban health problems increase as a result of in-migration and crowding under unsanitary conditions. Later, urban areas begin to benefit from sanitation. 7. Accidents occur in both home and factory.	1. Morbidity comes to overshadow mortality as an index of health as degenerative, man-made, and chronic disease problems (such as mental illness, drug addiction, radiation hazards, and pollution) increase. 2. Endemic infection and parasitism almost disappear except in certain pockets among underprivileged minority or racial groups. 3. Maternal and child health problems are brought under control, but geriatric problems become more serious. 4. Humanitarian workmen's legislation controls many occupational hazards, but new procedures and materials in industry create new hazards, e.g., electrical, chemical, and radiation hazards. 5. Environmental sanitation problems are ameliorated, but pollution due to industrialization and urbanization grows larger. 6. The rising cost of medical care becomes a serious problem in many countries. 7. Traffic and transportation accidents prevail.
Health Systems and Services		
1. The only health care systems are indigenous systems which often rely on witchcraft and poor practices in the care of the sick. 2. No decisive therapies are available. 3. Immunization is not available. 4. There is no environmental sanitation. 5. The only effective measures for	1. The recession of epidemics and relief of famines are triggered by improvement of nutrition and rising standards of living. 2. The beginnings of the sanitary revolution accelerate the recession of epidemics toward the end of the period. Refuse removal begins in London in 1848 and a network of sewers in 1865.	1. Modern nationwide organized health programs develop with comprehensive, integrated systems of curative and preventive health, intensive research, and advances in medical and surgical care. 2. Special categorical health programs are developed, for example, for maternal and child care, venereal disease con-

rodents, reservoirs of infection, poor food sanitation and poor housing.
6. Health problems are prevalent in both rural and urban areas.
7. Accidents occur mostly in the home.

5. Sanitary environmental hazards start to show signs of receding toward the end of this period.
6. Urban health problems increase as a result of in-migration and crowding under unsanitary conditions. Later, urban areas begin to benefit from sanitation.
7. Accidents occur in both home and factory.

4. Humanitarian workmen's legislation controls many occupational hazards, but new procedures and materials in industry create new hazards, e.g., electrical, chemical, and radiation hazards.
5. Environmental sanitation problems are ameliorated, but pollution due to industrialization and urbanization grows larger.
6. The rising cost of medical care becomes a serious problem in many countries.
7. Traffic and transportation accidents prevail.

Age of Pestilence and Famine	Age of Receding Pandemics	Age of Degenerative and Man-Made Diseases
	Health Systems and Services	
1. The only health care systems are indigenous systems which often rely on witchcraft and poor practices in the care of the sick. 2. No decisive therapies are available. 3. Immunization is not available. 4. There is no environmental sanitation. 5. The only effective measures for epidemic control are isolation and quarantine.	1. The recession of epidemics and relief of famines are triggered by improvement of nutrition and rising standards of living. 2. The beginnings of the sanitary revolution accelerate the recession of epidemics toward the end of the period. Refuse removal begins in London in 1848 and a network of sewers in 1865. Private wells were the main source of water until the introduction of some waterworks in the eighteenth and nineteenth centuries (without purification until the nineteenth century). Personal hygiene improved as soap and washable undergarments came into widespread use. 3. Isolation and quarantine measures for control of epidemics were more stringently enforced. 4. Medical advances, such as the development of antiseptics by Lister in 1865, made surgery safer. Immunization against smallpox was introduced by Jenner in 1798. 5. Organized health services were started in some countries and progressed in quality and quantity.	1. Modern nationwide organized health programs develop with comprehensive, integrated systems of curative and preventive health, intensive research, and advances in medical and surgical care. 2. Special categorical health programs are developed, for example, for maternal and child care, venereal disease control, and tuberculosis control. 3. Rigorous sanitary measures become more widespread, including adequate water purification with the introduction of chlorination, sewage treatment, refuse disposal, insect and rodent control, better housing, and town planning. 4. Case-finding and mass screening for some diseases become widespread. 5. Insecticides, chemotherapy, and antibiotics further accelerate the recession of epidemics. 6. Health systems are advanced by prosperous societies drawing on adequate health manpower and an enlightened public.

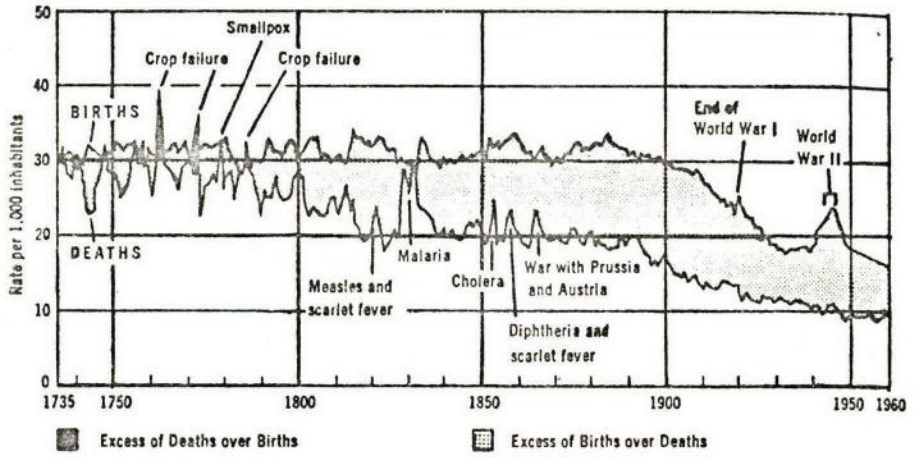

FIG. 1. The Epidemiologic Transition in Denmark: 1735–1960

Source: "A New Science Emerges," *Population Bulletin*, Vol. 10 (1954), p. 60 (reprinted by permission of the Population Reference Bureau).

profile over time—seems to be dominated by the disease and mortality patterns of a society. In the Age of Pestilence and Famine, mortality is very high and fluctuating, with high peaks in the years of epidemics and famines. Fertility is also high, but the resulting population growth is very small, if population grows at all.

During this period the economy is essentially that of a subsistence level; per capita income is very low; and social and living standards are very low. Medical services and education are grossly inadequate, if available at all. Poor nutrition compounds the problems of poor sanitary environments and crowded living conditions to contribute to the high prevalence of infectious diseases. Life expectancy is low—about 20 years of age—and child mortality is very high, as is mortality among women of reproductive age.

During the transition from the Age of Pestilence and Famine through the Age of Receding Pandemics, children and women benefit the most from the dramatic changes in patterns of health and disease. When pandemics begin to recede in response to improving standards of living, social welfare measures, early improvements in nutrition, and early sanitary measures, childhood survival is significantly improved. As women are better nourished and as public health measures become more widely available, they survive

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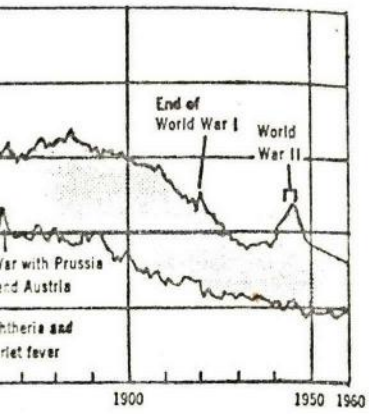

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through the reproductive span and their fertility is improved. Thus, there are subsequent waves of youth moving up the population pyramid as more and more of them survive and as women live long enough to produce more children.

During the transition from infectious- to degenerative-disease predominance, women usually move from a level of mortality consistently higher than that of men to one lower. A similar peculiarity also becomes manifest in urban-rural mortality patterns; during the early phase of the transition, morbidity and mortality are higher in the urban areas; but during the later phases of the transition, urban rates fall below rural rates.

The epidemiologic transition affects demographic patterns in complex ways. In a fairly stable population with high levels of vital rates and low levels of food supply, a small increase in food availability due to agricultural or transportation improvements, coupled with improvements in personal habits and better sanitation, can lower general mortality rates from infectious and deficiency diseases. This general lowering of mortality and morbidity can, in turn, increase the effectiveness of the labor force and may also bring a slight increase in survival through the reproductive span as well as in fertility performance. Recent evidence indicates that childhood nutritional levels can also influence later mental effectiveness.

The improved childhood survival experience presumably removes many of the complex social, emotional, and economic rationales for high birth rates and may indeed provoke serious strains within families that are adapted to an expectation of having few children survive to adulthood. The improvements in survival came slowly in the classical epidemiologic transition, thus allowing for gradual adaptation of fertility control practices as they became desirable. Childhood mortality is declining more rapidly in developing countries, however, and it becomes more important than ever to elucidate further the exact processes linking mortality and fertility declines.

Examples of specific changes in disease patterns between the Age of Pestilence and Famine and the Age of Degenerative and Man-Made Diseases are given in Table 3; historical trends in specific diseases such as plague, smallpox, typhus, etc., are described briefly in the chapter "The Communicable Disease Problem."

JAPAN'S ACCELERATED TRANSITION, AND PROSPECTS FOR DEVELOPING COUNTRIES

Japan's epidemiologic transition was similar to the classical transition experienced by Western countries except that it took a little over one-quarter of a century as compared to more than a century in the West. Japan started to industrialize after World War I, and by World War II it was already an

industrial power with a base from which to become a highly developed country very rapidly after the war. With industrialization and modernization, there occurred a demographic transition from high birth and death rates in the 1920s to low birth and death rates in the 1950s. An epidemiologic transition took place as well, with degenerative and man-made diseases very rapidly replacing infectious diseases as the leading causes of morbidity and mortality.

It is clear that almost all the developing countries have entered the transition with an Age of Pestilence and Famine characterizing their histories until the first half of the twentieth century. Although some countries—for example, Chile—showed a mortality decline (that is, entered the Age of Receding Pandemics) in the interwar period, most of the less developed countries entered this stage after World War II. With only a few exceptions, the less developed countries are still in the Age of Receding Pandemics, experiencing rapidly declining mortality but sustaining high fertility levels. As a result, population growth in most of the developing countries is explosive. It should be noted that the recession of epidemics in these countries has been the result more of medical change than of social change. The introduction of insecticides and the widespread use of immunization, chemotherapy, and antibiotics have been the major determinants in the control of epidemics and of endemic diseases. Improved nutrition and sanitation control programs have also had an impact on mortality levels.

A few developing countries have begun to show a decline in both fertility and mortality. These include Ceylon, Taiwan, Korea, and Guatemala, which are attempting to emerge from the critical phase of Receding Pandemics to the more favorable phase of Degenerative and Man-Made Diseases. However, although heart disease, stroke, and cancer have begun to move into the leading causes of death in these countries, infectious diseases still predominate. To illustrate this point, Table 5 gives the ten leading causes of death for the following countries: (1) the United States, as an example of a developed country which has been in the Age of Degenerative and Man-Made Diseases since early in the century, (2) Japan, as an example of a country which has achieved an accelerated transition, (3) Chile, as an example of a less developed country still trapped in the Age of Receding Pandemics, and (4) Ceylon, as an example of a less developed country about to emerge from the Age of Receding Pandemics into the Age of Degenerative and Man-Made Diseases.

Since the problems associated with population pressure in developing countries are becoming more intense, the need to understand the processes of the epidemiologic and demographic transitions therefore becomes more urgent. Whether or not the developing countries of today can undergo an accelerated transition in a way similar to Japan remains an important question and depends upon the many complex determinants of morbidity and mortality and the reaction of fertility practices to changes in mortality. (See also chapter on "The World Population Problem.")

TABLE 5. Leading C

United States (1967)	Pe Tota
Heart disease	
Cancer	
Vascular lesions	
Accidents	
Childhood diseases	
Hypertension	
Pneumonia	
Diabetes	
Cirrhosis of the liver	
Suicide	
Birth rate/1,000 population	
Death rate/1,000 population	
Rate of natural increase	
Chile (1966)	Pe Tota
Pneumonia	
Heart disease	
Cancer	
Childhood diseases	
Cerebrovascular disease	
Gastroenteritis	
Accidents	
Cirrhosis of the liver	
Tuberculosis	
Influenza	
Birth rate/1,000 population	
Death rate/1,000 population	
Rate of natural increase	

Source: Official Records of the *World Health Situation,* 196 1971).

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TABLE 5. Leading Causes of Death (for Selected Countries)

United States (1967)	Percent of Total Deaths	**Japan** (1968)	Percent of Total Deaths
Heart disease	33.8	Cerebrovascular disease	25.5
Cancer	16.8	Cancer	16.8
Vascular lesions	10.9	Heart disease	11.1
Accidents	6.1	Accidents	5.9
Childhood diseases	3.5	Pneumonia	3.7
Hypertension	3.3	Hypertensive disease	2.6
Pneumonia	3.0	Tuberculosis	2.5
Diabetes	1.9	Bronchitis, etc.	2.2
Cirrhosis of the liver	1.5	Suicide	2.1
Suicide	1.3	Childhood diseases	2.0
Birth rate/1,000 population	17.8	Birth rate/1,000 population	18.5
Death rate/1,000 population	9.4	Death rate/1,000 population	6.8
Rate of natural increase	0.84%	Rate of natural increase	1.17%
Chile (1966)	Percent of Total Deaths	**Ceylon** (1966)	Percent of Total Deaths
Pneumonia	14.7	Childhood diseases	12.2
Heart disease	11.3	Gastritis, diarrhea, etc.	6.4
Cancer	11.3	Heart disease	6.4
Childhood diseases	6.8	Pneumonia	5.8
Cerebrovascular disease	6.2	Accidents	3.6
Gastroenteritis	5.4	Cancer	3.2
Accidents	4.8	Anemias	2.5
Cirrhosis of the liver	4.2	Tuberculosis	1.8
Tuberculosis	3.5	Suicide	1.7
Influenza	2.8	Vascular lesions	1.5
Birth rate/1,000 population	30.1	Birth rate/1,000 population	32.3
Death rate/1,000 population	10.2	Death rate/1,000 population	8.3
Rate of natural increase	1.99%	Rate of natural increase	2.40%

Source: Official Records of the World Health Organization, *Fourth Report on the World Health Situation*, 1965–68 (No. 192; Geneva: World Health Organization, 1971).

RECOMMENDED READING

Abdel R. Omran, "The Epidemiologic Transition: A Theory of the Epidemiology of Population Change," *Milbank Memorial Fund Quarterly*, Vol. 49 (1971), pp. 509–538.

Mental Health Proble

Dorothea C. L

CLASSIFICATIC MENTAL ILLNI

Mental health is increasingly rec which doctors should be acquai between cases of illness due to l to social and psychological forc often a social and psychological that it must be attended to if th also a growing awareness of the development of serious mental i crippling psychoneurotic and otl

A review of the following abnormalities, following the orde *International Classification of Di*

Mental retardation
Organic brain syndromes
Psychoses
Neuroses
Personality disorders, sexual
Psychophysiologic disorders
Special symptoms
Transient situational disturb
Behavior disorders of childh
Miscellaneous conditions

With gratitude to Robert N. Wil

27 February 1981, Volume 211, Number 4485 SCIENCE

Innovation and Evaluation

Frederick Mosteller

Summary. Social, medical, and technological innovations are discussed, first with reference to historical examples and then with modern studies. I show the need for evaluating both the innovations themselves and the research processes leading to them. I suggest some kinds of research that need to be carried out if we are to continue to have a vigorous program of scientific and technological innovation. Finally, I explain the new initiative by the AAAS in science and engineering education.

My topic here is innovation and evaluation. I begin with an early experiment in nutrition. It was designed by Daniel of the Lions' Den, but for humans rather than lions. Daniel was held hostage in Nebuchadnezzar's court and, possibly for religious reasons, disapproved of the rich food, wine, and meat served there. The eunuch in charge feared for his own head if he were to give Daniel and his three friends merely the simple Judean vegetable fare called pulse (such as peas and beans). Daniel asked for a 10-day trial and promised to turn to the court's diet if the Judean hostages weren't then as healthy as the others. To turn to a translation of the original article, Daniel I:12–15 (*1*):

> Prove thy servants, I beseech thee, ten days; and let them give us pulse to eat, and water to drink.
>
> Then let our countenances be looked upon before thee, and the countenance of the children that eat of the portion of the king's meat: and as thou seest, deal with thy servants.
>
> So he [the eunuch] consented to them in this matter, and proved them ten days.
>
> And at the end of ten days, their countenances appeared fairer and fatter in flesh than all the children which did eat the portion of the king's meat.

Had this study been submitted as a report to *Science*, the reviewer might make the following remarks. First, there is no sampling problem because Daniel needed only to prove that he and his three friends were better off with the diet. He did not have to make the generalization to, say, the entire population of Judea or the human race. This is unusual because ordinarily we *are* trying to make such generalizations. For Daniel it was fortunate as well, because with such a small sample—Daniel, Shadrach, Meshach, and Abednego—the eunuch would have had to insist on using Student's *t*-test, and this would not be invented for another 2500 years, almost exactly.

Second, the length of the trial, 10 days, seems short for a nutrition experiment.

Third, the end point "fairer and fatter in flesh" seems not well defined. Other translations speak of "sleeker" which also is vague.

From the eunuch's point of view, the diet of pulse was an innovation, while the court's regular diet was the standard. And so Daniel designed a comparative experiment, an early evaluation of an innovation.

I turn to a historical, but more policy-oriented example: Another nutrition experiment was carried out by James Lancaster starting in 1601 when the East India Company sent its first expedition to India. He was general of four ships and a victualler (*2*). They sailed from Torbay in England in April 1601. At that time scurvy was the greatest killer of the navy and of expeditions and explorations, worse than accidents or warfare or all other causes of death together. More than half a crew might die of scurvy on a long voyage. In 1497 Vasco da Gama sailed around the Cape of Good Hope with a crew of 160 men: 100 died of scurvy (*3*).

Lancaster served three teaspoons of lemon juice every day to the sailors on the largest ship of his fleet and few became ill. By the time the fleet got to the Cape of Good Hope, so many sailors on the three smaller ships were sick from scurvy that Lancaster had to send sailors from the large ship to rig the smaller ones. When they reached the Cape of Good Hope 110 men had died, mostly from the 278 men who started on the three smaller ships. Clear evidence that lemon juice prevents scurvy? Maybe. At any rate, the evidence is so strong that the East India Company and the British Navy could surely be expected to follow up this investigation with further research. Not at all! Policy moves more majestically.

About 150 years later, 1747 to be precise, the physician James Lind (*4*) carried out an experiment consisting of adding something special to the diets of scurvy patients on the ship *Salisbury*. He had six dietary additions:

1) Six spoonfuls of vinegar.
2) Half-pint of sea water.
3) Quart of cider.
4) Seventy-five drops of vitriol elixir.
5) Two oranges and one lemon.
6) Nutmeg.

Lind assigned two sailors ill from scurvy to each treatment. Those who got the citrus fruit were cured in a few days and were able to help nurse the other patients. The supply of citrus fruit ran out in about 6 days.

Lind knew about Lancaster's work as well. With this dramatic and crucial experiment plus the backup of Lancaster's earlier voyage surely the British Navy

Frederick Mosteller is Roger I. Lee Professor, Department of Biostatistics, School of Public Health, Harvard University, Boston, Massachusetts 02115. He has just retired as president of AAAS. This article is the text of his address at the annual meeting of the AAAS in Toronto, Ontario, Canada, 6 January 1981.

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now will adopt citrus fruit for prevention of scurvy from long sea voyages? No! Forty-eight years later policy caught up. In 1795 the British Navy began using citrus juice on a regular basis and wiped out scurvy in the service (*5*). The British Board of Trade followed suit after a delay of only 70 years (1865) and wiped it out in the mercantile marine (*5*). We often talk about how slow we are to make use of innovations, but this case study of citrus juice should give us a little encouragement. Today we are worrying about 20-year lags. Here is one of 264 years.

Evaluation of Today's Social Programs

We need both to have a larger number of innovations and to be sure that they are beneficial. This requires both inventiveness and evaluation. Let me demonstrate first with social programs.

To see whether social programs that had been evaluated carefully were successful, Gilbert, Light, and I (*6*) reviewed a substantial number of programs. Each had been evaluated by a randomized controlled experiment. I mention only a few, to give you a feeling for their variety.

After we studied the evaluation of a program, we scored the program on a scale running from a double plus down to a double minus, with zero meaning there was essentially no gain from the program, a double plus meaning that the program was an excellent innovation, and a double minus that it was much worse than the treatment that it replaced. Our ratings did not include costs of the program; had they done so, they would probably have had to be reduced somewhat.

The studies were classified into social, sociomedical, and medical innovations. Four of the eight social innovations we studied were: negative income tax, studies of bail, training of police, and attempts to reduce delinquency among girls.

Let me describe one. The study of delinquent girls was intended to reduce the amount of juvenile delinquency by instituting a social program. It had two steps. First, the investigators needed to identify the potentially delinquent girls, and second to apply the program to them and so prevent their delinquency.

What happened in the experiment? First, the innovators were very successful in identifying those girls who were likely to become delinquents. Second, they had no success at all in diverting the young girls from their course. Thus we assigned this innovation a zero. Although it is worth something to be able to identify potential delinquents, and this feature would be useful in future studies, the purpose of the innovation was to reduce delinquency. Since it did not do this, it was rated a zero. It did not increase the delinquency rate either, and so it did not get either a minus or a double minus.

We also studied eight sociomedical innovations, of which four were: experiments on probation for conviction for public drunkenness, effects of broadening health insurance benefits, training mothers whose children have tonsillectomies, and training physicians in comprehensive medical care.

Let me briefly describe the probation experiment. The judge assigned these habitual offenders to one of three treatments in a randomized manner. Such offenders with two arrests in the previous 3 months or three in the previous year were fined $25, given a 30-day suspended sentence, and assigned to one of three groups:

1) No treatment.
2) An alcoholic clinic.
3) Alcoholics Anonymous.

The payoff variables were number of rearrests and time before first rearrest. The results were that the "No treatment" group performed somewhat better than the other two groups, each of which performed equally well.

The original authors, Ditman *et al.* (*7*), concluded that the study gave no support to the policy of short-term referrals. Thus we scored the innovation a zero. It might possibly have been scored a minus.

In this same group was the Kansas-Blue Cross experiment. It had been suggested that one reason for excessive use of hospitalization and consequently of the rising costs of medical care was that the insurers would pay only for work done in the hospital, whereas some work could be taken care of more cheaply with outpatient care. The insurance company responded to this suggestion with a substantial randomized experiment. They put 5000 people into a group that had added benefits of ambulatory care, free of charge, in addition to the regular hospitalization, and compared their results over a year with those of 10,000 patients on the regular program.

The results came out contrary to expectations. The amount of hospitalization for the group with extra ambulatory benefits went up by 16 percent, while that for the group with regular benefits increased by only 3 percent. Thus the overall effect went in the opposite direction to that hoped for. There was more information. For example, there were 15 percent fewer short-term stays in the extra-benefit group. But the decrease was more than offset by the added longer stays. This innovation received a minus because the results went in the direction opposite to that hoped for.

It is, of course, possible that there may be a benefit overall in this approach because of finding things wrong early that need attention and thus preventing later health problems. That would take a substantial further investigation to establish.

We studied 12 medical innovations, including the following four: the Salk vaccine experiment for polio prevention, treatment of cancer of the bronchus, vagotomy, and gastric freezing for ulcer.

The Salk vaccine was a major success and has nearly stamped out paralytic polio. In one investigation, children were allocated to two groups, those injected with the vaccine and those injected with a saline solution. The vaccine was highly effective, and we rated it a double plus.

The treatment for cancer of the bronchus presented a difficult rating problem because on the one hand there was a substantial improvement in survival, but on the other we did not have clear evidence about the quality of the lengthened life. The comparison was between surgery and radiation therapy. Patients receiving the radiotherapy survived almost 50 percent longer—up from about 200 days to nearly 300, so we gave the treatment a double plus. But a plus might have been appropriate because further information about quality of life might have changed our views.

These few examples illustrate some experiments and reforms and their evaluation.

How did it all come out?

Out of 28 innovations, 12 were positive, and of these 6 got double pluses, 3 were negative, and 13 were rated zero. Thus less than half of well-tested innovations we discovered in the literature were beneficial even if costs were neglected. This suggests strongly that social or medical innovations *do* need to be evaluated.

You may be concerned that our sample of innovations was rather catch-as-catch-can. We were troubled about this too, and therefore did a further study.

We evaluated surgical innovations (*8*). By using the MEDLARS search system, a computer-based bibliography of medical literature, we obtained a population of surgical studies that was selected in an objective way.

We chose randomized clinical trials. In all, we found for the period under

study—1964 to 1973—a total of 36 trials comparing a surgical innovation against a standard treatment. Among these, 44 percent were regarded as successful. Of these, 11 percent were not improvements over the standard, but they were the equal of it and offered new approaches that might be preferred in special circumstances. The actual improvements were about 33 percent, of which the excellent ones comprised 14 percent.

Thus we find again that when innovations are put to trial, they are successes only about half the time, and that substantial improvements are relatively rare, about one in seven.

Ethics and Self-Interest

This gives us an extra piece of information. One reason people often give for not using randomized clinical trials is that they are unethical. That is, one should not give a patient an inferior treatment. The information obtained from the controlled studies of surgery and anesthesia that we reviewed showed that the physician does not know which way a trial will come out. This goes far toward resolving the ethical issue.

In a period when the population is tightening up its attitude about participation in experiments, in sample surveys, and generally in information-producing activities, we need also to think about self-interest. Let us focus on the medical situation.

Sometimes participation in a trial may directly help the patient. The patient may be lucky and get the preferable therapy, or the treatment may be reversible so that after the trial, patients who had the less useful treatment can be given the better one. Nevertheless, sometimes the outcome of the trial may be of little benefit to the individual or his or her relatives or friends.

In spite of this, the patient may still wish to participate in the trial. If we recognize the trial as part of a general system of trials in which patients participate only when they qualify and when we require a trial to find the better treatment, we see that the patient may benefit not from the particular trial but from the system of trials.

Findings from other trials will help the patient, or relatives or friends. We should have our eye on the pooled benefit of the whole system. The longer the patient lives, the more likely he or she is to suffer from some of the diseases that we learn about through this system of trials. The patient will then be the beneficiary of this information. If trials are not made, then the information will be slow in coming, if it comes at all. Thus the patient has a stake in the whole system, not just in a particular trial.

The inferences derived from trials apply to the populations who participate in them. To the extent that individuals decline to participate, and to the extent that their responses may differ from those of others, the treatments may not apply as well to them and people "like" them. If special groups either deliberately fail to participate or if they are barred from participation, then the trials cannot be expected to apply as well to them as to the groups who do participate. It is hard to say just what "people like me" means, and a good solution is to have volunteers from the whole appropriate population.

If participation seems to be a sacrifice, others are making similar sacrifices in aid of "my" future illnesses, and the whole system is being upgraded for "my" benefit. Thus a special sort of statistical morality and exchange needs appreciation (*9*).

• *Measuring benefits*. In studying costs, risks, and benefits of surgery, we found that measuring benefits was our weakest point. Survival is the most-used measure of benefit. But much surgery, maybe most of it, is intended not as lifesaving but for improving quality of life. This means that we need to assess quality of life (convenience and comfort) to find out how much we are improving matters. Before we try this in social programs generally, we would do well to develop our methods in an area like surgery. My colleagues and I have been trying this out on an exploratory basis using a brief questionnaire, and we are much encouraged.

Safe surgery dilemma. Information about economics, about outcome, and agreed-on ethics cannot entirely determine social policy. What I call the safe surgery dilemma illustrates this (*10*). Consider a safe surgical operation like that for appendicitis. If physicians operated whenever they saw even slight signs and symptoms, the total lives lost might be minimized. But if they operated only when the symptoms were severe, this would minimize the total number of days spent by patients recuperating.

None of us want to be operated on needlessly, nor do we want to die because we have shown only mild symptoms. What should the policy be? To save the last life may require a million extra operations or hundreds of lifetimes of recuperation. This is a problem that society must settle, and while information and ethical considerations can help, the decision is a social one. Note that the conflict is not the usual one between society's interests and those of the individual, but is a conflict within the individual. We have here the classical mathematical difficulty that we cannot expect to maximize two functions at the same time. That is why the happy principle of "the greatest good for the greatest number" is only a slogan and rarely a useful tool.

Linkage and confidentiality. While I am on the subject of information, let me mention a further matter. A great deal of valuable information about the economy and about health is tied up in government computer systems. It is difficult to relate various kinds of information for statistical study purposes because we have become more and more concerned about privacy and confidentiality.

This leaves us with a serious question. Are we going to purchase this information all over again within a time delay in order to solve new problems, or are we going to use what we have? To use it requires that we link up information about an individual from separate statistical series. We do not need to know the person's name after the linkage has taken place, but some identification is required to make the link. Under suitable auspices, the linkage can be made and then the names erased. After that, statistical analyses can be made.

As an example of the need, associated with evaluation, we have many statistical series in the United States of exposure to various chemicals. Let us call these the input information. We also have many series concerning deaths or disablements or morbidity from various diseases. Let us call these the output information. What we do not have is many series where the exposure input data are linked to the health outcome data. A recent study at the National Center for Health Statistics (*11*) found only four series that related environmental input to health outcome, and the linkage was primarily of a geographic aggregate nature rather than on a single individual basis.

Thus if we want to clean up the environment, we need data linkage to tell us how to spend our money to reduce damage to health. We need to know where the most damage occurs and how effective expenditures would be in reducing health losses.

If we knew that one social policy would save a person-year of life for each $10,000 spent, and another policy would cost $500,000 per year of life saved, this information might well influence us in deciding how to spend the money. Lest you suppose that such extremes do not

arise, let me say that we can document wider extremes in some current lifesaving and safety policies (*12*).

What sort of strategy might we have for getting this information? We need more linkage of data about individual exposure and life histories and their relation to health outcome. We are trying to control health events that may take 20 or 30 years to develop, and we do have data of potential value in choosing such controls. The self-interest of the society might well decide that instead of starting out now to gather such data from scratch, we would do better to have some linkage and consider the various amounts of damage that different forms of exposure create, and what it might cost society to reduce untoward effects. Nevertheless, this is a political issue, and society may prefer its privacy and confidentiality to providing information that may save lives and disablements.

Research on Research

There have been several studies of basic research, or perhaps of research in general. We need many studies in this area, not to discover whether basic research yields dividends, but to find out something about the prospects for success of various kinds in research and development.

The first such study was Project Hindsight, which was carried out by the U.S. Department of Defense (*13*). Its general conclusion, which did not cheer up basic researchers, was that basic research did not contribute much to the development of weapons systems. It concluded that targeted research contributed more.

The second was the study of Comroe and Dripps (*14*, *15*). This study traced some major biomedical developments to their basic research roots, and showed the essential role of basic research in inventing new therapies.

The go-no-go approach to basic research seems to be a not very helpful concept. We need basic research for new developments. The problems must be what basic research is needed, and how much is worthwhile in a given area. Can evidence be adduced which would help with the funding and educational and occupational decisions that must be made? It is one thing to say that nobody knows, but another to face the fact that someone has to decide how much money to provide and how to spend it for the public good. Although such questions are political, definite quantitative information can help us with such decisions. Let me describe what I found common to the Comroe-Dripps and the Hindsight studies in spite of their opposing conclusions.

The first finding was that major practical advances in both weaponry and biomedical therapies seemed to require not just one innovation or breakthrough, but a bundle of them, often as many as a dozen. The second was that there is a substantial period, often 20 years, between a basic science innovation and its use in weaponry or therapies. If a variety of new things have to be assembled to make a whole, it is not surprising that they might on average be somewhat aged before being used in a major innovation.

Comroe and Dripps studied the origins of the ten most important clinical advances in cardiopulmonary medicine and surgery occurring between 1945 and 1975. Of 529 key research articles leading to these advances, 41 percent "reported work that, at the time it was done, had no relation whatever to the disease that it later helped to prevent, diagnose, treat, or alleviate" (*14*, p. 12).

A report with the acronym TRACES (*16*), prepared by the Illinois Institute of Technology Research Institute for the National Science Foundation, dealt with five advances: magnetic ferrites, video tape recorder, the oral contraceptive pill, the electron microscope, and matrix isolation. By studying a longer time period than Project Hindsight, the investigators found that key events leading to these advances divided into three groups: 70 percent nonmission research, 20 percent mission-oriented research, and 10 percent development and application. The distribution of nonmission events had a mode between 20 and 30 years prior to the innovation, while mission-oriented events peaked during the decade prior to the innovation. For these case studies, time from conception to demonstration ran about 9 years. Ten years prior to the innovation, 90 percent of the nonmission-oriented research had been completed.

The Battelle Columbus Laboratories (*17*) extended this research by adjoining the heart pacemaker, hybrid grains and the Green Revolution, electrophotography, input-output economic analysis, and organophosphorous insecticides to the magnetic ferrites, video tape recorder, and the pill studied by TRACES. The average time from conception to first realization of the innovations was 19 years. This set of innovations took longer to realize than those of TRACES, and of the significant events leading to the innovations, the distribution was 34 percent nonmission, 38 percent mission-oriented, 26 percent development, and 3 percent nontechnical. Thus the distribution of key events into the categories varies depending on the choices of innovations to study and perhaps on who classifies them. It seems clear, however, that both mission- and nonmission-oriented research are important, and that the nonmission work goes on generally well in advance of the mission-oriented research, which in turn tends to precede the developmental work.

We need some additional kinds of studies that are retrospective and prospective. For example, we need to have an idea about the population of research being done, and what it emits, in addition to a method that starts with highly selected output and works back.

Once this idea has been worked over carefully so that we understand what we need to find out, we then might engage in a truly prospective study. That is, we ultimately need to develop a study based on research as it starts. The major difference between a forward-looking retrospective study and a prospective study is that we have the opportunity to gather the data we want in the prospective study. In the forward-looking retrospective study we have to make do with the data history has provided. Recollections often differ, and the older I grow, the more I distrust oral history.

Funding agencies generally, and the U.S. Congress in particular (*18*), especially desire more research of this kind. We do not know much about how to do it. Blume (*19*) says that we should not expect universal principles of scientific management, but that the comparative analysis of scientific communities might do much to help us understand the workings of science. In such studies, he says, we might find out how organizational factors, resources, and division of labor vary in their effects from one specialty to another.

Although we can scarcely instruct anyone how to do this research on scientific productivity and scientific management, we should encourage a good deal more of it and not expect much payoff soon.

Successful technological innovations. We need considerably more work in the area of research on research, both in basic science and in innovations in technology. I illustrate this for the technology side using the British study called Project Sappho.

Investigators at the Science Policy Research Unit at the University of Sussex studied the reasons for success and failure in industrial innovation (*20*). They

combined a matched-pair and a case-study approach. They chose instances in which a technological innovation had been introduced at least twice, at least once successfully and at least once unsuccessfully. Then they carefully applied the case-study method to the details of both the successful and the unsuccessful innovation. In all, they studied 29 pairs of innovations, drawn from either the chemical industry or the scientific instruments industry. They wanted to find the characteristics that separate winners from losers.

The main finding was that no one variable seems to distinguish successful from unsuccessful innovations. Beyond this, their detailed findings can be summarized as follows: Successful innovators better understand user needs; pay more attention to marketing; develop more efficiently, but not necessarily faster; make better use of outside technology and advice; have responsible individuals with greater seniority and authority (mostly the business innovator rather than the technical innovator).

Many features did not seem relevant though often mentioned in business lore: size of firm, management techniques, use of qualified scientists and engineers, timing (being first or second to market the innovation), initial familiarity with markets and technology, structure of research, in-house versus out-of-house ideas, market pressures.

Of course, the sample studied has special features. It does not discuss technologies where just one attempt at introduction succeeded or failed, and these might form the majority of cases. Thus it would be valuable to have some further studies. In examining single successes and failures, we cannot readily create the comparability that the matching in Project Sappho provided.

Scientists and engineers. In recommending research on research and development, I wish that I could say that research on scientists and research on engineers were mutually supporting efforts and that what works for one works for the other. Research at Massachusetts Institute of Technology suggests that this is not true.

Even for research scientists working in the same firm with engineers, the goals are not the same (*21*; *22*, p. 310). Their priorities are almost reversed, with scientists more oriented to the world outside the company and engineers turned more inward toward the company.

Allen (*22*) reports that, for engineers, ideas suggested by people outside the firm for solving company problems have a low success rate compared with ideas developed within the firm. Research scientists, in contrast, find that suggestions from outside the firm have a good success rate.

Allen reports another difference. At first his group felt that engineers did not read the literature while the research scientists did. Further investigation showed that a few engineers acted as technological gatekeepers. They read the literature and interacted with the rest, keeping them informed. Of course, these gatekeepers were soon promoted to management, where they no longer interacted technically with the engineers and could no longer follow the literature. Among research scientists, the tendency was for each person to keep up with an appropriate literature—each scientist acting as his or her own technological gatekeeper.

These remarks merely support my earlier point that we cannot expect our research efforts to have universal applicability for scientists and engineers.

Technological innovation and the economy. In late 1979 the American Chemical Society held a symposium on innovation and research (*23*). In June 1980 the AAAS held its Fifth Annual R & D Colloquium (*24*). Both the symposium and the colloquium considered what could be done to stimulate innovation.

Edwin Mansfield (*25*) pointed out that the economist Zvi Griliches (*26*) used data from about 900 manufacturing firms to indicate that a firm's rate of productivity increase is directly related to the amount it has spent on R & D. Nestor Terleckyi (*27*) has shown corresponding results for whole industries. Mansfield (*28*) has found that there is a direct relation between amount spent on basic research and rate of productivity increase after adjusting for total R & D expenditure.

The participants at these conferences had many suggestions for increasing the rate of innovation mainly through changes in government policy. Several speakers pointed to Germany and Japan where they felt that the cooperation between government and industry to promote industrial development was a pattern to emulate. Others encouraged more relationship on what Daniel Boorstin (*29*) calls "the fertile verge" between industry and universities. Improved patent policy would help, some say. Others suggested reductions in regulations.

I shall not try to pull together or evaluate these suggestions made by others more qualified in this area than I. William D. Carey (*30*), Executive Officer of AAAS, pointed out that creating a substantial turn-around in public policy toward innovation would be a lot to expect because innovation has a rather small constituency. To enlarge it would require cooperation among large and small industries, labor organizations, economists, professional groups, media, and elected representatives. He doubts this will happen.

He points out too that since innovations take perhaps 10 years to develop, it is hard to evaluate the effectiveness of any specific policy shift in the process of technological innovation. He sums up these complications in a quotation from a friend who says "On a clear day, you can see practically nothing."

AAAS Initiative in Science and Engineering Education

With such a complicated outlook on the government and industrial side, what more can AAAS do? A fundamental ingredient in both scientific and technological innovation is the strength of the scientists and engineers who are available. Another important component is a well-educated public who can appreciate the value of research of all kinds and recognize the need to nourish them.

In the United States we have seen an erosion in education in science and mathematics both in amount and quality. The citizen has become less well informed, as we know from the many studies by the National Assessment of Educational Progress.

It may take 10 years to develop a technological innovation, but it takes 20 years to make a citizen or a scientist or engineer. We must find methods to do this better. As Antoine de Saint-Exupéry said (*31*, p. 155), "As for the Future, your task is not to forsee, but to enable it."

For example, I have been impressed with the educational work of the Ontario Science Centre. After Dr. Tuzo Wilson introduced me to it, I encouraged our AAAS Committee on the Public Understanding of Science to review the possible use of science and technology centers and museums as a resource for strengthening science education. That committee, chaired by John Truxal, has already taken steps in that direction. This is just one step. The committee has made several recommendations to the Board of Directors designed to strengthen the AAAS effort in education.

The board, after being informed of recent studies of science education in various countries, has resolved to mount a program to help improve science and engineering education both for the citizen and for professionals. James Rutherford will advise the board on developing a program for science education.

Our first steps will be to work with our affiliated science and engineering societies to advance science and engineering education in the 1980's. We will urge the President of the United States and the Congress to address the need for excellence in science and engineering education. I hope, personally, that our Canadian members will join us in considering what cooperative steps may be taken.

Finally, for the 1982 AAAS Meeting in Washington, D.C., we have directed that a major theme be "Toward a national commitment to educational excellence in science and engineering for all Americans."

Conclusion

To get and retain the benefits of social, medical, and technological innovations, we need to evaluate their effectiveness in practice. Otherwise we will find ourselves paying for poor innovations both in dollars and in delay of introducing better ones.

Individuals have some self-interest in participating in experiments and sample surveys and allowing the linkage of information for statistical purposes, because innovations may not be suited to the nonparticipants, and we may mount expensive programs that have little payoff. Still society must decide whether it approves. Solid information helps decisions about some innovations but cannot settle some issues where different payoff evaluations lead to differing policy actions.

To help the process of innovation and to inform the funding agencies and the public, we need more research on the research process itself both in basic science and in technology.

To maintain a strong economy we require constant innovation. This requires vigorous basic science and technological R & D programs. Providing these requires a citizenry well-educated in science and technology as well as strong training for specialists in science and engineering. This education needs a great deal of improvement. The AAAS plans to join with other societies and institutions in strengthening these educational programs.

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Geneva:

- Acknowledgments
- Nature of the Book.
- Evolution of Health Financing - components etc.
  - H as part of PHC
  - current bank financing programs etc.

Pop^{n}: addition of 2B. people before Y2000. -

- What kind of health investments are most important

Tools: - coverage - accessibility - equity.
- basic needs - prev. - fixability
- ~~cost recovery~~ affordable;
- appropriate.

} interplay of these 3 tools lead to GHA 2000

2 Categories of Investment.

(A) Standard of living { WSS, Food, Housing, Educ } Indirect Inv. in Health
(B) Health Services. — Direct Inv. in Health

Nature of investment varies with stage of Econ. of Country

	N	LE	IMR	Child
Stage I	+	51	49 237	18
II	60	61	12 157	10

- Describe 3 phases — generalization — 1. Stage - Typical of Rural Areas etc
- Pop? — 2. "Urban Health Scene - chr. dis
- 3. New era for H.C. + I.C - Social serv
- ~~Low Income Countries~~: — Help indirect
- INCOME — some effect up to $400 — Emphasis on ~~direct~~ for Stage I.
  — Exception — Nigeria, China, Sri Lanka, Kerala
- ~~Bad Income~~ — Major pockets of I.C.
  — demand in urban areas

Epidemiological Model over 100 – 200 yrs. There's 3 stages

LDC's face all 3 stages at once: — stage I — / Cope & Treat
— stage II — The Resources
— stage III — + Tropical Diseases

* Epidemiological progress & stage I ~~to~~ need to reduce to gain.
Now slowing down. (0.64% p.a. LE → 0.40 - Sweetser & Brandt)

* What are:

3. Conclusion
1. ~~Financial Constraint forces~~ Selectivity & interventions + diversified sources of funding
2. ~~Isolated~~ Untrodden Bank (components) – need to deal c systems approach
3. Dispersed human res. system – heavy demands on management

Examine briefly some of the obstacles to development

Canadian nurse with experience in outpost nursing of high Arctic reported on her experiences as a member of a School Health Team in a remote district of a developing country

examined 1500 girls ages 3-16 + sample of general pop

1. All children had worms, many had need to ensure anemia, large no goitre + caries
   No iodized salt available
2. 90% of adults have goitres (100,000,000 in world pop have goitre: Eliminate 8¢ per person
3. Many long term TBC with only partial Rx and recurrence of symptoms of other diseases
4. No concept health Educ",
   Visited newborn (day 21 – "This baby's eyes face and cord were covered with powdered cow dung. The baby was to be fed on undiluted cow's milk because the grandparents strongly believed the mother's milk had been cursed!" Death of 5 previous infants.
5. Prenatal mothers told by local "hakim" to have a diet free of meat, fish, eggs and milk
   Her Hgb was 5 grams
6. New patients diagnosed by team could not afford
   i to buy water - TB drugs
   ii home delivery – equivalent to one months wages in cash economy but NO cost
7. "Roads unpassable 3/12 yr. Jeep = 2 months wages: Cost get to health centre

[1] The Epidemiological Transition - Richerson - WDR.
- Growth in Mechanisation
- Rel^n to Kelley, can academics
- Rel^n between price + consumption

[2] challenge the "Provider"/"Consumer" Model — "delivery" of h.s.
"consumer" of ~~consumer~~

* Action vs Passive / preoccupation in health promotion + maintenance
Social-behavioural factors — in motivation of community leaders, mothers, grandparents
Bio behavioural factors in compliance with "delivered" services
Mobilization done in pilot projects
- Russia - China

[3] The "Urban" Shift: - Social/Bio location:
Statistics indicate that by the time we
underband urbanisation + underurbanisation, cold spots
-60% LDC - urban — 1/2 in S.A. - Rest Below
We don't know what new problems are emerging.

[4] The Resource/Orientation ~~to~~ — limited management capability
- a few do Harm p.c.
- Serious questions of priorities — problems to be addressed at what level by whom
- " " of cost-effectiveness — appropriate tech → it really works in the LDC setting
- " " of cultural appropriateness — acceptability/compliance
cost

[4] The overlapping stages of evolution of health care (arbitrary)
Western Patient - 3 stage
Urban stage all
LDC - 650 years
1. Competing priorities of each stage
2. Move from collection → underdevelopment → collection
3. Tension between Stage I (MPH) (Rural) vs Stage II (urban) (elite)
(impotent)
done all 3 stages concurrently

[5] Bridging the gap between Proclamation + Implementation: — "Political will" — RESOURCES = people, $
— MANAGEMENT (soc strategy)
Medical/Beh
1. Don't isolate from mainstream Medicine of RDs + underserviced education + utilization
Special target groups push them element
The Relative importance of Context to Content/Tech.
as move from Bio behavioural → Soc-Behav
i.e. - Research on site
- Training on site
Implications:

[6] Inversion of the Pyramid of Health Manpower
- numbers of MDs produce problems & destruction of
optimize
Agric extension supervision
- systems of health workers with diff. of tasks
Specification + management

[7] Drugs for All by the Year 2000 — low level skills health workers — drugs if you don't use injections part of culture
— injection ~~of~~ exp. — 75% in Clinic

[8]

"Vaccination vs Comprehensive Health Systems, simple priority
Trad. health workers, simple priority
" challenge to go off our imported + soft ware
- challenge to keep there

Health professionals face the dilemma
individual
↳ when life is concerned, we cannot count the cost.
— Population based perspectives

Scientific Ideology:
- If we can't explain it scientifically - it doesn't exist or if it does it isn't respectable or supportable.
OR

Effective
Anti Mental Disorders: ~~Meds~~: Anti Psychotic, Anti-depressant, Anti-convulsants — Demand on local practitioners to make Dx
? natural history of illness — in diff. cultures
? drugs effective in tropical countries
? compliance.
Schizophrenia better in 3rd world countries

Curative care approach to acute conditions.

Prevention of Mental Disorders by General Health Measures
- Mental retardation from measles, Rx of malaria,
- Functional mental retardation: nutrition, maternal stimulation

Major defect in software to development — i.e. how to conceptualize a health education message
? possible to telescope the long process of achieving literacy etc. Needs to be coupled with local participation.
Low cost approach to mass literacy communication
Problems of policy, control of content,
Effect of Stanford study

9 Availability of food not equated to ~~cancer~~ relief of hunger + malnutrition
- if you can't purchase it
- if you can't overcome the lack of mental stimulation of poor families (Cravioto etc.)

10 Appropriate Tech in Health — use cheaper tools
- microcomputer programmes for Dx + Rx — written cost
- transistor/IC of 40¢ — equivalent to transistor radio
- Satellite communication ? approach to health Educ. because of magnitude + power of TV message

? people willing to pay for it?
Relation to self care A B
— Marketing re importance in F.P., Nutr. etc

mouth, to get her husband off, that he should not go to sea. Uno ombre pouvait avoir done any cosa cum ella, but I did natha sino besar her. I to the Exchequer about striking new tallies; and I find the Exchequer, by proclamacion, removing to Nonesuch. Back again and at my papers, and putting up my books into chests, and settling my house and all things in the best and speediest order I can, lest it should please God to take me away or force me to leave my house.

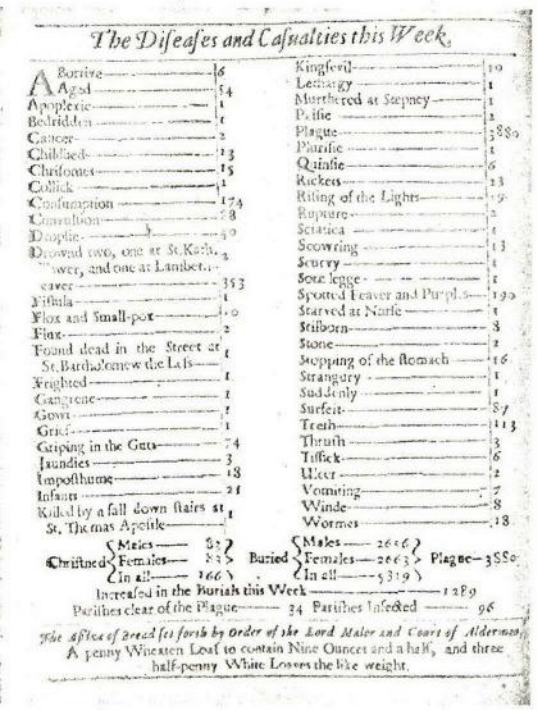
12 August. The people die so, that now it seems they are fain to carry the dead to be buried by daylight, the nights not sufficing to do it in. And my Lord Mayor commands people to be within at 9 at night, all (as they say) that the sick may have liberty to go abroad for ayre.

On 5 July Pepys had sent his wife out of plague-stricken London to lodge with William Sheldon, Clerk of the Cheque at Woolwich yard. He has just visited her there.

15 August. Up by 4 a-clock and walked to Greenwich, where called at Captain Cockes and to his chamber, he being in bed – where something put my last night's dream into my head, which I think is the best that ever was dreamed – which was, that I had my Lady Castlemayne in my armes and was admitted to use all the dalliance I desired with her, and

. . . . . .

'The people die so, that now it seems they are fain to carry the dead to be buried by daylight, the nights not sufficing to do it in.' (12 August 1665.) (*Left*) Bill of Mortality for 15–22 August 1665. These bills, published by the Parish Clerks' Company, gave details of deaths from all causes. (*Right*) A plague broadsheet, 1665.



The Diseases and Casualties this Week.

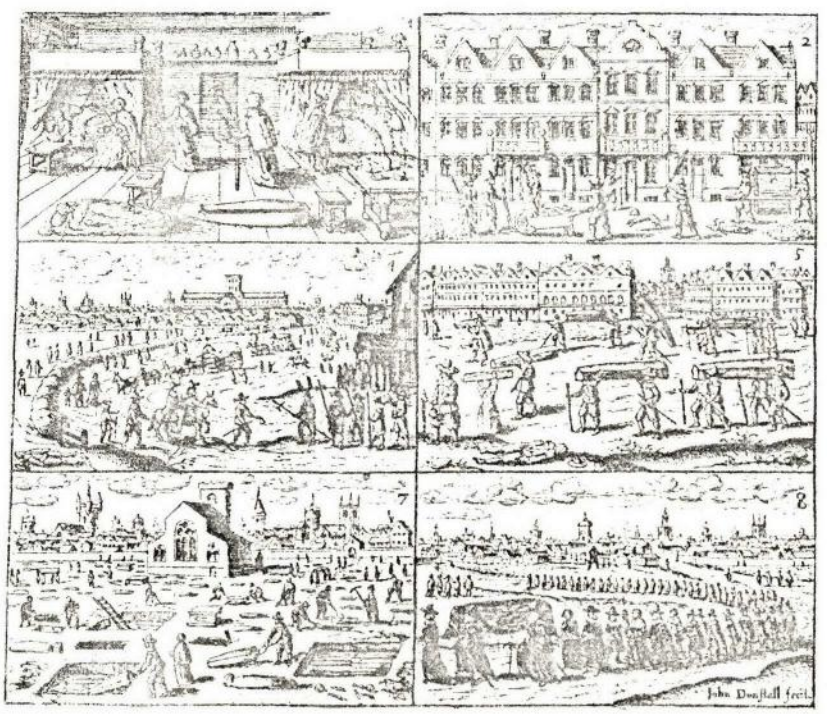
Abortive	6	Kingsevil	10
Aged	54	Lethargy	1
Apoplexie	1	Murthered at Stepney	1
Bedridden	1	Palsie	2
Cancer	2	Plague	3880
Chilblaines	3	Plurisie	1
Chrisomes	15	Quinsie	6
Collick	1	Rickets	23
Consumption	174	Riling of the Lights	19
Convulsion	78	Rupture	2
Dropsie	30	Sciatica	1
Drowned two, one at St. Kath. Tower, and one at Lambeth	2	Scowring	13
Feaver	353	Scurvy	1
Fistula	1	Sore legge	1
Flox and Small-pox	10	Spotted Feaver and Purples	190
Flux	2	Starved at Nurse	1
Found dead in the Street at St. Bartholomew the Less	1	Stillborn	8
Frighted	1	Stone	2
Gangrene	1	Stopping of the Stomach	16
Gowt	1	Strangury	1
Grief	1	Suddenly	1
Griping in the Guts	74	Surfeit	87
Jaundies	3	Teeth	113
Imposthume	18	Thrush	3
Infants	21	Tissick	6
Killed by a fall down staires at St. Thomas Apostle	1	Ulcer	2
		Vomiting	7
		Winde	8
		Wormes	18

Christned { Males 91, Females 83, In all 166 } Buried { Males 2616, Females 2663, In all 5319 } Plague 3880

Increased in the Burials this Week 1289

Parishes clear of the Plague 34 Parishes Infected 96

The Assize of Bread set forth by Order of the Lord Maior and Court of Aldermen:
A penny Wheaten Loaf to contain Nine Ounces and a half, and three half-penny White Loaves the like weight.



Richard Morrow

health sector objectives; and (c) technological, political and/or administrative feasibility of redressing health problems.[1/] This first step consists of an overview of the health problems of a country and identifies the range of issues and interventions that should be subjected to more detailed scrutiny, therefore setting the scene for Steps Two to Four.

Step Two. In light of the general framework established in Step One, sector objectives should be established in terms of precise targets for selected mortality, morbidity and ~~fatality~~ fertility reductions. Objectives of health investments may be stated in various ways and may be determined in part by goals such as raising worker productivity or meeting basic needs, which imply different target groups and different effects on indicators such as infant mortality rates, crude death rates, or life expectancy. Setting of targets is necessary in order to help in determining whether or not the use of scarce resources in achieving them is justified, and also to monitor and evaluate actual program performance.

Objectives must, by definition, be country-specific and address the underlying causes of major health and nutrition problems identified in Step One. The difficulty of quantifying desired outcomes, especially with imperfect knowledge, is well recognized throughout the international health community.[2] Nevertheless, enough data can be gleaned from health and family planning programs undertaken worldwide to make reasonable predictions of the likely range of reductions in morbidity, mortality, and fertility for ~~key~~ the

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1/ Refer to Warren and Walsh.

2) The problem of predicting the impact of improved water supplies on health have received much attention in the literature. See for example H.L. Shuval et al. Effect of investments in water supply and sanitation on health status: a threshold-saturation theory, Bulletin of the World Health Organization, 59(2), 1981.

But management is more than technical competence. It is the capability to give leadership to people.

Under C/B: Drabbenhoeas

The ~~use~~ ~~of~~ ~~benefits~~ of comparison of CEA is illustrated by ~~CEA~~ in the case of ~~interventions~~ treating unpaid WSTS and health interventions. ~~&~~ ~~AS~~ X-X found that health was most C/E

TTR:

That CBA can be done is illustrated by remarkable recent ~~study~~ ~~in~~ in Ghana. ~~by~~ The study also indicates how time consuming and ~~is~~ intensive studies are and how ~~pro~~ friendly ~~the~~ The ~~shadow~~ values given to ~~mortality~~ different health benefits ~~of~~ reflected the results.

Economists + health experts did not. countries acknowledge the difficulty of applying the ~~results of~~ CBA to health sector (Barta)

repeat last day and expand

Without trade liberalization, there is real. ~~no~~ repeat poverty the underdeveloped world will transfer know-how and technology inappropriate to LDC ~~needs~~ and compound their problems.

changes in skin thickness and glycosylated hemoglobin with pump administration of insulin. Clin Res. 1980; 28:866A. abstract.
10. Chang AY, Noble RE, Perry CS, Greenberg HS. Renal glucosyltransferase activity in highly-inbred spontaneously diabetic Chinese hamsters. Diabetologia. 1980; 19:40-4.
11. Dornan TL, Mann JI, Ting A, et al. An association between HLA-DR4 and retinopathy in insulin-dependent diabetics. Diabetologia. 1980; 19:559. abstract.
12. Marks JF, Raskin P, Stastny P. Increase in capillary basement membrane width in parents of children with type 1 diabetes mellitus: association with HLA-DR4. Diabetes. 1981; 30:475-80.

HEALTH STATISTICS: PAST AND PRESENT

THIS month marks the 25th anniversary of the National Health Survey Act, the landmark legislation in the recent development of national health-information sources. The Act made possible the design and continuing operation of a series of sample surveys, collectively called the National Health Survey and administered by the National Center for Health Statistics, which were intended to elicit data from a society in which the infectious diseases were no longer the paramount threat to life and health.

In authorizing the National Health Survey in 1956 the Congress continued an effort that predates the nation's founding. The earliest American settlements kept death records of some sort, and in the 17th century, colonies such as Massachusetts and Virginia, following English custom, required that records be kept of christenings, weddings, and burials. Although compilation of health data was not the original purpose of the records, they represent the beginning of the vital registration system. In time, these records shifted to the more meaningful categories of births, marriages, and deaths.

It was not until the early 1800s, however, that the value of vital statistics derived from central registries began to be fully understood, and it was not until the early 1900s that registration of vital events by the states was widespread enough to supersede the decennial census as the source of national data on births and deaths. In this country, Lemuel Shattuck of Boston was the leading proponent of registration. He guided through the Massachusetts Assembly the strict law of 1842 that required registration of births and deaths with information on causes of death. His analysis of vital statistics for the city of Boston demonstrated that health was deteriorating, as measured by mortality levels, and that mortality levels differed according to locality. In the work for which he is best remembered, *The Report of the Sanitary Commission of Massachusetts*, Shattuck anticipated most of the public-health measures that the next two generations would introduce. Among the recommendations was the creation of a state board of health whose program would be based on complete registration and vital statistics.

Shattuck's recommendations were realized only slowly in Massachusetts and elsewhere. As health boards and agencies came into being in the late 1800s, so did another development in public-health statistics — the reporting of communicable diseases.

These statistical activities reflected the knowledge and health problems of their time. By the time of the National Health Survey Act, the problems were different. The science of bacteriology had disproved the belief, widely held in Shattuck's time, that disease resulted from the failure of the individual patient to observe the laws of nature. Chronic diseases had surpassed infectious diseases as causes of death. The National Health Survey of 1935-1936, a study of health under depressed economic conditions, and other, smaller surveys conducted in the 1940s and 1950s had demonstrated the prevalence of chronic diseases, for which better medical management and rehabilitation were becoming increasingly available. As the nation moved toward acceptance of health care as a basic right, and as the federal government began to assume more responsibility for ensuring that right, data were needed to guide their efforts.

The surveys that were established as a consequence of the National Health Survey Act were and are unique among the nation's health resources. The surveys draw on a range of information sources: the people themselves, the institutions and professions that provide health services, and vital records. The purpose is to present a broad picture of the nation's health status and use of health resources and to show various aspects in relation to each other. Over the past 25 years, as new data systems were developed and new areas of health were explored, the National Health Survey findings have done just that.

The surveys, particularly the National Health Interview Survey, have delineated the differentials in health status and in level of health care between the poor and the more fortunate Americans. In the years since Medicare, Medicaid, and other programs to equalize access to care were implemented, the surveys have shown the elimination of these income differentials in regard to receipt of care, although not yet of the differentials in health status. Survey findings have also demonstrated the importance of targeting efforts for promoting health toward the poor and the less educated, because it is among these groups that cigarette smoking and other poor health habits are most prevalent.

Similarly, the birth and death records, amassed in the millions year by year, have continued to document such major trends as the marked and sustained decline in death rates for heart disease, and to spark investigations to determine why trends occur. The mortality data for cancer, mapped in geographic detail by the National Cancer Institute, have shown large differences in death rates for different types of cancer and led to epidemiologic studies of factors that may be associated with the differences.

The surveys and the vital statistics together meet well many of the current needs for health data. The

cross-sectional survey data give a "snapshot" of the health status of people of different ages at a point in time and also, like the vital statistics, allow examination of changes over time.

Still needed, however, are large-scale longitudinal studies that record in sequence the health events of life. Efforts in this area are just beginning. Later this year an epidemiologic follow-up study will begin of 14,000 adults who participated in the National Health and Nutrition Examination Survey of 1971-1975. The survey involved physical examination, medical history, and dietary-intake interview, as well as various standardized tests and measurements — electrocardiography, x-ray examination, pulmonary diffusion, and detailed biochemistry studies. In the follow-up survey these subjects will be traced and interviewed to ascertain their health history in the intervening years and their current health status; the information needed to determine how factors originally measured relate to health conditions that have developed since will be sought. Death certificates of original participants will be reviewed for causes of death.

Such repeated observations of the same group over time are particularly essential to understanding the impact of the environment on health. With the data from the National Health and Nutrition Examination Survey and the epidemiologic follow-up, it will be possible, for example, to study the slow-acting consequences of long-term and low-dosage exposure to a combination of environmental, dietary, social, and demographic factors.

Assessment of environmental health risks can also be facilitated by data produced by the Center's regular data systems. The second National Health and Nutrition Examination Survey of 1976-1980, for example, has provided the first data on exposures to certain pesticides for a representative sample of the population.

The newly established National Death Index is a unique resource for medical research in clinical and environmental areas. It is a centralized file of identifying information on each person in the United States who has died since the beginning of 1979. Health investigators attempting to locate subjects with whom contact has been lost may use this index to determine whether a subject has died and if so, which state office for vital statistics to contact for such information as the cause of death and a copy of the death certificate.

Evolution resulting from advances in survey and statistical methodology of surveying and statistics as well as from changes in requirements for data has been one of the hallmarks of the National Health Survey over the past 25 years. As we look ahead, it is clear that the programs of the National Center for Health Statistics must continue to evolve if it is to accommodate the data requirements of the future as it has those of the past.

National Center for
Health Statistics
Hyattsville, MD 20782

DOROTHY P. RICE

CLARA D. DAVIES

UNTIL her recent death at the age of 88, Clara D. Davies had the longest association with the *Journal* of anyone alive: her 35 years in its service up to her retirement in 1955 were followed by nearly three more decades in which her interest in its progress and accomplishments never flagged. Joining the staff of the old *Boston Medical and Surgical Journal* in 1920, before its purchase by the Massachusetts Medical Society, she filled the positions of general secretary and assistant to the editor, assistant editor, and executive editor under four editors — Green, Bowers, Nye, and Garland.

Her career, however, represented more than a tie of long duration. She worked without stint for the organization that had employed her at the age of 27 years and had given her increasing responsibilities and duties through the decades. As production manager, officer manager, treasurer, and proofreader with few equals, she labored long and hard, through hours and years, to help the *Journal* achieve and maintain the excellence that has made it a byword among medical publications here and abroad; hours of the day and days of the week had little meaning for Miss Davies, who arrived at work early, left late, and took home great quantities of business and editorial material each evening and weekend — indeed, it is safe to say that, except when she was ill or on vacation, she never had a weekend to herself.

This accomplished musician, expert typist, and outstanding proofreader gave her all to the *Journal*. To her associates her work was a marvel of accuracy; subordinates acknowledged her high standards and cheerfully did their utmost to match her devotion and never-flagging effort. When she retired, a generation of editors, associates, and others paid tribute to her contribution to the *Journal*. Those who were personally acquainted with her always admired her splendid work; they will mourn this devoted, tireless worker and courageous woman, and will cherish the privilege of having known her.

ROBERT O'LEARY

MASSACHUSETTS MEDICAL SOCIETY

DEATHS

CHASSELL — Joseph Olin Chassell, M.D., of Stockbridge, died on April 17. He was in his 81st year.

Dr. Chassell received his degree from the University of Rochester School of Medicine in 1931. He was a member of the American Medical Association, the American Psychiatric Association, and the American Psychoanalytic Association.

He is survived by his wife, three daughters and a son, and two sisters.

~~French → IRH & RGR re Grades I Essays~~

- I.R.B. notes for Shalbuck
- Holladay + Lucie

Selectivity of Interventions

Bergeron Studies	p8	Tuffnell
Walsh + Warren	p9	"
Groups of 41 interventions looked	p8	"

Organizing Effective health surveillance in conjunction with delivery of health care provides planning + managerial direction - adaptation of services in response to changing priorities of pop. at risk and commitment organizing the community + workers around the problems (Bergeron found significant ↓ in mortality ~~de~~ by introducing health surveillance with involvement of village pop^n in Haiti).

On macro scale need

- info on health status of pop^n
- assessment of CE of alternative technologies of health care
- estimates of scale of health resources now + in future

"MISTAKEN CONCEPT OF "PHC FILLING THE VACUUM"

STRATEGY:

∴ Extension of PHC is not into a medical vacuum
There is already a medical system in almost every community.
Trad healers, birth attendants, herbalists, magicians, depositories.
Trad - ~~healers~~, herbalists, magicians, depositories.
Trad health attendants.

(A) – identify & cultivate customers
(B) – make them living at it & will oppose anything that interferes.
(C) – often important positive role by ~~available~~ available all the time. NOT a few hours
(D) – give better "care" (as contrasted with "cure"). TBA lives in for luck
(E) – No problems of supply – medicines often made locally, cheap.

∴ Extension of system of PHC must

(a) recognize that select part of care will continue to be given by Trad and presumed unless they can be incorporated.
(b) system must adapt to local culture & customs
∴ Recruit from community
(c) services must be "available" "accessible" and "credible" – times of service prog. content
and "acceptable" (i.e. women for MCH in many countries)

"Health ~~Care~~ for ALL" or "Health for ALL WOMEN + CHILDREN"

PHC focus is on health + killers of 1° Epi Transition
Highest priority given
But also by extension of survivors of childhood with diseases of 2° stage Epi Transition and morbidity from back pain, skin diseases and ~~age~~ conditions, mental disorders etc

System must be able to cope with the ~~the~~ full range of medical care & the alternatives available.

SHATTUCK

(1) PHC not filling a "vacuum": It is competing with (a) Trad. Ind. Care (in rural particularly)
(b) More sophisticated hosp based health services particularly in urban.
(c) Over the counter drugs + injectionists

(2) Cross Subsidy: to P.H.C.
i essential drugs from "commercial drugs"
ii 2° + 3° health services → P.H.C.
iii ??? from Trad. medicine – unlikely

~~Dist Chief – Klinden (Procurement procedures)~~

FILE SHATTUCK

Richard Morrow

Basis for Priority Setting + Resource Allocation:

1. Measures of Disease Impact (Loss of "healthy days" due to illness, disability or death)
2. Benefits of health interventions — "cure" "care" functions — "healthy days" saved by ↓ fatality, disability or death
3. Costing the ~~two~~ interventions + mix of them
4. Work out the optimum mix

Useful Sources of Data:

Census — rarely; Vital Statistics — do;

Health facilities: (1) OPD data — poor quality (2) In patient: Good quality

Death certificates useful in Ghana

* Special local reports v. helpful Danfa

Need: Disease incidence (sometimes calculated from prevalence)

Case Fatality rate, duration + degree of Disability

System does not count costs of burden of illness to family or health system

Shattuck Modified Jha Disease

Compare: Benefits + Costs Jha Disease + Bradley.

In Ghana opportunity where of impact of mortality of WS+S.

	% ↓
Cholera	50
Typhoid	30
Diarrhoea + G.E.	~~25~~
Skin	50
Trachoma + Leprosy	55
Schisto	25
Guinea	100 %

Impact of public standpipe water = 4.25 days/dollar

Jha Disease now thinks the figures are far too optimistic.

Shattuck ↓

Days saved	Cost / 1000 pop
Extend Hosp/HC. systems by 1/2.	1 day / cdi	2700
* — PHC.	21 " "	2500
Expanded Immunization by Mobile Teams	40	250
Immun (EPI) as part of PHC.	230	50

Days Saved

Water Supply + Sewer

This evidence is incredibly indirect but its direction is useful counterbalance to the professional, political, urban, biases towards more sophisticated services

* — Does this assume that PHC

The Relief Teams have to be done —
These teams have to be done — Management

H/O base for planning + management

Ghana

Survey 2000 people: Rx + lab test + gentam
2 wks q 2yr - by District Health Team
* Must see its importance

Mali

Ind Sch → epid. survey for project
Advantages 1.
2
3. Impact on training

Linkage of Planning with
(1) Budgeting
(2) Doers (& managers)
(3) Decentralization
(4) Short term targets

Health Planning: Starting Point: (1) Health status (2) Resources (3) Present program
Where to End up (1) Health Policies (2) Goal, Targets,
How to get there (1) Program procedures (2) Management of Systems

Ghana - 3× ↑ health manpower
2× ↑ prog. load
4× ↑ real resources over 1960 - 1976 decade - no improvement in CMR + birth
Yaws retreated. Cholera, Measles not ↓

Shalhoub.

Potential Contribution from Private Sector

(1) Comparison expenditures in public and private sectors on health
- El Nadour W.B.
- Berhill - Syria, Morocco

Types of expenditures

(2) Potential: ~~success~~ Which services better funded publicly + privately.

What are policy implications

Role of - industries
- cooperatives