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KLUGMAN Nutritional Status and Household Welfare Among Pre-School Children in Uzbekistan

679-97

COMPLETION

THE WORLD BANK/IFC/MIGA

OFFICE MEMORANDUM

FILE COPY

DATE: March 21, 1995

TO: Jeni Klugman, EC3HR

FROM: Gregory K. Ingram, Administrator, Research Advisory Staff

EXTENSION: 31052

SUBJECT: Research proposal, "Nutritional Status and Household Welfare among Pre-School Children in Uzbekistan"

I have read with interest the above proposal, and found it complete, concise, frugal, and unusually well-designed. The project will examine crucial issues of targeting assistance during the transition, and address the most basic needs of children, often the most vulnerable social group. It will analyze anthropometric data in tandem with a wealth of socioeconomic information derived from the larger surveys of 1,500 Uzbekistani households. This approach ameliorates the measurement problems reflected in economies in which payment-in-kind, subsistence consumption and sharp variations in price over time and across regions all make accurate assessment of household welfare elusive. All this will be possible at a small cost given the opportunity to collect the anthropometric data as a marginal supplement to the major socioeconomic survey being conducted by the European University Institute and funded by other sources. Thus I am very pleased to approve your request for $31,600 in funding from the Research Support Budget (RSB) for this work.

The policy relevance of the project is clear and the work well-focused on it. The efficacy of existing kindergarten feeding programs will be directly assessed, based on analysis of the differences in nutritional status between children in at-home and kindergarten-based care. The targeting of the recently-instituted cash social assistance scheme will be similarly evaluated. And data from the Russian Longitudinal Monitoring Study and the Kyrgystan Multi-Purpose Poverty Study suggest that the prevalence and prevention of childhood malnutrition will be an important policy issue throughout the transitional economies.

Given this, I suspect that an important and interested potential audience may not be well-served by the dissemination strategy you propose. May I suggest that a middle-ground group between the Uzbekistani and Russian audience and the academic community would be public health policymakers and analysts throughout the region and Eastern Europe. An article written for the World Bank Research Observer would reach just such a group, as well as a sizable portion of the academic community in the transition and developing countries.

The Research Committee has taken a direct interest in the full and public availability of information collected in Bank research, and requires that data obtained using RSB funds be widely publicized and distributed. Approval of this grant thus is predicated on agreement by EC3 to provide the resources for this task. Although the Bank may have no proprietary interest in the socioeconomic data, I also would ask that you investigate the possibility of similarly wide dissemination of that information.

I have approved the following account and financial authorizations for your project:

i)	Identification code (RPO #)	679-97
ii)	FY95 authorization	$20,000
iii)	FY96 authorization	$11,600
iv)	Total authorization	$31,600

Expenses related to the project may be charged to the above account number up to the total amount authorized. Please use the account number as an identification code in all correspondence and documents relating to or resulting from the grant.

The completion date of the project will be June 30, 1996; the account will remain open until October 31, 1996 to allow for disbursements against outstanding commitments. **The account will be subject to the Bank's standard fiscal-year-end accounting regulations and procedures in both FY95 and FY96.** In this time of substantial budget cuts and financial stringency it is important that you use well the diminishing resources that are devoted to research. Thus we ask you to pay attention to the commitment and expenditure process as the fiscal year ends approach.

A project completion report will be due by August 31, 1996. Forms for that purpose may be obtained from this office.

For information on RPO accounting procedures that cannot be answered by your department's budget officer please contact Vilma Mataac, the RSB Budget Officer (extension 31030). Questions about the RSB or Research Committee policy may be directed to Clara Else at extension 3-1049.

cc: M. Selowsky, K. Krumm, ECAVP; Y. Huang, EC3DR; R. Liebenthal, EC3HR;
M. T. Dose, ACTPR; M. Bellinger, ORGHD;
C. Else, V. Mataac, B. Pleskovic, E. Thomas, RAD
Research Committee members

BUDGET

Project Completion Report: Research Support Budget-Funded Projects

(for projects with funding less than $40K)

Project RPO Number: 679-97 Project Completion Date: September 20, 1996

Project Title: ***Nutritional Status and Household Welfare among Pre-School Children in Uzbekistan***

Research Team:

(a) Bank Staff/Principal Supervisor: Jeni Klugman

(b) Consultants:

(i) John Micklewright
Nationality : British
Institutional affiliation: UNICEF International Child Development Center

(ii) Suraiya Ismail
Nationality: British
Institutional affiliation: London School of Hygiene & Tropical Medicine

Research Objectives, Results and Dissemination:

1. The general objective of the project was to measure child welfare during transition using anthropometric measures (wasting and stunting) as an alternative to monetized indicators that suffer many drawbacks.

(a) The key findings were as follows:

i. Overall moderate levels of stunting (low height-for-age) and virtual absence of wasting (weight-for-height) suggest that energy deficiency was not a problem among children under five years of age in the summer of 1995.

ii. As in other developing countries, the weaning age appears to be a particularly vulnerable period of a child's life in Uzbekistan.

iii. There was wide variation in the prevalence of undernutrition between large cities, small towns and rural areas; in particular nutritional status is lower in rural areas.

iv. Measured cash income was found to have a low positive correlation with weight-for-height and no association at all with height-for-age.

v. There is substantial variation within households in the nutritional status of children, as well as between households.

vi. The data suggest a positive association between weight-for-age and kindergarten attendance, controlling for other observable factors.

vii. Nutritional status (measured by stunting) is substantially and significantly lower among

families receiving locally targeted social assistance.

(b) Significance of the Findings for Development Policy and Bank Operations.

i. The importance of examining non-monetized measures of welfare is highlighted by the results.

ii. Rural disadvantage suggests that policy efforts should focus on improving conditions, in particular access to social services and water and sanitation, that impact positively on nutritional status.

iii. A selective targeting approach seems to be justified, given the uneven prevalence of undernutrition.

iv. Monitoring of child nutritional status would be appropriate; in this case, given universal school enrollment, routine measuring could be supported upon entry to elementary school.

v. Kindergartens have a positive impact on energy intake and on this basis could be argued to warrant public subsidies.

vi. Local social assistance based on local discretion that includes but is not restricted to household income is seen to be an appropriate means of identifying families, or at least children, in need.

Not done for Re Russia report?

2. Please provide full references for each **publication and report.** Indicate the principal reports with asterisks. **Describe the contents, program and access for any data product** arising from the project. **Enclose three copies of each report and database description.**

Nutritional Status and Household Welfare Among Pre-School Children in Uzbekistan, Suraiya Ismail and John Micklewright. * Draft Report, September 20, 1996

3. Please list all **dissemination** activities:

i. Revised paper to be submitted to WBER in Spring, including comparison with recent survey data from Kazakstan.

ii. Paper to be published as a UNICEF ICDC Innocenti Occasional Paper in Spring 1997.

iii. Presentation of the paper to a Bank seminar in late spring 1997, as well as other conferences and forums.

Project Expenditures ($ '000)

	Research Support Budget Funding		Departmental	External	Total
Fiscal Year	Authorized[1]	Actual	Actual[2]	Actual[3]	Actual
1996	11,600	11,600		11,600	11,600
TOTAL ?					

RPO # 679-97

Project Completion Report (PCR) for Research Support Budget-Funded Projects

1. Initial FY authorizations as shown in approval memorandum.
2. Do **not** include staff time costs.
3. List **below** the agencies and amounts contributed each fiscal year.

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Departmental Approval

Division Chief: Robert Liebenthal Signature: Date:

Department Director :Yukon Huang: Signature: Date:

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March 5, 1997 2:12 PM

NUTRITIONAL STATUS AND HOUSEHOLD WELFARE AMONG PRE-SCHOOL CHILDREN IN UZBEKISTAN

World Bank Research Committee Grant 679-97

Final Report

DRAFT September 20, 1996

Suraiya Ismail

London School of Hygiene and Tropical Medicine

John Micklewright

European University Institute, Florence

Acknowledgement

The research reported on here benefitted from additional financial support from the EU TACIS scheme, the Save the Children (UK) Erica Wheeler memorial fund, and the World Bank "Women in Development" fund. We are grateful to Jeni Klugman for her role as task manager at the World Bank, to Alisher Ilkhamov and his colleagues in EXPERT Centre, Tashkent, for collecting the data, and to Hereward Hill and Alan Dangour (LSHTM), and Aline Coudouel and Sheila Marnie (EUI) for their assistance.

1. Introduction

Children form a high proportion of the population of the Central Asian countries of the Former Soviet Union (FSU). In the case of Uzbekistan, the most populous of the Central Asian republics with over 20 million inhabitants and the subject of this research, some 40% of the population is aged under 12. Concern about the welfare of the population of Central Asian countries during the transition period and beyond is therefore in large measure a concern about child welfare.

Measurement by economists and other social scientists of child welfare typically focuses on the measurement of household poverty using monetized indicators of welfare such as household income and expenditure. The measurement of the incidence of poverty among households using such indicators (adjusting for differences in household size and composition) then provides evidence on whether and to what extent poverty is a phenomenon concentrated on children. Design of social assistance schemes and other more pro-active measures to combat poverty can then take this information into account when targeting scarce resources on the poor.

The research reported on here takes a different route to the measurement of child welfare, using simple anthropometric measurements of child height (stature) and weight. These data have three important attractions to any analysis of household and child welfare.

First, low height in relation to age, known as "stunting", and low weight in relation to height, known as "wasting", are important direct indicators of nutritional status. Nutritional status is a subject of direct interest if one is concerned about child welfare, summarising a variety of influences on child development including food intake and morbidity. Low nutritional status in childhood may have an adverse impact on health and productivity in later life thus reducing an individual's adult "capabilities" (Sen, 1981) as well as increasing the risk of mortality while still a child.

Second, anthropometry avoids the problems of measurement of monetised indicators of household welfare, such as income or expenditure. These problems can be acute in transition economies in which a substantial amount of economic activity is not monetised. Notably in Centra Asia, the predominately rural nature of the region implies that a great many households have access to an agricultural plot and derive substantial amounts of income from land in the form of food produced and consumed within the household.[1] Moreover, prices may vary substantially within a country but with no tradition of accurate price measurement in the Central Asian countries (Koen, 1995), the appropriate indices to adjust monetary welfare measures for regional price

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[1]. The 1993 KMPS in neighbouring Kyrgyzstan estimated the value of production on these plots to be over 20% of total household income. However, there must be considerable doubt about the reliability of this estimate (and hence of the valuation at the level of the individual households in the sample) since the amounts of agricultural production and self-consumption were collected though recall over a 12 month period, and the appropriate prices at which to value the amounts are open to debate (due to the high rates of inflation and the lack of market prices at the time of the survey for goods out of season).

variation do not yet exist.[2] On this argument anthropometric data may be seen as providing a proxy for other indicators of household welfare and in addition offers a fundamental absolute measure of living standards that allows comparison of the Central Asian countries with those in other regions.

Third, anthropometry provides information on *individuals*, thus avoiding the typically untestable assumption made in most analyses of household welfare based on incomes or expenditures that household members pool and share their resources. Anthropometric data offers the opportunity to go inside the "black-box" of the household and actually observe intra-household variation in a measure of individual welfare.

Our research reports on the first systematic measurement of anthropometry in Uzbekistan. Morse (1994) provides some concrete data based for a single remote district in the region of Karakalpakstan bordering the Aral Sea and finds 25% of children aged less than 5 to be stunted and 12% wasted, but there is no good reason to believe these figures to be representative of Uzbekistan as a whole, or even of Karakalpakstan. Our data are collected in three of the fourteen regions of Uzbekistan, chosen to provide a wide range of economic and geographical circumstances. Some comparisons are also made with data from surveys conducted (Ismail and Hill, 1996)in 1994/95 in three districts (Kazalinsk, Djalagash and Zhanakorgan) of Kzyl-Orda, a neighbouring region of Kazakhstan.

Section 2 provides information on the survey used to collect the anthropometric data, the 1995 EUI/Essex Survey in Uzbekistan (EESU), and on the children for whom anthropometric measurements were made. Anthropometric measurements formed just part of this survey which was of the sort traditionally used by social scientists to evaluate living standards, collecting a range of both monetized and non-monetized data.

Section 3 provides basic results on nutritional status by region, urban/rural status and age, and looks at the association between the two measures in the data, height-for-age and weight-for-height, at the individual level. Section 4 looks at intra-household variation in nutritional status, providing information, for example, on the correlation between stunting and wasting between siblings. Section 5 uses multivariate analysis to test three hypotheses. First, that controlling for cash income, nutritional status is higher in rural than in urban areas. Second, that a new means-tested social assistance scheme, aimed principally at families with children and administered by *Mahallah* local committees, is well-targeted in terms of nutritional status. Third, that attendance at state or enterprise

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[2]. Even without these problems a profile of poverty - including urban/rural differences and regional variation - might well not be robust to the choice of poverty indicator (Ravallion and Bidani, 1994). These considerations reinforce the value of anthropometric measurement and analysis of the data may modify the picture of household welfare obtained from monetized measures. For example, Popkin and Martinchik (1994, Table 6A) found that wasting among pre- school children in Kyrgyzstan did not decline monotonically with measured income (including the estimated value of self-consumption of agricultural production). And these authors' figures for wasting in Kyrgystan by region display quite a low correlation with regional figures for head-count ratios of poverty (on an expenditure basis) from the same survey data found by Falkingham and Acland (1994).

kindergartens has a positive impact on nutritional status.

Section 6 discusses the implications for policy on health and social safety nets of the research stemming from both the work reported in Section 5 and from the analyses of earlier sections.

2. Data

The EUI/Essex Survey in Uzbekistan (EESU) was conducted in the Summer of 1995 and collected data on about 500 households in each of three regions that together contain over a quarter of the republic's population - the capital city of Tashkent, the important region of Fergana in the populous valley of the same name in the south-east of the country, and the autonomous republic of Karakalpakstan bordering the Aral Sea in the north-west. The three regions appear to contrast considerably in terms of average living standards (Coudouel et al, 1995). Tashkent, a city of over two million people and much the largest city in Central Asia, appears on economic indicators to be considerably ahead of all other regions in the republic. Karakalpakstan appears on the same indicators to be at the other end of the range and is commonly thought to have suffered substantially from environmental degradation associated with the retreat of the Aral Sea. Fergana can be viewed as a reasonably prosperous agricultural area but also containing some large urban areas.

The EESU collected data on a range of household and individual characteristics via interview. There were questionnaires for the head of the household, for each adult in the household aged 16 or over, and for mothers of children aged under 7 in respect of each child of this age. Information was collected on a range of subjects including demographic characteristics, housing conditions, employment, cash incomes in different forms, and agricultural assets and activity. No information was collected on expenditure or consumption. Anthropometric measurements of children aged less than 7 were collected in separate visits from the main interviews.[3]

In all, 1581 households responded to the EESU, representing an overall response rate of 85% Refusals accounted for just under a third of non-response. (Details of sampling and response are given in Coudouel, 1995.) 851 responding households contained children aged over 6 months and under 7 but in 10 percent of these collection of anthropometric data proved impossible for one reason or another, including refusal to be measured. Measurement was successfully carried out on 1298 children in 765 households.

Table 2.1 shows the number of children measured per household, distinguishing by whether the children concerned have the same mother. In nearly half of the households there was more than one child of appropriate age for measurement and in well over 100 there were three or more children.

3. Nutritional Status Results

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[3]. The survey was conducted by EXPERT Centre, Tashkent. Anthropometric measurements were made by persons receiving training from a team from the London School of Hygiene.

Growth assessment, by means of anthropometry, is one type of measurement used to evaluate the nutritional status of individuals. The anthropometric measurements most commonly used, height (length for children under 2 years) and weight, are matched for age and sex with reference standards from the National Centre for Health Statistics/World Health Organization (NCHS/WHO), and then converted into two main indices: height for age and weight for height, expressed either as z-scores or as percent of the reference median. Population means of anthropometric indices permit inter-country and regional comparisons. Cut-off points (Table 3.1) are used to define the proportion of the population that is considered to be malnourished (stunted or wasted).

Low height for age, referred to as 'stunting' (short stature) and reflecting suboptimal linear growth, has been associated with poor socioeconomic conditions, chronic or repeated infections and, more recently, poor diet quality.[4] The proportion of stunted children in a population can be taken as a measure of social deprivation (WHO, 1986). Low weight for height or 'wasting' (thinness) reflects the body proportions, and because it can develop rapidly, it can reflect the impact of a recent episode of disease or seasonality in food supply (WHO, 1986). As a responsive, age-independent index, it is especially useful in monitoring food deficit areas and targeting food relief. Unlike wasting, stunting develops slowly, with deficits in attained height increasing throughout a child's growth period if conditions remain unfavourable. [example of deficits from country X to come maybe?]. Linear growth failure (failure to grow in height) is however most marked during the early years when the rate of growth is at its peak, and when the child is most vulnerable to nutritional insults and high morbidity.

Catch-up growth of stature is possible if suitable interventions are provided or if the child's socio-economic conditions improve, leading to a better diet or reduced morbidity. (It goes without saying that catch-up growth of weight is also possible.) This important fact aids the interpretation of stunting as an indicator reflecting both *current* as well as past living standards, although wasting may be thought of as a more direct measure of the former. Intervention at an early age appears to have the greatest positive impact on catch-up growth of stature (refs), although studies of the impact of late interventions are limited. Piyadasa (1996) has shown that supplementation with milk or calcium significantly increased the rate of linear growth in stunted Sri Lankan children aged 4-7 years. The linear growth deficit was reduced from xxx% to xxx% over the intervention period of four months. Longitudinal studies are needed to show if full recovery is possible with sustained intervention.

The basic anthropometric results of the EESU are given in Tables 3.2A and 3.2B, the former grouping the children in terms of z-scores while the latter gives the distributions of height for age and weight for height expressed as percentages of the medians of the reference standards. The data indicate that there was no significant moderate or severe wasting in the sample of children from the three surveyed oblasts (only 3% of children are more than two standard deviations below the reference median). However, some mild wasting (<-1SD below reference median) did exist (15.5%), and 7.9% of the children were overweight. The overall prevalence of stunting (<-2SD below reference median) in the total sample was 14.6%, and 33% of the children were

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[4] "Linear" growth refers to the growth of stature as opposed to other aspects of the body such as size.

mildly stunted. In general, a prevalence of greater than 10% for moderate and severe wasting is considered cause for concern by nutritionists. In the virtual absence of this degree of wasting in our Uzbek samples, we have focused our attention on differences in the prevalence of mild wasting as well, but it should be noted that the existence of mild wasting alone does not warrant the initiation of nutritional interventions.

How do these results compare with those from elsewhere? We first consider findings from outside the Central Asian region. The combination of a moderate prevalence of stunting with a low prevalence of wasting is also seen in Latin American countries, although the prevalence in Uzbekistan is lower than is commonly found in most countries of Latin America (de Onis et al, 1993). Similarly low levels of wasting have also been recorded in Mongolia and China (de Onis et al, 1993). Highest levels of both stunting and wasting are seen in Africa and in South Asia (de Onis, 1993).

Turning to other parts of Central Asia, we see that those from the EESU are not out of line with the limited available results which refer to Muynak, a remote district of northern Karakalpakstan on the shores of the Aral Sea, Morse 1994), the Kzyl Orda region of Kazakhstan which borders Karakalpakstan (Ismail and Hill, 1996), and to a representative survey of Kyrgyzstan (World Bank, 1995). For example, a 7% prevalence of moderate and severe wasting was found in Kyrgyzstan (no information on the prevalence of stunting could be calculated rom the data). We give a detailed comparison later in this section of the EESU results with those from Kyzl Orda.

Table 3.2A shows also that the prevalence of stunting was lowest in Tashkent and highest in the Fergana region. While all the households of the Tashkent sample lived in the large city of Tashkent (with a population of over 2 million), the Fergana and Karakalpak samples comprised both rural households and households living in urban areas ranging in size from xxxxx to xxxxx. We decided therefore to disaggregate the Fergana and Karakalpak urban samples into two groups: households living in large urban centres (populations > 100,000) and those living in smaller towns. Our Fergana sample includes three cities of over 100,000 - the capital (which has the same name as the oblast), Kokhand, and Margilan, all of which have between zzz and zzz inhabitants. Karakalpakstan has just one such city, the capital Nukus with a population of zzzz.

Table 3.3 shows that the prevalence of stunting is much lower in large urban centres (6.8%). The prevalence elsewhere is at more than double this level with no difference between the children from small towns (18.5%) and those from rural areas (18.4%). The latter is a similar result to that obtained in the surveys of the Kzyl-Orda oblast of Kazakhstan (Ismail and Hill, 1995 and 1996a, 1996b) where no differences were found between rural children and those from small towns (the Kzyl-Orda sample contained no children from large urban centres).

In Uzbekistan, we found that there was no difference in the levels of stunting among children from the large urban centres of Tashkent, Fergana and Karakalpak (7.1%, 5.5% and 7.9% respectively). There was however a significant difference between the rural children of Fergana and Karakalpakstan (Table 3.4), with the former being significantly more stunted (23%) than the latter (13%). The prevalence of mild and moderate wasting followed a similar pattern but did not reach significance. Unfortunately the small town sample from Fergana was too small to permit a valid comparison with

its counterpart in Karakalpakstan.[5]

The prevalence of wasting (<-1SD of reference median) was also lower in Tashkent than in either Karakalpakstan or Fergana (Table 3.2A), and lower in large urban centres of the three oblasts than in small towns or rural areas (Table 3.3), but the differences were not so marked as for stunting, ranging from 14.6% in Tashkent to 22.4% in rural Fergana.

Table 3.5 compares selected results from the EESU (Fergana and Karakalpak small town and rural, children under 6 only) with those of surveys conducted in three districts (Kazalinsk, Djalagash and Zhanakorgan) of the Kzyl-Orda region of Kazakhstan which lies to the northeast of Karakalpakstan. Some interesting comparisons can be made here, between Kazalinsk and Karakalpak on the one hand and Fergana, Zhanakorgan and Djalagash on the other. Kazalinsk lies on the northeastern edge of Karakalpakstan, and like Karakalpakstan, borders on the Aral Sea. Agriculture is similar in both areas, with a heavy emphasis on animal rearing. Zhanakorgan and Djalagash in Kazakhstan are fruit-growing regions, like parts of Fergana in Uzbekistan, and fewer households keep animals. Table 3.5 shows that levels of stunting in Kazalinsk and Karakalpak are similar, as are levels of stunting in Fergana, Zhanakorgan and Djalagash.

Recent studies have suggested that the nutritional factors associated with stunting and wasting may be quite different; Victora (1992) and other authors (refs) propose that while wasting may be due to a deficit in energy, stunting reflects rather the quality of the diet once the demand for energy has been satisfied, and may be due to a deficiency in one or more micronutrients. A number of micronutrients have been proposed, but a recent study (Piyadasa, 1996) would seem to indicate that an adequate intake of calcium is crucial for optimal linear growth. There is some support for the findings of these studies from the Uzbek and Kazakh surveys. The Kazakh surveys found that the ownership of cattle and the consumption of dairy products were higher in Kazalinsk, where stunting is less prevalent, than in the other two districts of Kzyl-Orda. Similarly, while no food consumption data were collected in Uzbekistan, we did find that a larger proportion of households owned cattle in Karakalpak (88%) than in Fergana (68%).

It is however important to appreciate that calcium intake may not be the only nutritional factor involved and also that nutritional factors are by no means the only factors implicated in the aetiology of stunting; other factors include the individual's genetic potential and the frequency and severity of disease episodes. The prevalence of disease is itself related to a range of socioeconomic factors such as educational level, hygiene practices, access to health services, clean water and good sanitation. The relative contributions of the various factors to linear growth promotion or retardation is likely to vary from one country to the next, and within a country, from one region to another. The aetiology of stunting in Central Asia has not yet been examined

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[5] Within the rural samples of both Fergana and Karakalpakstan we found considerable differences in the prevalence of stunting from one sampling point to another, with figures ranging from 12% to 35% in Fergana and 8% to 23% in Karakalpak. Although sample sizes at this level of disaggregation are small, there is an indication that not all rural areas, even within one region, are uniform.

in any detail although efforts are underway using the Kzyl-Orda data set.

The prevalence of stunting and wasting by age group is shown in Table 3.6. The Uzbek pattern of change in the prevalence of stunting and wasting with age is consistent with the findings of other studies: wasting is highest during the weaning period (6-24 months), then decreases as the child gets older; stunting on the other hand is lowest in the infant (<12 months), rising slowly but steadily over the next four to five years, with sometimes a partial recovery in the older child. The weaning age is a period of high nutritional risk for a child; nutrients from breastmilk alone become insufficient to support good growth, and supplementary weaning foods may be low in energy content, of poor dietary quality or prepared unhygienically. The weaning age is also the age when a child begins to explore his environment thereby exposing himself to higher risk of disease.

There was no difference in the prevalence of either stunting or wasting between male and female children. There was also no significant correlation between height for age and weight for height, expressed as percentages of the reference median. In the absence of a significant level of moderate (<-2SD) or severe (<-3SD) wasting, this latter finding is not surprising, and is consistent with the findings of the Kazakhstan (Kzyl-Orda) surveys.

4. Intra-household variation in nutritional status

To this point we have ignored the fact that most of our measured children in the EESU live in households where another child was also measured for anthropometry. In this section we consider the variation in the data within households.

Table 4.1 shows the partitioning of the overall variance in height for age and weight for height into the variance between households and the variance within households, restricting the analysis to those households with at least two measured children. For both indices, the intra-and inter-household variances are similar although in each case inter-household variance is slightly higher.

Tables 4.2 and 4.3 compare directly the anthropometry between the first and second child in households with two children or more. The former correlates for these pairs of children the continuous variables height for age and weight for height (as a percentage of the reference median). Significant and positive correlations were obtained for the total sample (Table 4.2) (and for the large city, small town and rural subsamples), for both stunting and wasting, with the correlations being higher when both children have the same mother.[6] This suggests the existence of vulnerable households, although the degree of correlation might be considered insufficient to imply that the anthropometric indicators are a sufficiently good indicator of household as opposed to individual welfare.

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[6] In the Kzyl-Orda study in Kazakhstan, while correlations between siblings' nutritional indicators were not examined, a strong correlation was found between the nutritional status of the mother and her child, both in anthropometric status and in levels of anaemia, suggesting again the existence of vulnerable households.

Table 4.3 presents the EESU data in a different way, examining whether or not the siblings of a stunted or wasted child are more likely to be similarly stunted or wasted. The table shows that 38.3% of second children in a household are stunted (<-2SD) and 25.2% are moderately or mildly wasted (<-1SD) if the first child is similarly stunted or wasted, while only 11.9% are stunted and 4.8% wasted if the first child is adequately nourished.

5. Testing Hypotheses concerning Living Standards and Public Policy

In this section we test the three hypotheses outlined in the Introduction concerning , (ii) the impact of kindergartens on nutritional status, and (iii) the targeting of the *Mahalla* social assistance scheme.

(i) *living standards in rural and urban areas*

Section 3 showed clearly that on one indicator, height for age, there is lower nutritional status in the rural areas in the regions covered by the EESU than in the large urban areas, with small urban areas in an intermediate position. While stunting was found in 18% of children in rural areas of Karakalpakstan and Fergana, only 7% of children in cities of over 100,00 population were stunted (including Tashkent). The results on the other indicator, weight for age, which gives a more short-term measure of nutritional status, was less clear cut, with mild to moderate wasting varying from 15% in the large cities to 21% in the rural areas.

In this section we investigate these differences in more detail. The analysis in the earlier section was sufficient to reject the hypothesis that nutritional status is higher in rural areas, but only when we control for no other factors. We have yet to see, for example, whether controlling for measured cash income has an effect on the apparent differences in nutritional status by location. Higher income can be expected to be associated with higher nutritional status. If when we control for the differences in observed cash income between urban and rural areas we find that nutritional status in the latter is in fact *higher*, this will suggest that unmeasured non-cash income in rural areas, particularly food grown on agricultural plots and consumed within the home, is an important factor in sustaining household living standards in rural areas. This in turn underlines the danger in treating cash income as an adequate measure of household welfare.

Our strategy in testing the hypothesis concerning rural/urban differences is to estimate multivariate equations, regressing anthropometric status of the child on the location indicators, progressively adding in a variety of control variables. The measures of anthropometric status that we use are the height-for-age and weight-for-height relative to the reference medians, both expressed in natural logarithms.[7]

Tables 5.1 and 5.2 give the results of this exercise. We report only the estimated coefficients on the location variables, but we comment below on

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[7] These regressions are estimated by OLS. We have also estimated the same equations by GLS, allowing for an unobserved household level random effect, constant across children in the same household (and uncorrelated with observable factors included in the regression). The results were very similar to those obtained with OLS.

the impacts of some of the control variables.

The specification in column 1 contains only the location variables, which we restrict to dummies for urban areas with less than 100,000, and for rural Karakalpakstan and rural Fergana. The base is therefore all cities greater than 100,000, where we showed earlier there was no variation in the prevalence of stunting across oblasts. Height for age is 2% less in the smaller urban areas (we refer to the these in what follows as "towns") than in cities, nearly 3% less in rural Fergana, and 1% less in rural Karakalpakstan. The variation across location for weight-for-height is similar in its pattern, with all three estimated coefficients negative and the estimated differentials being similar in size to those for height-for-age, but the impacts are much less precisely determined, as indicated by the t-statistics.

Column 2 includes controls for household composition, including size, age of children, and whether the household head is of Slav ethnicity. The mean values of all of these varies across location but we can see that their inclusion in the equations has very little impact on the estimated location effects for either measure of nutritional status. The age variables are not important in either equation but the other household composition controls are only significant for height-for-age. Notably, a Slav head is associated with a quite well determined increase in height-for-age of nearly 3%,

Column 3 includes measure cash income. This variable refers to all income in the previous month whether it was received or not, the later including wages or cash benefits due in that month which were not actually paid, a common feature in transition economies. Information on cash incomes in the EESU was collected in considerable detail, with each adult separately questioned about a wide range of different possible sources and the results then aggregated into a household income variable. While cash income may well not be an adequate measure of household welfare in Uzbekistan we are reasonably confident that we have at least measured household cash income properly.

The inclusion of the cash income variable (which is equivalised for differences in household size) has virtually no impact on the estimated location effects - a striking result which came as some surprise given our prior suspicions outlined above. There seems to be two reasons for this. First, differences in mean cash incomes across location in the EESU are not as large as one might expect from evidence from other sources (Coudouel et al, 1996). Mean income (using the equivalence scale described in the notes to Table 5.1) varies between 790 sum (the Uzbek currency) per month in cities to 601 sum in rural areas and, moreover, there is substantial variation within each type of area - mean income is 859 sum in Tashkent but only 634 sum in the three Fergana cities.

Second, even the simple correlation between household cash income and individual nutritional status is very low - the two measures of welfare appear to be very weakly related. We cannot reject the hypothesis that the correlation coefficient between equivalised income and height-for-age is zero. That between weight-for-height and income is significant at the 1% level but

the correlation is very weak (r = 0.07).[8] Similarly, in the regressions reported in Table 5.1 (where we are controlling for other factors), equivalised income has a completely insignificant impact on height-for-age. The estimated impact on weight-for-height is, like the simple correlation, significant at the 1% level but is very small - a 10% increase in income from its mean level is estimated to increase weight-for-height by only 0.1%. These results are not changed much when we allow the effect of income to vary by oblast. In no oblast has income a significant impact on height-for-age; the impact on weight-for-height is insignificant in Fergana while in Tashkent it is about double that estimated for the three regions taken together (with a t-statistic of 3.5).

The greater impact of cash income in the last month on weight-for-height makes sense, since this is a short-run measure of nutritional status. The lack of association with height-for-age may be interpreted in various ways; one is cash income over a month is a poor indicator of "permanent and full" income.

The agricultural asset variables entered into the specification in the final column are intended to pick up important sources of other aspects of "full" income for households. Here we do find a substantial change in the estimated impact of the location variables. The difference between rural Karakalpakstan and the large cities now disappears for both nutritional indicators and as far as weight-for-height is concerned there are no differences in any of the location types from the big cities. However, when we look at the estimated coefficients on the agricultural asset variables we find that a number of them are *negative*. (Indeed, this must be the case in order to account for the change in the location impacts given that the cash income variable did nothing). Children in households with any cash income from crop or stock sales in the last month are estimated to have height-for-age and weight-for-height that are lower by about 1% and 2% respectively than for other children. The income itself from this source is included in the cash income variable and the agricultural income dummy is intended to pick up households with sufficient involvement in private agriculture to engage in selling to others.

Overall, the conclusion from this exercise seems to be a rejection of the hypothesis we wished to test. Nutritional status does seem to be lower in rural areas when we control for cash incomes. Further controls do help explain some of the apparent rural "effects", for example status is lower in households without running water, which is less common in rural areas.

(ii) *the impact of kindergartens on nutritional status*

The impact of kindergartens on nutritional status is of considerable policy interest. As elsewhere in Central Asia (Klugman et al, 1995) kindergarten enrollment has fallen significantly in Uzbekistan, from 35% of the relevant age-group in 1991 to 26% in 1995.[9]

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[8] The degree and significance of correlation between income and weight-for-height is more or less unchanged if we use instead either total (unequivalised) income or per capita income.

[9] Information supplied by the Ministry of Labour.

These falls in enrollment have in all probability reflected both demand and supply side factors, the latter including closure of some enterprise facilities.[10] Whatever the cause, the issue rises of whether this falling enrollment is a cause for concern as regards public policy. Kindergartens have a number of functions and hence positive impacts on household welfare. One possible effect of kindergartens is that of enhancing nutritional status among children, via the provision of food that would not otherwise be eaten. We do not investigate here whether this benefit from kindergarten attendance, if it exists, goes to richer or poorer households, although the distributional impact of the large state subsidies to kindergartens is clearly important. Our purpose here is restricted to merely detecting if kindergarten attendance does have a positive impact or not on nutritional status.

We investigate this issue by estimating by inserting a dummy variable for kindergarten attendance in the regression equations described above. About 25% of children in the sample are in kindergartens. Table 5.2 reports the coefficient on the kindergarten dummy in regressions of (log) height-for-age and weight-for-height (relative to the appropriate reference median) under two different treatments of unobservable factors. Column 1 reports OLS regressions analogous to those in Table 5.1 column 4 in which all the controls were included. In these equations each child is treated as an independent observation and any unobservable influences on nutritional status are assumed to be uncorrelated with included variables.[11]

The problem with the OLS estimates is that unobserved factors may indeed be correlated with the kindergarten dummy, which in this case would partly proxy those factors. For example, "good" mothers may provide their children with more food and better living conditions but they may also be more likely to send their children to kindergarten so as to take advantage of the benefits offered. In this case a positive impact of the kindergarten dummy in an OLS regression of nutritional status could merely be proxying the unobservable factor of having a "good" mother.

The estimates in column 2 allow for this problem and are obtained with the fixed-effects estimator, exploiting the fact that we often observe more than one child per household. With a two child household this technique is equivalent to regressing the difference in nutritional status between the two children on the difference in their kindergarten attendance. Unobserved household factors such as a "good" mother which are common to the children drop out of the equation (their difference is zero) thus leaving an estimated kindergarten effect that is uncontaminated. The disadvantage of this technique is that the kindergarten impact is estimated only from the within-household variation in kindergarten attendance, and none of that between households. The amount of such variation is low and we cannot therefore hope for well-determined estimates.

The results show that with neither the OLS nor fixed-effects estimator is there any impact of kindergarten status on height-for-age, or stunting. The kindergarten variable is completely insignificant in both cases. However,

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[10] As in Kazakhstan and Kyrgyzstan - see Klugman et al, 1996 - enrollment has fallen by more than the number of available places.

[11] We also estimated a GLS regression (see footnote X) with identical results.

it does seem that weight-for-height may be affected positively by kindergarten attendance. The OLS results indicate that weight for height is about 1% higher where the child is in a kindergarten, controlling for other observables factors (including, for example, age which is strongly correlated with kindergarten attendance). The estimated impact, which is not trivial in size, is just significant at the 5% level. The fixed effect estimator, which allows for the possibility that the OLS impact is caused by omitted unobservable factors, yields an estimate which is similar in size, but which is poorly determined, being significant at only the 15% level. A considerably larger sample size would be needed to estimated the effect with more precision.

(iii) *the targeting of the Mahalla social assistance scheme*

As part of its moves to rationalise the existing social safety net inherited from the Soviet era and to provide more targeted support to those in need, the Uzbek government introduced a means-tested social assistance scheme in the Autumn of 1994.[12] A key feature of this scheme, is that support is administered by committees of the *Mahalla*, a pre-Soviet traditional community organisation that has been revived under the government's auspices. There are about 1000 *Mahalla* in the republic as a whole. The scheme is an important form of support for households. Initially granted a budgetary allocation of about 0.5% of GDP, some 1 in 5 households were apparently granted benefit under the scheme in 1995 for periods of three months (renewable), at a level which is intended to be between 1.5 and 3 times the minimum wage. In the EESU data, income from the *Mahalla* scheme amounted to X% of all recorded cash income received in the previous month.

The *Mahalla* scheme combines on the one hand firm rules regarding applications and procedures for assessing them with, on the other, a very large element of discretion for the *Mahalla* committees. Clear guidelines lay down the information that the Mahalla committees should take into account in assessing need but at the end of the day the committees' decisions, which are not subject to appeal, are their own and there is no attempt made by the central authorities to define when support must or must not be given. The idea behind the scheme seems to be that each Mahallah committee should help the poorest households in its area and although guidelines are given to help identify need it is us to the committees to decide on the allocation as they see fit.

The guidelines for assessing need indicate that the committees should collect information on a wide range of indicators that might be thought of determining the household's "full" income, including household composition, labour force status of adults, cash incomes, durable good ownership and agricultural plot size and use. The guidelines also indicate examples of types of households who may be expected to benefit from the scheme, of which households with large numbers of children head the list.

In principle the Mahalla scheme seems to be well designed, ensuring that both standard information is taken into account in assessing need but also that the scheme may be administered with discretion, tailoring decisions to the local situation. However, a strong discretionary element brings with it the risk of errors in targeting - discretion may be inappropriately applied

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[12] The introduction of the Mahalla scheme in 1994 co-incided with a phasing out of food subsidies.

to both exclude the needy and to include those not genuinely in need. In addition, ignorance of the scheme or a reluctance to publicly display need (Mahallah committee recommendations are voted on in a monthly public meeting) may lead to a failure to claim benefit.

We use the data on nutritional status in the EESU to conduct a simple test of the targeting of the Mahalla social assistance scheme, simply comparing mean height-for-age and weight-for-height in households with and without support from the Mahalla. Among households in the EESU with children for whom anthropometric data were collected, 16% reported receiving social assistance from the Mahallah in Tashkent, 23% in Fergana, and 27% in Karakalpakstan. We give results in Table 5.3 both at the level of the child and the household. In the former (column 1) we are looking at differences in means for children living in households with and without support; in the latter (column 2), we take in the case of multi-child households the minimum recorded height-for-age and weight-for-height.

The switch between the analysing all children in column 1 and only the child with the lowest status in column 2 makes an important difference to the results for height-for-age. Children in households receiving support have a height-for-age in relation to the reference median which is only 0.5% less than that in households not receiving support from the Mahalla and this difference is not significant at the 10% level. However, the results in column 2 show a much larger difference when we consider only the status of the child with the lowest height for age in each household. Here we see a sizeable difference of 1.4%, which is strongly significant. Putting the data on this basis does appear to indicate that on average Mahalla support goes to household with at least one child of notably lower nutritional status, giving an encouraging picture of targeting.

In the case of weight-for-height, a more short-term measure of nutritional status, we cannot rule out the possibility that receipt of social assistance has allowed nutritional status to improve, due in particular to increased food intake. Thus a finding of no significant difference in weight-for-height between households with and without support from the Mahalla is not inconsistent with the support having gone to those households most in need on the basis of this nutritional indicator. On the other hand, a finding that weight-for-height is lower in households receiving support may be considered quite a strong result since it will have emerged despite any positive impact of the support on nutritional status.

The results in Table 5.3 again show that nutritional status is lower in households receiving support but even when we look at the lowest recorded status within each household (column 2) we do not find a difference which is significant at the 10% level. However, for the reason explained above this is not sufficient for us to rule out that support has gone to the households with the greatest need.

6. Conclusions and policy implications

Our conclusions and the implications of the research for policy relate to a number of issues.

I. Overall Nutritional Status

With moderate levels of stunting and the virtual absence of moderate and severe wasting in the Uzbek data, it is reasonable to assume that energy deficiency is not a serious nutritional problem in the regions covered in the survey. The results for the three Uzbek regions also appear to be in line with those found in separate survey work in the Kyzl-Orda area of Kazakhstan. However, the quality of the diet may be poor with deficiencies in one or more micronutrients.

As in many developing countries, the weaning age appears to be a particularly vulnerable period of a child's life in Uzbekistan. A nutrition education programme should thus be considered, to address the question of diet quality and child feeding during the weaning age. No information on diet was collected in the Uzbek surveys, but preliminary data from Kazakhstan (Kzyl-Orda) suggest that improvements are needed. The nutrition education programme would need to take into consideration regional food consumption patterns, as well as regional food availability and food prices. No information on morbidity was gathered in the Uzbek survey; again, if the situation is similar to that found in Kzyl-Orda, sanitation, hygiene and levels of morbidity are likely to be unsatisfactory in rural areas and in small towns. Public health programmes should address these issues.

II. Urban/Rural Variation and Growth Monitoring

We found a wide variation in the prevalence of undernutrition between large cities, small towns and rural areas, and within rural areas. This suggests on the one hand that nationwide programmes are not necessary, and that considerable savings in expenditure on interventions can be made with appropriate targeting, and on the other hand that there are some parts of the country that are probably in need of quite urgent attention. Furthermore, while the situation is not yet poor in some areas, in the face of rapid economic change it is certainly advisable to consider some form of nutrition monitoring.

A number of options for monitoring are available, ranging from a full-scale national surveillance system to monitoring of nutritional status indicators only at selected "sentinel" sites. An option that is particularly appropriate for Central Asia is the routine measuring of heights and weights of all children at entry to elementary school, which remains universal. With basic training (and periodic re-training) and investment in good equipment, such data are easy to gather and analyse, and would indicate those areas of the country in need of further investigation to select suitable social, economic, health or nutrition interventions. Measurements can be taken either by teachers or by mobile teams of health personnel.

III. Urban/Rural Variation and the Measurement of Household Welfare

The nutritional status of Uzbek children is lower in rural areas, and our analysis does not indicate that this is mediated to any substantial degree

by cash income. Cash income was found to have a low positive correlation with weight-for-height and no association at all with height-for-age. In most developing countries, rural children have worse nutritional status than urban children, and this has been associated with a variety of factors including lack of access to health care and a low level of education. While health care is widely available in rural Uzbekistan, it is possible that the quality of care is poorer than in urban areas although we have not information on this. Educational levels are high, as in other former socialist states, and our results gave no indication that lower levels of maternal education in rural areas was an explanatory factor.

These results both underline the existence of lower living standards in rural areas and the limitation of monthly cash income as a measure of household welfare.

IV. Individual Nutritional Status and the Measurement of Household Welfare

There is substantial variation within households in the nutritional status of children as well as between households. This suggests that any nutritional interventions are best targeted on the individual children themselves rather than by supplementing the resources of households. On the other hand, we did find a moderate correlation between nutritional status of children in the same household indicating that the low nutritional status of any child in the household could, with care, be taken as a proxy for that household's welfare.

V. The Impact of Kindergarten Attendance on Nutritional Status

Controlling for other observable factors, attendance at kindergartens had no positive association with height-for-age. However, the data did suggest a positive association of weight-for-height with kindergarten attendance. This association was not very well determined but seemed moderately robust to changes in the econometric treatment of the data. This result is consistent with the hypothesis that kindergartens have a positive impact on energy intake of children which has a bearing on government policy on pre-school education.

VI. The Targeting of Social Assistance

Controlling for no other factors, the data show that nutritional status measured by height-for-age is substantially and significantly lower for at least one child in households receiving means-tested support from the social assistance scheme administered by the *Mahalla* than it is in other households with young children who do not receive support. On the face of it, this gives an encouraging picture of targeting in this new social assistance scheme, which has a substantial discretionary element. Weight-for-height is less obviously lower in households receiving support but we cannot rule out that this reflects in part the positive impact of receiving social assistance on this short-term nutritional measure.

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Table 2.1: Number of Measured Children per Household

Number of Measured Children (6 – 72 months)	Number of Households: Children have same mother	Number of Households: Children have different mothers	Total
1	396	–	396
2	230	21	251
3	57	35	92
4	2	14	16
5	–	5	5
6	–	2	2
7	–	2	2
9	–	1	1
Total	685	80	765

Table 3.1: Anthropometric Classification

Cut Off	*Height for age (*)*	*Weight for Height (*)*
> + 2SD	Normal	Obese
< + 2SD to + 1SD	Normal	Overweight
-1 SD to + 1SD	Normal	Normal
- 2SD to - 1SD	Mildly stunted	Mildly wasted
- 2SD to - 3SD	Moderately stunted	Moderately wasted
<-3SD	Severely stunted	Severely wasted

Table 3.2A: Anthropometric Status by region (2 scores)

		Tashkent	*Fergana*	*Karakalpak*	*Total Sample*
1) Height for age					
Normal	N	171	212	297	680
	%	67.6	45.2	51.6	52.4
Mildly stunted	N	64	168	196	428
	%	25.3	35.8	34.0	33.0
Moderate + severe stunted	N	18	89	83	190
	%	7.1	19.0	14.4	14.6
Total	N	253	469	576	1298
	%	19.5	36.1	44.4	100.0
[χ^2 = 57.6; p <.001]					
ii) Weight for height					
Overweight	N	27	23	52	102
	%	10.7	4.9	9.0	7.9
Normal	N	189	347	420	956
	%	74.7	74.0	72.9	73.7
Mildly wasted	N	32	82	87	201
	%	12.6	17.5	15.1	15.5
Moderate + severe wasted	N	5	17	17	39
	%	2.0	3.6	3.0	3.0
Total	N	253	469	576	1298
	%	19.5	36.1	44.4	100.0

Table 3.2B: Anthropometric Status by region (% of ref. Media)

[To come - maybe a figure instead]

Table 3.3: Anthropometric Status by Location

	Large Towns		*Small Towns*		*Rural*	
	N	%	N	%	N	%
1) Height for age						
Normal	273	64.1	122	47.1	285	46.5
Mildly stunted	124	29.1	89	34.4	215	35.1
Moderate & severe stunted	29	6.8	48	18.5	113	18.2
Total	426		259		613	
[$\chi^2 = 46.0$; $p < .001$]						
ii) Weight for Height						
Overweight	42	9.9	22	8.5	38	6.2
Normal	319	74.9	188	72.6	449	73.3
Wasted	65	15.3	49	18.9	126	20.6
Total	426		259		613	
[$\chi^2 = 8.4$; $p = .077$]						

Table 3.4: Anthropometric Status of Rural Children by Region

	Rural Fergana		*Rural Karakalpak*	
	N	**%**	**N**	**%**
i) Height for age	128	39.3	157	54.7
Normal	123	37.7	92	32.1
Mildly stunted	75	23.0	38	13.2
Moderate & severe stunted	326		287	
Total				
[$\chi^2 = 17.1$; $p<.001$]				
ii) Weight for height				
Overweight	15	4.6	23	8.0
Normal	238	73.0	211	73.5
Wasted	73	22.4	53	18.5
Total				
[$\chi^2 = 4.0$; $p = 0.134$]				

Table 3.5 Stunting : Comparison with Kazak data

	Sample Size	*% Stunted (<-2SD)*
Uzbekistan (*)		
Fergana region	256	22.5
Karakalpak region	459	15.7
Kazakstan (Kzyl-Orda region)		
Kazalkinsk district	256	14.1
Djalagash district	382	20.4
Zhanakorgan district	267	21.4
Total Kzyl-Orda region	905	18.9

*For this comparison, the Uzbek samples were limited to small town and rural households only and to children up to 6 years of age.

Table 3.6: Anthropometric Status by age group

i) Height for age

Age group	*(<-2SD) Moderately + Severely Stunted (%)*	*(<- 1SD) Mildly Stunted (%)*	*(>-1SD) Not Stunted (%)*
6-12 months	8.1	24.2	67.7
13-36	14.2	30.4	55.5
37-72	16.5	36.3	47.3
73-84	12.9	32.2	55.0

[$\chi^2 = 18.4$; $p = .005$]

Age Group	**(<-1SD) Wasted (%)**	**(-1SD to + 1SD) Normal (%)**	**(> + 1SD) Overweight**
6-24 months	35.7	59.1	5.2
25-60	13.0	78.5	8.5
61-84	13.3	77.7	9.0

[$\chi^2 = 8.2$; $p < .001$]

Table 4.1 Variances in Anthropometric Status

	Variance	Min.	Max.	N
a) Height for Age				
Overall	19.8	79.5	114.7	902
Between households	11.3	86.2	107.8	369
Within household	9.0	83.7	108.4	
b) Weight for height				
Overall	70.6	72.2	134.6	902
Between household	42.8	79.4	125.7	369
Within household	31.1	76.6	128.0	

Table 4.2: Correlation between household children

	Height for age (*)	Weight for height (*)	Sample Size
All household children	0.27	0.26	533
Siblings only	0.36	0.33	350

(*) $p<.001$ for all coefficients.

Table 4.3: Percent of second children in household stunted or mildly wasted by status of first child

a) Stunting	
Status of first Child	**% of Second Children Stunted**
Moderate & severe stunting	38.3
Mild stunting	19.1
Normal	11.9
b) Wasting	
Status of first child	**% of second children mildly wasted**
Mild wasting	25.2
Normal	10.8
Overweight	4.8

Table 5.1: Location Effects and Nutritional Status

	1. No Controls	2. + Household Composition	3. + Cash Income	4. + Dwelling Characteristics and Agricultural Assets
	height-for-age (log): OLS coefficients			
Town < 100,000	–0.021	–0.019	–0.019	–0.013
	(5.89)	(5.27)	(5.29)	(3.05)
Rural Fergana	–0.027	–0.026	–0.026	–0.016
	(8.00)	(7.78)	(7.78)	(3.11)
Rural Karakalpakstan	–0.012	–0.008	–0.008	0.002
	(3.54)	(2.42)	(2.47)	(0.34)
	weight-for-height (log): OLS coefficients			
Town < 100,000	–0.014	–0.013	–0.013	–0.012
	(2.15)	(2.03)	(1.95)	(1.47)
Rural Fergana	–0.029	–0.028	–0.026	–0.013
	(4.69)	(4.49)	(4.25)	(1.35)
Rural Karakalpakstan	–0.010	–0.010	–0.008	0.002
	(1.57)	(1.64)	(1.19)	(0.22)

Notes:

T-statistics are given in brackets; sample size is 1298 children. The specification in column 2 includes 6 age dummies, dummies for low maternal education (failure to complete secondary school), a dummy for Slav head of household, and variables measuring the numbers of adults and children in the household. The specification in column 3 includes in addition a variable $Y/H^{0.6}$ where Y is the total household cash income in the last month (whether or not actually received) and H is the number of persons in the household. The specification in column 4 includes (in addition to variables in the previous specifications) dummies for running water and central drainage, plot ownership, ownership of cattle, sheep, fruit trees, vines and for receipt of cash income from sales of agricultural produce from the plot in the previous month.

Table 5.2: The Effect of Kindergarten Attendance on Nutritional Status

Dependent Variable	Estimation Technique 1. OLS	2. Fixed-Effects
Height-for-age as % of reference median (log)	–0.001 (t=0.33)	–0.0003 (t=0.05)
Weight-for-height as % of reference median (log)	0.012 (t=2.01)	0.016 (t=1.44)
n	1298	532

Note:

The results in column 1 are obtained by OLS regression on the full sample of 1298 children in an equation containing all the control variables listed in the notes to Table 5.1 as well as a dummy variable for kindergarten attendance. The results in column 2 are obtained by OLS on a transformed equation in which the dependent and independent variables are adjusted by subtracting their household-specific mean values. This within-groups estimator is unaffected by the presence of unobservable household factors which are correlated with the explanatory variables and is estimated on the 532 individuals in multi-child households for who the resulting transformed variables exhibit variation.

Table 5.3: Mean Nutritional Status by Receipt of Social Assistance from the Mahalla

	1. Individuals		2. Households	
	with Social Assistance	without Social Assistance	with Social Assistance	without Social Assistance
height-for-age as % of reference median	95.91	96.42	94.29	95.70
	(t=1.75)		(t=3.62)	
weight-for-height as % of reference median	98.00	98.81	95.19	96.43
	(t=1.51)		(t=1.75)	
n	1,298		765	

Note:

The t-statistic in brackets is of the test that the means are equal. 25% of measured children live in households in which social assistance is received; 23% of households with measured children receive assistance. In the case of households with more than one measured child the results in column 2 relate to the minimum height-for-age or weight-for-height.

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1 September 1997

Dear Gregory Ingram,

Please find attached a paper entitled "Living Standards and Public Policy in Central Asia: What Can Be Learnt From Child Anthropometry", based on research financed principally by the World Bank Research Committee (Grant No. 679-97). The paper empirically tests several hypotheses concerning living standards and public policy using data collected by a household survey in Uzbekistan in 1995, which have important implications for assessments of child welfare during transition, as well as for World Bank operations. The authors are submitting the paper to the Editors of the World Bank Economic Review.

Thank-you for your support of this work.

Yours sincerely,

Jeni Klugman

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LIVING STANDARDS AND PUBLIC POLICY IN CENTRAL ASIA: WHAT CAN BE LEARNT FROM CHILD ANTHROPOMETRY?

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Abstract

Data on weight and height of children are used to assess living standards and public policy in Uzbekistan, the most populous of the Central Asian republics. The paper begins by making the case for the use of such data, contrasting them with monetised measures of welfare based on household incomes or expenditures, before going on to review the problems of interpretation that anthropometry present for the economist. The prevalence of stunting and wasting in three regions of Uzbekistan is compared with that in neighbouring Kazakhstan and with other countries from outside the region. Multivariate analysis is then used to test three hypotheses concerning rural-urban differences in living standards, the impact of kindergartens on nutritional status, and the targeting of means-tested social assistance.

Keywords: nutrition, living standards, targeting, Uzbekistan.

JEL classification: I12, I32, J13

1. Introduction

Measurement of household welfare in transition economies such as those of Central Asia typically focuses on the measurement of poverty using monetised indicators in the form of income or expenditure. These indicators (after adjustment for differences in household size and composition) provide evidence on the relative incidence of poverty on different groups in the population, for example children or the old. Design of social assistance schemes and other policies to combat poverty can then take this information into account when targeting scarce public resources.

This paper takes a different route to the measurement of welfare in Central Asia and the assessment of public policy, by using information on child anthropometry – measurement of children's body size.

Anthropometric indicators appear to offer three attractions. First, anthropometry provides information on *individuals*, in contrast to a "poverty profile" constructed from information on incomes or expenditures which tells us only about the living standards of households. Use of household incomes or expenditures to infer anything about the welfare of individuals requires an assumption that household members pool and share all their resources. Children form a high proportion of the population of the Central Asian countries of the former Soviet Union. In the case of Uzbekistan, the most populous republic with over 20 million inhabitants and the focus of this paper, some 40 percent of the population is aged under 12. Concern about the population's welfare in Central Asia is therefore in large measure a concern about the welfare of children and anthropometry is one way of assessing this directly.

Second, anthropometry is one way of measuring nutritional status. This is a subject of direct concern to the analysis of child welfare, summarising a variety of influences including food intake and infection. Much evidence suggests that low nutritional status in childhood may have an adverse impact on development and hence health and productivity in later life, as well as increasing the risk of mortality and morbidity while still a child.

Third, use of anthropometry avoids the problems of measurement of monetised indicators of household welfare. These problems can be acute in transition economies. Not only is money income sometimes hard to measure, such as that from self-employment of various forms, but a substantial amount of economic activity is not monetised. The rural nature of much of Central Asia means that a great many households derive substantial amounts of income in kind from land in the form of food produced and consumed within the household. The measurement of these amounts and the imputation of their value is a far from trivial issue (Casley and Lury, 1987, Falkingham and Micklewright, 1997). In addition, prices may vary substantially within a country but the appropriate indices to adjust monetary welfare measures for regional price variation are often unavailable (Koen, 1997). To the extent that anthropometric status reflects household incomes and living conditions, data on body measurement therefore complement welfare indicators that are subject to errors of construction and interpretation. Moreover, the non-monetary nature of anthropometric data allows comparison of welfare in Central Asia with that in countries in other regions.

These attractions appear strong and increasing use has been made of anthropometric data by economic historians and development economists (for example, Komlos, 1994, Steckel, 1995, Thomas et al, 1996). However, the apparent attractions of anthropometry must be tempered by an appreciation of the limitations of this form of information. In Section 2 we review the informational content of data on children's weight and height viewed from the standpoint of economic analysis, illustrating some aspects of the discussion with the data used in the rest of the paper.

The data we use refer to 1,298 children in a survey of households conducted in Uzbekistan in 1995. This covered three of the fourteen regions of the country, chosen to provide a wide range of economic and geographical circumstances. The collection of these data seem to be the first attempt to measure anthropometry in the country as part of a general household survey. Section 3 provides basic results on anthropometric status from the survey, using the data to shed light both on living standards in relation to those in other countries and the variation within Uzbekistan. The mixture of Soviet and Asian influences makes for a somewhat confusing picture of the absolute level of development and of living standards in the region (Falkingham et al, 1997). Neither is the variation clear within Uzbekistan and other Central Asian countries (Coudouel et al, 1997), with such basic issues as rural-urban differences not yet firmly established. In both cases the use of child anthropometry allows substantial progress to be made.

Section 4 uses multivariate analysis to test three hypotheses concerning living standards and public policy. First, that controlling for differences in cash income, anthropometric status is higher in rural than in urban areas, reflecting the much greater presence of sources of non-monetised income. Second, that attendance at state or enterprise kindergartens has a positive impact on nutrition. Third, that a new means-tested social assistance scheme, aimed principally at families with children and administered by Mahalla local committees, is well-targeted in terms of anthropometric status. Section 5 concludes.

2. What Can Child Anthropometry Reveal about Living Standards?

What information on living standards is conveyed by an individual's weight and height? We note here some of the features of such data that the novice needs to be aware of.

Most obviously, body size is strongly influenced by genetic inheritance as well as by the "environmental" factors that we are interested in, such as family income and housing conditions. Indeed, the former explains most of the variance in individuals' heights (Tanner, 1994, p.1). The interaction of genetic and environmental factors appears to be complex and far from fully understood. For example, Eveleth and Tanner note that "two genotypes which produce the same adult heights under optimal environmental circumstances may produce different heights under circumstances of privation" (1976, p.222). This casts doubt on the often unstated assumption that genetic factors can be absorbed into an unobserved additive error term in regression

equations explaining anthropometric status.

On one view, the influence of genetic inheritance is no constraint to the use of anthropometric data to measure human welfare. At the outset of his survey article on "Stature and the Standard of Living", Steckel (1995) urges that

> "newcomers to the idea that stature measures important aspects of living standards should not be side-tracked by genetic issues. Genes are important determinants of individual height, but genetic differences approximately cancel in comparisons of averages across most populations" (p.1903).

The averaging out of genetic influence is particularly true of child populations – much evidence indicates that differences in the impact of genetic endowment on growth that are associated with ethnic group manifest themselves only in adolescence (e.g. WHO, 1995). Measurements of height and weight taken from any child population are therefore usually matched for age and sex with reference standards from the National Centre for Health Statistics/World Health Organisation (NCHS/WHO), which are based on a large sample of healthy US children. The most common indices calculated are height for age and weight for height. The convention is for a child to be classified as "stunted" if height for age is beneath the two standard deviations of the median in the reference population and as "wasted" if the same condition applies to weight for height.[1]

The use of international standards facilitates cross-country comparisons but there are limitations to such an exercise. Wasting is often rare even in countries at low levels of development unless they are undergoing an exceptional crisis in living standards. Stunting, which is more frequent, may be the better measure to compare but the same levels of either stunting or wasting in two different settings may be associated with different risks of mortality and morbidity on account of a variety of intermediating factors between malnutrition and outcome, including "epidemiology of certain diseases, access to health care facilities ... and behavioural differences in relation to household management of infection" (Tomkins, 1994, p.113). One might therefore argue that classification of stunting and wasting on the basis of international standards is not analogous to calculation of poverty on the basis of purchasing power parity dollars, since a given sum of the latter provides in principle the same command over resources in all countries. On the other hand, the same amount of purchasing power parity dollars may be associated with different living standards in different countries, due to varying levels of social services and facilities financed by the State.

The averaging out of genetic differences means that anthropometry can be used to make statements about living standards by focusing on the between-group variation, for example between urban and rural areas. Opinions differ on whether much notice should be taken of the within-group variation. Those making the case for the study with anthropometry of historical changes in living standards naturally place

[1] The terminology is unfortunate since it implies that the conditions should always be seen in a negative light.

little emphasis on this.[2] On the other hand, aid programmes in the developing world do use anthropometric status at the individual level as a basis for the targeting of intervention (e.g. United Nations, 1990, p.16). This stems in part from a focus on different measures. The economic historian uses data on height, while the emergency aid worker is more often interested in weight (conditional on height), which is subject to great change as a result of changes in the individual's health and access to food. Low weight relative to height provides a good measure of mortality risk at the individual level in situations of famine and is used as one basis for screening and intervention in the provision of food relief.

In general, however, deviant anthropometry provides imperfect information on living standards at the individual level on account of genetic factors. A child with weight or height below two standard deviations of the reference standard for his or her age is *more likely* to be living in a household where conditions are not conducive to development than is a child with values at the median but targeting of, say, cash social assistance on the basis of this classification would be subject to both Type I and Type II error.[3] Anthropometric status clearly does not provide a welfare ranking in the same sense as would an adequately measured full income variable.[4]

Genetically determined variation in height is also present among siblings (unless they are identical twins) and the genetic differences "exert, in general, much more force than environmental ones, unless one or more [of the siblings] has been for some reason subject to real starvation" (Tanner, 1994, p2). This limits the potential of anthropometry to measure intra-household differences in child welfare. In our Uzbek data, 902 of the 1,298 measured children lived in households with more than one measured child. Over 40 percent of the variance in both height-for-age and weight-for-height (relative to the reference median) among these children was within households and it would clearly be wrong to associate all this variation in anthropometry with variation in individual welfare.

The nutritional science literature emphasises the use of anthropometry for one child to infer something about the household environment that may affect others in the household, including "a sibling yet to be born" (United Nations, 1990, p.10). Our Uzbek data certainly do reveal some correlation between anthropometric measures for children of the same household. The correlations for Z-scores of height for age and weight for height between successive pairs of children in the household are 0.27 and

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[2] Addressing the issue of noise in the data from genetic influence, Tanner argues firmly in his introduction to the use of height data to measure welfare that, "we are talking about the *mean heights of populations* or sub-populations...we are not talking about the height of any individual" (1994, p1, author's emphasis).

[3] Nor does a focus on change over time solve all problems of interpretation since the genetic impact cannot be treated as an additive error to be differenced out. That said, the problems do appear to be less than with one-off assessment and "growth monitoring" is a standard technique in measurement of child welfare in developed as well as developing world. (Ulijaszek (1994) gives a good discussion of individual variation in the growth process and problems of interpretation stemming from this.)

[4] A further difference is that, unlike income, the anthropometric index would not provide a monotonically increasing measure of welfare even if it were free of genetic noise; excessive weight is associated with increased health risk.

0.24.[5] (These figures rise to 0.36 and 0.33 if attention is restricted to siblings only.) Where the first child in any pair is classified as stunted, 38 percent of the second children are also so classified, compared to only 12 percent if the first child has height for age that is normal. This reflects Tanner's observation that while most of the variation in height within two sets of brothers growing up under different household circumstances will be due to their genetic differences, the difference in means between the two sets "is a measure of the suitability of their respective environments for fostering growth" (Tanner, 1994, p.2). There is a higher mean probability of stunting for the brothers in the poorer environment.

To the extent that child anthropometry conveys information about a household's living standards, are they those in the present or in the past? Low weight for height can develop rapidly and at any age. Hence wasting reflects current household and individual circumstances, including seasonality in food supply or the impact of a recent episode of disease. Stunting, on the other hand, develops more slowly, with deficits in attained height increasing throughout a child's growth period if conditions remain unfavourable. However, the impact on stature of circumstances detrimental to growth is most marked during the first two years of life when the rate of growth is at its peak, and when the child is most vulnerable to nutritional insults of various kinds. Hence achieved stature may be thought of principally as reflecting a process of *failing* to grow in very young children and of *having failed* to grow in older children (United Nations, 1990, p.7). The greater is the extent of income mobility (in the sense of true income fully measured) the more noisy will be the information on current living standards conveyed by height data among older children.[6] Cross national comparisons of stunting among all children under 6 (the usual age group taken for comparison) therefore tell something about living standards in different countries averaged over several years, rather than for just the year in which the data were collected. And changes in stunting prevalence among this age group should be viewed as a lagged indicator of changes in living standards, something that is important to note in the context of the economic transition.

Weight for height and height for age may therefore convey different information about current living standards and the correlation between the two is often not strong. In our Uzbek data, the correlation of Z-scores was only 0.06 among all measured children (aged 6 to 72 months). But even in very young children aged up to 24 months, where the two indicators might be expected to be more closely related, the correlation was only 0.09. Recent studies have suggested that the nutritional factors

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[5] For the purposes of this calculation we order measured children within the household on age. Each child is then compared with the next child, so in a three child household the second child is compared with both the first and the third.

[6] There is considerable debate about the extent to which "catch-up growth" of height is possible if suitable interventions are provided or if the child's socio-economic conditions improve, leading to a better diet or reduced morbidity. (It goes without saying that catch-up growth of weight is possible.) Intervention at an early age appears to have the greatest positive impact (United Nations, 1990), although studies of the impact of late interventions are limited (Dasgupta, 1993, p.85). One example is that of Piyadasa (1996) who found that supplementation with milk or calcium increased the rate of growth in stunted Sri Lankan children aged 4-7 years by one fifth. The interpretation of height-for-age among older children as reflecting past circumstances clearly assumes that little catch-up is possible after the first two or three years of life.

associated with stunting and wasting may be quite different; Victora (1992) and other authors propose that while wasting may be due to a deficit in energy, stunting reflects rather the quality of the diet once the demand for energy has been satisfied, and may be due to a deficiency in one or more micronutrients. A number of micronutrients have been proposed, but a recent study (Piyadasa, 1996) would seem to indicate that an adequate intake of calcium is crucial for optimal growth.[7]

Anthropometric data are best viewed as another instrument in the bag of welfare measurement tools.[8] In some circumstances they are the best tool, as in assessment of the appropriate persons to receive emergency food aid in the situation of dire deprivation brought on by famine. In other circumstances they complement but do not necessarily dominate other tools. The genetic influence on body size introduces a lot of noise at the individual level but it does not mean that the data can tell us nothing about welfare below the household level. Focusing on the between-group variation, anthropometry can be used to investigate the welfare of groups of individuals - children in the case of this paper - as opposed to households. And investigation of anthropometry for different groups of individuals, in particular by gender, can shed light on average patterns of intra-household distribution.

3. Anthropometric status of children in Uzbekistan

Our investigation is based on the EUI/Essex Survey in Uzbekistan (EESU), which was conducted in the Summer of 1995. (Details of the survey are given in the Appendix.) This collected data on about 500 households in each of three regions that together contain over a quarter of the republic's population - the capital city of Tashkent, the important region of Fergana in the populous valley of the same name in the south-east of the country, and the autonomous republic of Karakalpakstan bordering the Aral Sea in the north-west. The three regions appear to contrast considerably in terms of average living standards (Coudouel et al, 1997). Tashkent, a city of over two million people and much the largest city in Central Asia, appears on economic indicators to be considerably ahead of all other regions in the republic. Karakalpakstan appears on the same indicators to be at the other end of the range and has suffered substantially from environmental degradation associated with the retreat of the Aral Sea. Fergana is sometimes viewed as a reasonably prosperous agricultural area (containing also some big urban areas) and scores relatively highly on several of the indicators based on information derived from official sources, although Coudouel et al (1997) also record that EESU income data do not show much clear water between this region and Karakalpakstan. The use of the anthropometric data in

[7] However, calcium intake is not the only nutritional factor involved and nutritional factors are by no means the only factors implicated in the aetiology of stunting; besides genetic potential, other factors include the frequency and severity of disease episodes, which in turn are related to a range of socio-economic factors such as educational level, hygiene practices, access to health services, clean water and good sanitation. The relative contributions of the various factors to promotion or retardation of growth in stature is likely to vary from one country to the next, and within a country, from one region to another.

[8] The problems in collecting accurate anthropometric data, which we have not reviewed here, should not be overlooked. See, for example, Kostermans (1994).

the ESSU provide an opportunity to shed more light on what is still a rather unclear picture of regional variation in living standards.

The basic anthropometric results for the 1,298 children aged 7-83 months who were measured in the EESU are given in Table 1. The data indicate that there was very little moderate or severe wasting in the sample of children from the three surveyed oblasts. Only 3 percent of children are more than two standard deviations below the reference median - barely more than in the NCHS reference population of healthy US children - although more than 1 in 6 children are between one and two standard deviations below and the mean Z-score (not shown) is -0.21, significantly different from zero (t=7.5). At the other end of the range, 8 percent of the children were at a level classified as overweight (more than one standard deviation above the reference standard). The prevalence of moderate and severe stunting (two or more standard deviations below the reference median) is notably higher than for wasting; 15 percent of the children are in this position and another third of the sample were between one and two standard deviations below. Thus nearly one half of the distribution is below one standard deviation of the reference median compared to only 1 in 20 who are one standard deviation or more above it. (The mean Z-score is -0.89.)

These results refer to the three regions taken together, weighted for their respective population sizes. However, Table 1 shows some substantial differences between the regions in height for age. Whereas only 7 percent of children in the capital are stunted, 20 percent are stunted in Fergana. Somewhat fewer children are stunted in Karakalpakstan than in Fergana - only 14 percent - but the hypothesis that the grouped Z-score distributions are the same in these two regions cannot be rejected on a chi-square test, and it is Tashkent city that stands out as being different from the other two. Weight for height shows little regional variation and it is notable, for example, how the grouped Z-score distributions are similar in the capital and in Karakalpakstan (mean Z-scores just differ at the 5 percent significance level), the two regions that on many welfare indicators are at opposite ends of the observed range.

Fergana and Karakalpakstan both contain large urban centres and in Table 2 we identify these separately from towns (urban areas with less than 100,000 inhabitants) and rural areas. As far as height for age is concerned, there appear to be two clear groupings. First, the prevalence of stunting in the four regional cities in our sample is no higher than that in the (much larger) capital. (There are no significant differences among the former.) Second, prevalence in towns and rural areas is almost identical at around 1 in 5 children, and some two and a half times that in the capital and other large urban centres. A focus on a simple "urban/rural" split would hide some of this difference, the prevalence of stunting in all urban areas being 10 percent, and 13 percent if we exclude Tashkent (which would get far less weight in a national sample).

A focus on stunting prevalence alone when considering height for age suggests that the better position of children in Tashkent compared to other regions is more to do with the capital being a large urban area than it being the capital *per se*. However, the mean values of the heights for age as a percent of the median, also shown in the

table, *are* significantly higher in Tashkent than in the other cities (t = 3.8) which serves as a warning against an exclusive focus on the lower tail of the distribution. (There is no significant difference between the means for towns and rural areas.) A final point to make about the height data in Table 2 is that they hide what appear to be differences between the rural areas in Fergana and Karakalpakstan, which have an incidence of stunting of 23 percent and 13 percent respectively. Hence it is rural Fergana where the incidence of stunting is highest in the parts of Uzbekistan covered by the EESU and the contrast in this region between the situation in the cities and in the countryside is thus particularly marked.

The lower part of Table 2 gives the results for weight for height. These follow a similar pattern to those for height for age but the prevalence of wasting remains low in all types of location, reaching a maximum of 4 percent in rural areas, and the differences in neither wasting nor mean weight for height are significant.

All the results in Tables 1 and 2 refer to boys and girls taken together. There are no significant differences in mean height for age or weight for height between the sexes or in the prevalence of stunting or wasting. (For example, stunting affects 14.6 percent of boys and 14.8 percent of girls.) Nor did the conclusion change when we conducted a more powerful test of the hypothesis of equal treatment of the two genders by focusing on differences between the sexes within households.[9]

The prevalence of stunting and wasting by age is shown in Figure 1, taking all three regions together. The pattern of change is consistent with the findings of many other studies: wasting is highest during the weaning period (6-24 months) when some 8 percent of children are affected - about double what is found in the reference population of this age - then decreases sharply as the child gets older; stunting on the other hand is lowest in the infant (<12 months) and no more prevalent in the EESU data at this age than is wasting, but then rises substantially over the next four to five years, with sometimes a partial recovery in the older child. The weaning age is a period of high nutritional risk for a child; nutrients from breastmilk alone become insufficient to support good growth, and supplementary weaning foods may be low in energy content, of poor dietary quality or prepared unhygienically. The weaning age is also the age when a child begins to explore his or her environment thereby increasing exposure to higher risk of disease.

How does the prevalence of stunting and wasting in the EESU data compare with those from elsewhere and hence what can we say about absolute levels of child welfare in Uzbekistan using other countries as a yardstick? We first consider findings from outside Central Asia. Carlson and Wardlaw (1990) review findings on child anthropometry from nearly 70 countries at a low and medium level of development. About a third had levels of wasting below that recorded in the EESU and a quarter had

[9] We calculated mean height for age and weight for height (in Z scores) separately by gender within each household. (Where, for example, there was one boy and two girls these means were equal to the boy's Z score and the average of those for the two girls.) We then tested for differences in the average values of these means in those households with a least one measured boy and one measured girl. Mean Z score of height for age for girls in such households was -0.991 and for boys -0.995.

lower prevalence of stunting.[10] The combination of a moderate prevalence of stunting with a low prevalence of wasting found in Uzbekistan is typical of a number of the more developed Latin American countries. For example, 9.6 percent of children (aged 0-71 months) were stunted in Chile in 1986 and only 0.5 percent wasted; figures for stunting among children aged 0-59 were 15.9 percent in Uruguay in 1987 and 15.4 percent in Brazil in 1989 (with wasting at 2.0 percent), a Latin American country at a somewhat lower level of development (Carlson and Wardlaw, 1990, pp85, 115, and De Onis et al, 1993, p.706). The figures for Uzbekistan are clearly far better than those for many countries in Africa and in South Asia (and for other South American countries) where the highest levels of both stunting and wasting are recorded. They do, however, repeat one marked feature of the results from many other countries, namely a higher prevalence of stunting in rural areas – Carlson and Wardlaw report that stunting prevalence was on average 1.5 times higher in rural areas and wasting prevalence 1.2 times higher (1990, p.23).

Table 3 compares the results for Uzbekistan with others available for Central Asia. National figures are available for Kazakhstan (the most populous country in Central Asia after Uzbekistan) for children aged under 3, from the 1995 Demographic and Health Survey (DHS). (Like the other surveys in the table, this survey was conducted in the Summer months.) We compare results with those for Fergana and Karakalpakstan only, dropping children aged over 35 months and in addition all those in Tashkent, who make up 25 percent of the weighted EESU sample. (By contrast, less than 5 percent of children in the DHS sample were from the Kazakh capital, and largest city, Almaty.) The results seem very similar. The overall level of stunting is around 15-16 percent in both countries and wasting is even less common in Kazakhstan than it is in the two Uzbek regions.[11] One difference is that the Kazakh data show a much sharper urban-rural gap in stunting incidence.

The second comparison is with three districts of the large Kazakh region of Kzyl-Orda, which borders Karakalpakstan to the north-east. Some interesting comparisons can be made here, between Kazalinsk and Karakalpakstan on the one hand and Fergana, Zhanakorgan and Djalagash on the other. Like Karakalpakstan, Kazalinsk borders on the Aral Sea and agriculture is similar in both areas, with a heavy emphasis on animal rearing. Zhanakorgan and Djalagash are fruit-growing regions, like parts of Fergana, and fewer households keep animals. (We exclude the four cities from the EESU data since urban areas of this size are not present in the three Kazakh districts concerned.) Table 3 shows that levels of stunting in Kazalinsk and Karakalpakstan are similar, as are the somewhat higher levels of stunting in Fergana, Zhanakorgan and Djalagash. The ranking of the Kazakh districts mirrors that of the Uzbek regions. Economic conditions in Kazalinsk and Karakalpakstan appear less favourable and both areas suffer from environmental degradation but the prevalence of stunting appears rather lower than in the other areas taken for comparison. We referred earlier to the importance of calcium for linear growth and it may be that milk

[10] The studies reviewed by Carlson and Wardlaw refer in the main to the mid 1980s and in general to children aged 0-59 months.

[11] If infants aged 0-5 months are excluded from the Kazakh results, as they are from the EESU sample, the incidence of stunting rises by two percent points (Macro International, 1996, p129).

consumption is greater in Karakalpakstan and Kazalinsk on account of the relative higher cattle ownership in these areas.

The final comparison is between the rural and small urban areas of Karakalpakstan in the EESU with Muynak, a remote district in the same region on the shores of the Aral Sea. Wasting was again low in Muynak in 1993 but stunting in this case was as high as 26 percent, suggesting that child (and household) welfare in the remoter areas in Karakalpakstan may be notably lower than in other parts of the region.

Several general conclusions are suggested by these comparisons and by the earlier results in this section. First, the low prevalence of wasting in all the different studies indicates that there was no major problem of aggregate energy deficit in Uzbekistan or Kazakhstan at the time the data concerned were collected.[12] Second, stunting levels appear similar in the two countries, at around the level found in several more developed Latin American countries and this provides one marker for the Central Asian countries in terms of average living standards. Third, no differences in the anthropometric status of boys and girls emerged in the EESU data, a feature repeated in the other studies covered in Table 3; on this measure of individual welfare, neither gender appears to have an advantage over the other.[13] Fourth, living standards as indicated by stunting prevalence appear markedly lower in rural areas than in urban areas (especially large cities), a finding that runs counter to the frequent claim that private plots enable rural households to maintain higher living standards than their urban counterparts.

4. Testing Hypotheses concerning Living Standards and Public Policy

In this section we test the three hypotheses outlined in the Introduction concerning (i) living standards in rural and urban areas, (ii) the impact of kindergartens on nutritional status, and (iii) the targeting of the Mahalla social assistance scheme.

(i) living standards in rural and urban areas

Height for age is clearly lower in the rural areas in the regions covered by the EESU than in the large urban areas, with small urban areas in an intermediate position. We now investigate these differences in more detail. Higher income can be expected to be associated with higher nutritional status (although the relationship is subject to debate (Alderman, 1993)). If when controlling for variation in observed cash income between urban and rural areas we find that nutritional status in the latter is in fact higher, this will suggest that unmeasured non-cash income in rural areas, particularly food grown on agricultural plots and consumed within the home, is

[12] National figures on the incidence of wasting are also available for Kyrgyzstan and show a somewhat higher level of 7 percent among 1,415 children aged under 7 in the World Bank sponsored Kyrgyzstan Multipurpose Poverty Survey of Autumn 1993 (Popkin and Martinchik, 1994, Table 4). (Information on month of birth was not collected in the survey, precluding calculations of height for age.)

[13] Carlson and Wardlaw find that in many less developed countries girls in fact enjoy slightly better anthropometric status than boys, the ratio of stunting and wasting prevalence between boys and girls for 39 countries averaging 1.1 and 1.3 respectively (1990, Table 6).

an important factor in sustaining household living standards in rural areas.[14] This in turn would underline the danger of the State treating cash income as an adequate measure of household welfare when targeting cash and in-kind benefits.

Our strategy is to estimate multivariate equations, regressing anthropometric status of the child on the location indicators and progressively adding in a variety of control variables. We report results for both height for age and weight for height as percentages of the reference medians. The equations are estimated by GLS, allowing for an unobserved household level random effect assumed constant across children in the same household (and uncorrelated with observable factors included in the regression).[15] Results are given in Table 4 for the estimated coefficients on the location variables only. (We comment in the text on the impact of some of the control variables.)

The specification in column 1 contains only the five location variables, for which the base is Tashkent city. Mean height for age in rural Fergana is over 3 percent points lower than in the capital, nearly 3 points less in the smaller urban areas (we refer to these as "towns"), and 2 points less in rural Karakalpakstan. The deficit in cities relative to the capital is between 1.5 and 2 percent. The variation across location in weight for height is similar in its pattern (although much smaller in relation to the standard deviation), with the noted exception of Nukus (the single Karakalpak city) where there is no difference from the capital.

Column 2 includes controls for household composition, including household size, the age of the child, and whether the household head is of Slav ethnicity. The mean values of all of these vary across location but their inclusion in the equations has no great impact, although the differences in mean height for age relative to that in the capital do all fall somewhat. One notable result is that a Slav household head is associated with a quite well determined increase in height for age of 2 percent points (but has no significant impact on weight for height). Height for age is lower in large households - by about 0.25 percent points for each other child present aged under sixteen.

Column 3 includes measured cash income. This variable refers to all income in the previous month whether it was received or not, the latter including wages or cash benefits due in that month which were not actually paid. Information on cash incomes in the EESU was collected in considerable detail, with each adult separately questioned about a wide range of different possible sources. The inclusion of the cash income variable (which is equivalised by dividing by the square root of household size) has no impact on the estimated location coefficients for height for age. Those for

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[14] Such a pattern is suggested by official budget survey data from pre-reform Uzbekistan, which show recorded calorie and protein intake in collective farm households as being higher than that in worker-employee households, holding cash income constant (Marnie and Micklewright, 1994, Figure 7).

[15] This household error can be thought of as proxying a variety of unobserved influences including common "environmental" factors and shared genetic inheritance. (Our earlier discussion indicates that the major part of genetic inheritance will enter via the individual and not the household specific error; and our treatment of genetic influences as additive is clearly unsatisfactory.) An LM test always rejected the hypothesis of no random effects.

weight for height fall but only by about one tenth. Even the simple correlation between household cash income and individual nutritional status is very low - the two measures of welfare appear to be weakly related. The hypothesis that the correlation coefficient between equivalised income and height for age is zero cannot be rejected. That between weight for height and income is significant at the 1 percent level but the estimated value is only 0.09. Similarly, in the regressions reported in Table 4, where we control for other factors, equivalised income has a completely insignificant impact on height for age. The estimated impact on weight for height is significant at the 5 percent level but is very small; an increase in income of one standard deviation raises weight for height by only 0.5 percent points.[16] The greater impact of cash income in the last month on weight for height makes sense, since this is a short-run measure of nutritional status. The lack of association with height for age may be interpreted in various ways; one is that cash income over a month is a poor indicator of permanent or full income.

The agricultural asset variables entered into the specification in the final column are intended to pick up important sources of other aspects of full income for households. Here we do find a substantial change in the estimated impact of the location variables. The difference between rural Karakalpakstan and Tashkent now disappears for both nutritional indicators and as far as weight for height is concerned there are no differences in any of the location types from the capital. However, when we look at the estimated coefficients on the agricultural asset variables we find that a number of them are negative. (In fact this must be the case in order to account for the change in the location impacts given that the cash income variable does so little). For example, children in households with any cash income from crop or stock sales in the last month are estimated to have height for age and weight for height that are lower by about 0.7 and 1.3 percent points respectively than for other children, although these effects are barely significant at the 10 percent level. (The income itself from this source is included in the cash income variable and the agricultural income dummy is intended to pick up households with sufficient involvement in private agriculture to engage in selling to others.) Larger private agricultural plots are associated with lower height for age.

Overall, the conclusion seems to be a rejection of the null hypothesis with which we started - anthropometric status is lower in rural areas even when we control for cash income. Further controls do help explain some of the apparent rural "effects". The specification in column 4 also includes some housing condition dummies; running water in the household, which is typically present in urban areas and typically absent in rural areas, is significantly associated with an increase in weight for height of 1.5 percent points.

(ii) the impact of kindergartens on nutritional status

The impact of kindergartens on nutritional status is of considerable policy interest. As elsewhere in Central Asia (Klugman et al, 1997) kindergarten enrolment

[16] These results are not changed much when we allow the effect of income to vary by oblast although there is some suggestion that the impact on weight for height is higher in Tashkent.

has fallen significantly in Uzbekistan, from 35 percent of the relevant age-group in 1991 to 26 percent in 1995.[17]

These falls in enrolment have in all probability reflected both demand and supply side factors, the latter including closure of some enterprise facilities. Whatever the explanation, the issue is whether this falling enrolment is a cause for concern for public policy. Kindergartens have a number of functions and hence positive impacts on household welfare. One possible effect is that of enhancing nutritional status among children, through provision of food that would not otherwise be eaten.

We investigate this issue by inserting a dummy variable for kindergarten attendance in the regression equations described above. About a quarter of the children in the EESU sample are in kindergartens. Table 5 reports the coefficient on the kindergarten dummy in regressions of height for age and weight for height under two different treatments of unobservable factors. Column 1 reports GLS regressions in which the control variables follow the specification in the final column of Table 4. This assumes unobservables to be uncorrelated with observable factors. However, unobserved factors may indeed be correlated with the kindergarten dummy, which in this case would partly proxy those factors. For example, "good" mothers (in some unobserved sense) may provide their children with more food and better living conditions but they may also be more likely to send their children to kindergarten so as to take advantage of the benefits offered. In this case a positive impact of the kindergarten dummy in a GLS regression of nutritional status could merely be proxying the unobservable factor of having a "good" mother.

The estimates in column 2 try to allow for this and are obtained with the fixed-effects estimator, exploiting the fact that we often observe more than one child per household. With a two child household this technique is equivalent to regressing the difference in nutritional status between the two children on the difference in their kindergarten attendance. Unobserved household factors such as a "good" mother which are common to the children drop out of the equation (their difference is zero) thus leaving an estimated kindergarten effect that should be uncontaminated. The disadvantage of this technique is that the kindergarten impact is estimated only from the within-household variation in kindergarten attendance, and none of that between households. The amount of such variation is low - in only 72 households is there at least one child under 7 attending kindergarten and one who is not. We cannot therefore hope for well-determined estimates.

The results show that with neither the GLS nor the fixed-effects estimator is there any impact of kindergarten status on height for age. However, it does seem that weight for height, the more short-term nutritional indicator, may be affected positively by kindergarten attendance. The GLS results indicate that weight for height is about 1 percent higher where the child is in a kindergarten, controlling for other observables factors (including, for example, age which is strongly correlated with kindergarten attendance), a difference which is just significant at the 5 percent level. The fixed

[17] Information supplied by the Ministry of Labour.

effect estimator yields an estimate which is similar in size but as expected it is poorly determined and significant at only the 13 percent level, although it is worth noting that a Hausman test fails to reject the hypothesis of no fixed effects. A considerably larger sample size would be needed to estimate the kindergarten effect with more precision.

(iii) the targeting of the Mahalla social assistance scheme

As part of its moves to provide more targeted support to those in need, the Uzbek government introduced a new means-tested social assistance scheme in the Autumn of 1994.[18] A key feature of this scheme is that support is administered by committees of the "Mahalla", a pre-Soviet traditional community organisation that has been revived under the government's auspices. There are several thousand Mahalla in the republic as a whole. The scheme is an important form of support for households. Initially granted a budgetary allocation of about 0.5 percent of GDP, some 1 in 5 households were apparently granted benefit under the scheme in 1995 for renewable periods of three months, at a level which is intended to be between 1.5 and 3 times the minimum wage.

The scheme combines on the one hand firm rules regarding applications and procedures for assessing them with, on the other, a large element of discretion for the Mahalla committees. Clear guidelines lay down the information that the Mahalla committees should take into account in assessing need but there is no attempt made by the central authorities to define when support must or must not be given and the committees' decisions are not subject to appeal.

The guidelines for assessing need indicate that the committees should collect information on a wide range of indicators that might be thought of as determining the household's "full" income, including household composition, labour force status of adults, cash incomes, durable good ownership and agricultural plot size and use. The guidelines also indicate examples of types of households who may be expected to benefit from the scheme, among whom households with large numbers of children head the list.

The Mahalla scheme is designed to take into account the usual sort of information on income and assets relevant to the assessment of need but also to allow local committees discretion, tailoring decisions to the local situation and other available knowledge of the circumstances of applicants. However, a strong discretionary element brings with it the risk of errors in targeting - discretion may be inappropriately applied to both exclude the needy and to include those not genuinely in need. In addition, ignorance of the scheme or a reluctance to publicly display need (Mahalla committee recommendations are voted on in a monthly public meeting) may lead to a failure to claim benefit.

We use the data on anthropometric status in the EESU to conduct a simple test

[18] The introduction of the Mahalla scheme coincided with a phasing out of remaining food subsidies, in particular those on bread and flour.

of the targeting of the Mahalla scheme, simply comparing mean height for age and weight for height in households with and without support from the Mahalla. Among households in the EESU with children for whom anthropometric data were collected, 16 percent reported receiving social assistance from the Mahalla in Tashkent, 24 percent in Fergana, and 28 percent in Karakalpakstan. The unit of analysis is the household and the measures we take are the minimum values among measured children in each household of height for age and weight for height as a percent of the reference median.

Looking first at the results for all households, the data indicate a clear difference in height for age. Households receiving assistance from the Mahalla have a minimum measured height for age which is on average 1.4 percent lower and the difference is quite strongly significant. Weight for height is also lower, by 1.2 percent but the difference is only significant at the 10 percent level. The data appear to indicate that on average Mahalla support goes to households with at least one child of significantly lower anthropometric status. The separate results for each oblast provide mixed support to this finding. The means in every case and for both measures are lower for households receiving support from the Mahalla. The differences are often not significant but the much smaller sample sizes at the oblast level need to be taken into account.[19]

In the case of weight for height, the more short-term measure of nutritional status, the possibility cannot be ruled out that receipt of social assistance has allowed weight to improve due to the household having a greater command over food resources as a result of the higher income provided by the scheme (although the very modest income effects found earlier in this section need to be noted). On this argument the finding of lower weight for height in households receiving support is quite a strong result since it will have emerged despite any positive impact of the support on nutritional status.

5. Conclusions and policy implications

This paper has used measurements of children's body size to quantify individual and household welfare and to investigate public policy. We began by giving the reasons for using such data and the problems of interpretation that arise. In these conclusions we concentrate on the substantive results for Uzbekistan and their implications for policy.

i) Overall Nutritional Status

With moderate levels of stunting and the virtual absence of wasting in the Uzbek data, it is reasonable to assume that energy deficiency is not a serious nutritional problem in the regions covered in the survey. However, the quality of the diet may be poor with deficiencies in one or more micronutrients. The results on

[19] For example, the Tashkent sample is less than a quarter of the size of the overall sample, so standard errors that are over twice as large are to be expected.

anthropometric status for the three Uzbek regions appear to be broadly in line with those found in Kazakhstan and provide an absolute measure of child welfare for the purposes of international comparison. We noted Latin American countries with a similar prevalence of stunting and wasting.

As in many developing countries, the weaning age appears to be a particularly vulnerable period of a child's life in Uzbekistan. A nutrition education programme should thus be considered, to address the question of diet quality and child feeding during the weaning age. This would need to take into consideration regional food consumption patterns, as well as regional food availability and food prices. No information on morbidity was gathered in the Uzbek survey; if the situation is similar to that found in the Kzyl-Orda region of Kazakhstan, sanitation, hygiene and levels of morbidity are likely to be unsatisfactory in rural areas and in small towns. Public health programmes need to address these issues.

ii) Urban-Rural Variation and Growth Monitoring

We found wide variation in anthropometric status between large cities, small towns and rural areas. On the one hand this suggests that nationwide programmes of nutritional intervention are not necessary, and that considerable savings in expenditure on interventions can be made with appropriate targeting. On the other hand it suggests that there are some parts of the country that are probably in need of quite urgent attention. Furthermore, while the situation is not yet serious in some areas, in the face of rapid economic change it is certainly advisable to consider some form of nutrition monitoring.

A number of options for monitoring are available, ranging from a full-scale national surveillance system to monitoring of nutritional status indicators only at selected "sentinel" sites. An option that may be particularly appropriate for Central Asia is the routine measuring of heights and weights of all children at entry to elementary school, which remains universal. Measurements could be taken either by teachers or by mobile teams of health personnel. With basic training (and periodic re-training) and investment in good equipment, such data are easy to gather and analyse, and would indicate those areas of the country in need of further investigation to select suitable social, economic, health or nutrition interventions.

iii) Urban-Rural Variation and the Measurement of Welfare

The anthropometric status of Uzbek children is notably lower in the rural areas covered by the EESU data, and our analysis does not indicate that this is mediated to any substantial degree by cash income. Cash income was found to have a low positive correlation with weight for height and no association at all with height for age. Rural children have worse nutritional status than urban children in most developing countries, and this has been associated with a variety of factors including lack of access to health care and a low level of education. While health care is widely available in rural Uzbekistan, it is possible that the quality of care is poorer than in urban areas although we have no information on this. Basic education has been virtually universal, as in other former socialist states, and our results gave no indication

that lower levels of maternal education in rural areas were an explanatory factor.

These results both underline the existence of lower living standards in rural areas and the limitation of monthly cash income as a measure of household welfare.

iv) The Impact of Kindergarten Attendance

Controlling for other observable factors, attendance at kindergartens had no positive association with height for age. However, the data did suggest a positive association of weight for height with kindergarten attendance. This association was not very well determined but seemed moderately robust to changes in the econometric treatment of the data. This result is consistent with the hypothesis that kindergartens have a positive impact on energy intake of children, which has a bearing on government policy on pre-school education.

v) The Targeting of Social Assistance

Nutritional status as measured by height for age was significantly lower for at least one child in households receiving means-tested support from the social assistance scheme administered by the Mahalla. On the face of it, this gives an encouraging picture of targeting in this new social assistance scheme, which has a substantial discretionary element. Weight for height is less obviously lower in households receiving support but we cannot rule out that this reflects in part the positive impact of receiving social assistance on this short-term nutritional measure.

Appendix

The European University Institute and University of Essex Survey in Uzbekistan (EESU) collected data on a range of household and individual characteristics via interviews conducted in the early Summer of 1995. There were questionnaires for the head of the household, for each adult in the household aged 16 or over, and for mothers of children aged under 7 in respect of each child of this age. Information was obtained on a range of subjects including demographic characteristics, housing conditions, employment, cash incomes in different forms, and agricultural assets and activity. (No information was collected on expenditure or consumption.) Anthropometric measurements of children aged less than 7 were collected in separate visits from the main interviews. The survey was conducted by EXPERT Centre, Tashkent, and the anthropometric measurements were made by persons receiving training from a team from the London School of Hygiene and Tropical Medicine.

In all, 1581 households responded to the EESU, representing an overall response rate of 85 percent. Refusals accounted for just under a third of non-response. (Details of sampling and response are given in Coudouel, 1997.) 851 responding households contained children aged over 6 months and under 7 but in 10 percent of these collection of anthropometric data proved impossible for one reason or another, including refusal to be measured. Measurement was successfully carried out on 1,298 children in 765 households.

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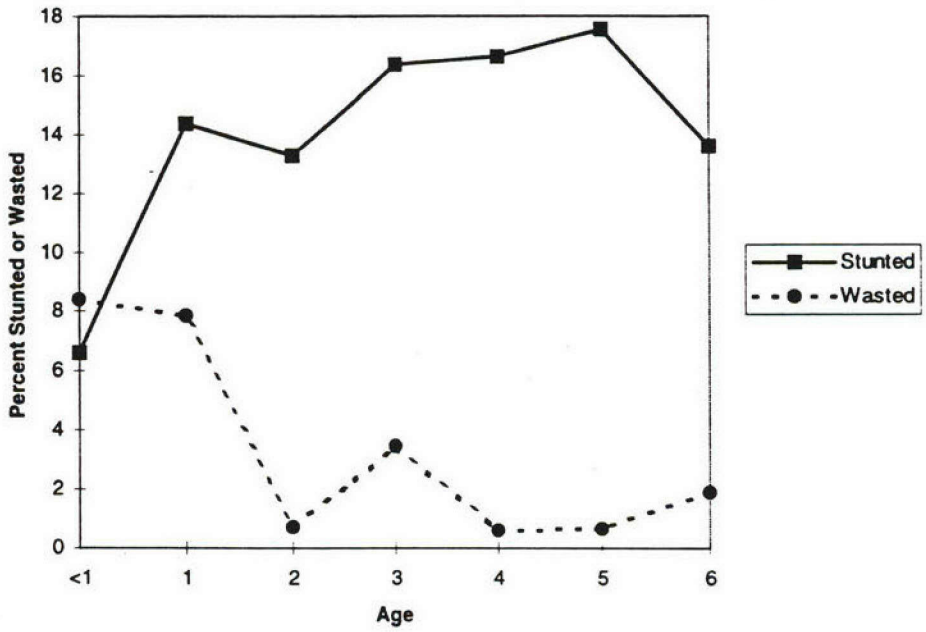
Figure 1 Variation of Stunting and Wasting by Age in EESU data



Notes:
See Table 1.

Table 1: Anthropometric status of children aged 7-71 months in three regions of Uzbekistan, Summer 1995

Range	Tashkent city %	Fergana %	Karakalpakstan %	Total %
i) Height for age				
≥+ 1 S.D.	9.9	2.3	2.8	4.6
-1 to +1 S.D.	57.7	41.7	49.3	48.3
-2 to -1 S.D.	25.3	36.2	33.7	32.4
≤ 2 S.D.	7.1	19.8	14.2	14.7
Total	100.0	100.0	100.0	100.0
ii) Weight for height				
≤ + 1 S.D.	10.7	4.8	8.9	7.6
-1 to +1 S.D.	74.7	73.8	73.0	73.9
-2 to -1 S.D.	12.6	17.6	15.1	15.5
≤ 2 S.D.	2.0	3.8	3.0	3.0
Total	100.0	100.0	100.0	100.0
Number of children	253	469	576	1298

Notes:

1. S.D.= standard deviation from median of NCHS/WHO reference standard.
2. Weights are applied to the data from Fergana and Karakalpakstan to adjust for oversampling of urban areas and to all data so as to produce a sample in which the proportion of households in each region corresponds to that in the population. In the weighted data, the shares of children in each region are 29% in Tashkent, 44% in Fergana and 27% in Karakalpakstan. (The last row of the table gives the unweighted numbers.)

Table 2: Stunting and Wasting in the EESU by Urban-Rural Location

	Tashkent city	Other cities	Towns	Rural areas
i) Height for age				
% ≤ -2 S.D.	7.1	6.0	19.2	19.9
mean height for age as % of median	98.2	96.7	95.6	95.5
ii) Weight for height				
% ≤ -2 S.D.	2.0	2.1	2.7	3.9
mean weight for height as % of median	100.3	98.8	98.2	97.5
Sample size	253	173	259	613

Notes:
"Other cities" defined as population over 100,000 and comprise Fergana (189,000), Marghilan (133,000) and Kokhand (186,000) in Fergana oblast and Nukus (186,000) in Karakalpakstan. (The population of Tashkent is 2,200,000). "Towns" are all urban areas beneath 100,000 population. See also notes to Table 1 on weighting.

Table 3: Stunting and Wasting in Central Asia

	Stunting %	Wasting %	Sample Size
i) Comparison with Kazakhstan DHS, 1995 (0-35 months)			
Kazakhstan			
Urban	7.5	3.7	300
Rural	21.8	3.0	417
Total	15.8	3.3	717
EESU, Fergana and Karakalpakstan (6-35 months)			
Urban	12.0	5.0	177
Rural	16.5	6.2	237
Total	15.0	5.0	414
ii) Comparison with Kyzl-Orda, Kazakhstan, 1994 (6-71 months)			
Kyzl-Orda			
Kazalinsk (1994)	14.1	1.2	256
Djalagash	20.4	1.0	382
Zhanakorgan	21.4	1.9	267
EESU (town, rural)			
Fergana	22.5	4.2	308
Karakalpakstan	15.4	3.1	454
iii) Comparison with Muynak, Karakalpakstan, 1993 (6-59 months)			
Muynak	25.9	3.6	532
EESU (town, rural)			
Karakalpakstan	14.9	3.5	369

Sources:
i) Kazakhstan Demographic and Health Survey (DHS): Macro International (1996), Table 10.7, p.129. The data were collected during May-September.

ii) Kyzl-Orda: Ismail and Hill (1996). The data were collected during June-August.

iii) Muynak: Morse (1994), Table 17, p.39.

Notes: See Table 1 for information on weighting of EESU data. The sample sizes refer to the unweighted data.

Table 4: Location Effects and Nutritional Status: GLS Regression Results

	1 No Controls	2 + Household Composition	3 + Cash Income	4 + Dwelling Characteristics and Agricultural Assets
	Height-for-age as a percentage of reference median (mean = 96.3, SD = 4.4)			
City Fergana	-1.53	-1.30	-1.34	-1.16
	(2.9)	(2.4)	(2.5)	(2.0)
City Karakalpakstan	-1.88	-1.54	-1.55	-1.38
	(2.8)	(2.3)	(2.3)	(2.0)
Town	-2.70	-2.32	-2.34	-1.89
	(6.4)	(5.4)	(5.4)	(3.3)
Rural Fergana	-3.28	-3.04	-3.07	-2.08
	(8.3)	(7.5)	(7.5)	(3.3)
Rural Karakalpakstan	-1.97	-1.43	-1.49	-0.23
	(4.8)	(3.4)	(3.5)	(0.3)
	Weight-for-height as a percentage of reference median (mean = 98.7, SD = 8.4)			
City Fergana	-1.93	-1.90	-1.66	-1.61
	(1.8)	(1.8)	(1.6)	(1.4)
City Karakalpakstan	0.54	-0.08	-0.02	-0.46
	(0.4)	(0.1)	(0.1)	(0.3)
Town	-1.70	-1.67	-1.54	-1.65
	(2.0)	(2.0)	(1.8)	(1.5)
Rural Fergana	-3.27	-3.30	-3.08	-1.89
	(4.2)	(4.1)	(3.8)	(1.5)
Rural Karakalpakstan	-1.54	-1.75	-1.42	-0.76
	(1.9)	(2.1)	(1.7)	(0.5)

Notes:

T-statistics are given in brackets; sample size is 1,298 children. The base for the location dummies is Tashkent city. The specification in column 2 includes 6 age dummies, dummies for low maternal education (failure to complete secondary school), a dummy for Slav head of household, and variables measuring the numbers of adults and children in the household. The specification in column 3 includes in addition a variable $Y/H^{0.5}$ where Y is the total household cash income in the last month (whether or not actually received) and H is the number of persons in the household. The specification in column 4 includes (in addition to variables in the previous specifications) dummies for running water and central drainage, plot ownership, ownership of cattle, sheep, fruit trees, vines and for receipt of cash income from sales of agricultural produce from the plot in the previous month.

Table 5: The Effect of Kindergarten Attendance on Nutritional Status

	Coefficient on Kindergarten Dummy	
	1. GLS	2. Fixed-Effects
Dependent Variable		
Height-for-age as % of reference median	-0.20 (t = 0.65)	-0.03 (t = 0.05)
Weight-for-height as % of reference median	1.19 (t = 2.01)	1.68 (t = 1.53)
sample size	1,298	765

Note:

The results in column 1 are obtained by GLS regression on the full sample of 1,298 children in an equation containing all the control variables listed in the notes to Table 3 as well as the dummy variable for kindergarten attendance. The results in column 2 are obtained by OLS on a transformed equation in which the dependent and independent variables are adjusted by subtracting their household-specific mean values and is estimated on the 765 multi-child households.

Table 6: Mean Anthropometric Status within Households by Receipt of Social Assistance from the Mahalla

	Height for Age as % of the reference median (mean of household minimum)		Weight for Height as % of the reference median (mean of household minimum)	
	with Social Assistance	without Social Assistance	with Social Assistance	without Social Assistance
Tashkent	96.64	98.04	95.56	98.60
	(t = 1.31)		(t = 1.55)	
Fergana	93.45	94.89	94.11	95.18
	(t = 2.45)		(t = 0.99)	
Karakalpakstan	94.24	95.13	95.90	96.39
	(t = 1.64)		(t = 0.47)	
All households	94.29	95.70	95.19	96.43
	(t = 3.62)		(t = 1.75)	

The results refer to the average values across households with and without Social Assistance of the minimum value within each household of height for age and weight for height among all measured children. The total number of households is 765 (159 in Tashkent, 289 in Fergana and 317 in Karakalpakstan). The t-test in brackets is of the hypothesis that the means are equal.

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1 September 1997

Dear Gregory Ingram,

Please find attached a paper entitled "Living Standards and Public Policy in Central Asia: What Can Be Learnt From Child Anthropometry", based on research financed principally by the World Bank Research Committee (Grant No. 679-97). The paper empirically tests several hypotheses concerning living standards and public policy using data collected by a household survey in Uzbekistan in 1995, which have important implications for assessments of child welfare during transition, as well as for World Bank operations. The authors are submitting the paper to the Editors of the World Bank Economic Review.

Thank-you for your support of this work.

Yours sincerely,

Jeni Klugman

Gregory Ingram
Chair, Research Advisory Committee
World Bank
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LIVING STANDARDS AND PUBLIC POLICY IN CENTRAL ASIA: WHAT CAN BE LEARNT FROM CHILD ANTHROPOMETRY?

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September, 1997

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Abstract

Data on weight and height of children are used to assess living standards and public policy in Uzbekistan, the most populous of the Central Asian republics. The paper begins by making the case for the use of such data, contrasting them with monetised measures of welfare based on household incomes or expenditures, before going on to review the problems of interpretation that anthropometry present for the economist. The prevalence of stunting and wasting in three regions of Uzbekistan is compared with that in neighbouring Kazakhstan and with other countries from outside the region. Multivariate analysis is then used to test three hypotheses concerning rural-urban differences in living standards, the impact of kindergartens on nutritional status, and the targeting of means-tested social assistance.

Keywords: nutrition, living standards, targeting, Uzbekistan.

JEL classification: I12, I32, J13

1. Introduction

Measurement of household welfare in transition economies such as those of Central Asia typically focuses on the measurement of poverty using monetised indicators in the form of income or expenditure. These indicators (after adjustment for differences in household size and composition) provide evidence on the relative incidence of poverty on different groups in the population, for example children or the old. Design of social assistance schemes and other policies to combat poverty can then take this information into account when targeting scarce public resources.

This paper takes a different route to the measurement of welfare in Central Asia and the assessment of public policy, by using information on child anthropometry – measurement of children's body size.

Anthropometric indicators appear to offer three attractions. First, anthropometry provides information on *individuals*, in contrast to a "poverty profile" constructed from information on incomes or expenditures which tells us only about the living standards of households. Use of household incomes or expenditures to infer anything about the welfare of individuals requires an assumption that household members pool and share all their resources. Children form a high proportion of the population of the Central Asian countries of the former Soviet Union. In the case of Uzbekistan, the most populous republic with over 20 million inhabitants and the focus of this paper, some 40 percent of the population is aged under 12. Concern about the population's welfare in Central Asia is therefore in large measure a concern about the welfare of children and anthropometry is one way of assessing this directly.

Second, anthropometry is one way of measuring nutritional status. This is a subject of direct concern to the analysis of child welfare, summarising a variety of influences including food intake and infection. Much evidence suggests that low nutritional status in childhood may have an adverse impact on development and hence health and productivity in later life, as well as increasing the risk of mortality and morbidity while still a child.

Third, use of anthropometry avoids the problems of measurement of monetised indicators of household welfare. These problems can be acute in transition economies. Not only is money income sometimes hard to measure, such as that from self-employment of various forms, but a substantial amount of economic activity is not monetised. The rural nature of much of Central Asia means that a great many households derive substantial amounts of income in kind from land in the form of food produced and consumed within the household. The measurement of these amounts and the imputation of their value is a far from trivial issue (Casley and Lury, 1987, Falkingham and Micklewright, 1997). In addition, prices may vary substantially within a country but the appropriate indices to adjust monetary welfare measures for regional price variation are often unavailable (Koen, 1997). To the extent that anthropometric status reflects household incomes and living conditions, data on body measurement therefore complement welfare indicators that are subject to errors of construction and interpretation. Moreover, the non-monetary nature of anthropometric data allows comparison of welfare in Central Asia with that in countries in other regions.

These attractions appear strong and increasing use has been made of anthropometric data by economic historians and development economists (for example, Komlos, 1994, Steckel, 1995, Thomas et al, 1996). However, the apparent attractions of anthropometry must be tempered by an appreciation of the limitations of this form of information. In Section 2 we review the informational content of data on children's weight and height viewed from the standpoint of economic analysis, illustrating some aspects of the discussion with the data used in the rest of the paper.

The data we use refer to 1,298 children in a survey of households conducted in Uzbekistan in 1995. This covered three of the fourteen regions of the country, chosen to provide a wide range of economic and geographical circumstances. The collection of these data seem to be the first attempt to measure anthropometry in the country as part of a general household survey. Section 3 provides basic results on anthropometric status from the survey, using the data to shed light both on living standards in relation to those in other countries and the variation within Uzbekistan. The mixture of Soviet and Asian influences makes for a somewhat confusing picture of the absolute level of development and of living standards in the region (Falkingham et al, 1997). Neither is the variation clear within Uzbekistan and other Central Asian countries (Coudouel et al, 1997), with such basic issues as rural-urban differences not yet firmly established. In both cases the use of child anthropometry allows substantial progress to be made.

Section 4 uses multivariate analysis to test three hypotheses concerning living standards and public policy. First, that controlling for differences in cash income, anthropometric status is higher in rural than in urban areas, reflecting the much greater presence of sources of non-monetised income. Second, that attendance at state or enterprise kindergartens has a positive impact on nutrition. Third, that a new means-tested social assistance scheme, aimed principally at families with children and administered by Mahalla local committees, is well-targeted in terms of anthropometric status. Section 5 concludes.

2. What Can Child Anthropometry Reveal about Living Standards?

What information on living standards is conveyed by an individual's weight and height? We note here some of the features of such data that the novice needs to be aware of.

Most obviously, body size is strongly influenced by genetic inheritance as well as by the "environmental" factors that we are interested in, such as family income and housing conditions. Indeed, the former explains most of the variance in individuals' heights (Tanner, 1994, p.1). The interaction of genetic and environmental factors appears to be complex and far from fully understood. For example, Eveleth and Tanner note that "two genotypes which produce the same adult heights under optimal environmental circumstances may produce different heights under circumstances of privation" (1976, p.222). This casts doubt on the often unstated assumption that genetic factors can be absorbed into an unobserved additive error term in regression

equations explaining anthropometric status.

On one view, the influence of genetic inheritance is no constraint to the use of anthropometric data to measure human welfare. At the outset of his survey article on "Stature and the Standard of Living", Steckel (1995) urges that

> "newcomers to the idea that stature measures important aspects of living standards should not be side-tracked by genetic issues. Genes are important determinants of individual height, but genetic differences approximately cancel in comparisons of averages across most populations" (p.1903).

The averaging out of genetic influence is particularly true of child populations – much evidence indicates that differences in the impact of genetic endowment on growth that are associated with ethnic group manifest themselves only in adolescence (e.g. WHO, 1995). Measurements of height and weight taken from any child population are therefore usually matched for age and sex with reference standards from the National Centre for Health Statistics/World Health Organisation (NCHS/WHO), which are based on a large sample of healthy US children. The most common indices calculated are height for age and weight for height. The convention is for a child to be classified as "stunted" if height for age is beneath the two standard deviations of the median in the reference population and as "wasted" if the same condition applies to weight for height.[1]

The use of international standards facilitates cross-country comparisons but there are limitations to such an exercise. Wasting is often rare even in countries at low levels of development unless they are undergoing an exceptional crisis in living standards. Stunting, which is more frequent, may be the better measure to compare but the same levels of either stunting or wasting in two different settings may be associated with different risks of mortality and morbidity on account of a variety of intermediating factors between malnutrition and outcome, including "epidemiology of certain diseases, access to health care facilities ... and behavioural differences in relation to household management of infection" (Tomkins, 1994, p.113). One might therefore argue that classification of stunting and wasting on the basis of international standards is not analogous to calculation of poverty on the basis of purchasing power parity dollars, since a given sum of the latter provides in principle the same command over resources in all countries. On the other hand, the same amount of purchasing power parity dollars may be associated with different living standards in different countries, due to varying levels of social services and facilities financed by the State.

The averaging out of genetic differences means that anthropometry can be used to make statements about living standards by focusing on the between-group variation, for example between urban and rural areas. Opinions differ on whether much notice should be taken of the within-group variation. Those making the case for the study with anthropometry of historical changes in living standards naturally place

[1] The terminology is unfortunate since it implies that the conditions should always be seen in a negative light.

little emphasis on this.[2] On the other hand, aid programmes in the developing world do use anthropometric status at the individual level as a basis for the targeting of intervention (e.g. United Nations, 1990, p.16). This stems in part from a focus on different measures. The economic historian uses data on height, while the emergency aid worker is more often interested in weight (conditional on height), which is subject to great change as a result of changes in the individual's health and access to food. Low weight relative to height provides a good measure of mortality risk at the individual level in situations of famine and is used as one basis for screening and intervention in the provision of food relief.

In general, however, deviant anthropometry provides imperfect information on living standards at the individual level on account of genetic factors. A child with weight or height below two standard deviations of the reference standard for his or her age is *more likely* to be living in a household where conditions are not conducive to development than is a child with values at the median but targeting of, say, cash social assistance on the basis of this classification would be subject to both Type I and Type II error.[3] Anthropometric status clearly does not provide a welfare ranking in the same sense as would an adequately measured full income variable.[4]

Genetically determined variation in height is also present among siblings (unless they are identical twins) and the genetic differences "exert, in general, much more force than environmental ones, unless one or more [of the siblings] has been for some reason subject to real starvation" (Tanner, 1994, p2). This limits the potential of anthropometry to measure intra-household differences in child welfare. In our Uzbek data, 902 of the 1,298 measured children lived in households with more than one measured child. Over 40 percent of the variance in both height-for-age and weight-for-height (relative to the reference median) among these children was within households and it would clearly be wrong to associate all this variation in anthropometry with variation in individual welfare.

The nutritional science literature emphasises the use of anthropometry for one child to infer something about the household environment that may affect others in the household, including "a sibling yet to be born" (United Nations, 1990, p.10). Our Uzbek data certainly do reveal some correlation between anthropometric measures for children of the same household. The correlations for Z-scores of height for age and weight for height between successive pairs of children in the household are 0.27 and

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[2] Addressing the issue of noise in the data from genetic influence, Tanner argues firmly in his introduction to the use of height data to measure welfare that, "we are talking about the *mean heights of populations* or sub-populations...we are not talking about the height of any individual" (1994, p1, author's emphasis).

[3] Nor does a focus on change over time solve all problems of interpretation since the genetic impact cannot be treated as an additive error to be differenced out. That said, the problems do appear to be less than with one-off assessment and "growth monitoring" is a standard technique in measurement of child welfare in developed as well as developing world. (Ulijaszek (1994) gives a good discussion of individual variation in the growth process and problems of interpretation stemming from this.)

[4] A further difference is that, unlike income, the anthropometric index would not provide a monotonically increasing measure of welfare even if it were free of genetic noise; excessive weight is associated with increased health risk.

0.24.[5] (These figures rise to 0.36 and 0.33 if attention is restricted to siblings only.) Where the first child in any pair is classified as stunted, 38 percent of the second children are also so classified, compared to only 12 percent if the first child has height for age that is normal. This reflects Tanner's observation that while most of the variation in height within two sets of brothers growing up under different household circumstances will be due to their genetic differences, the difference in means between the two sets "is a measure of the suitability of their respective environments for fostering growth" (Tanner, 1994, p.2). There is a higher mean probability of stunting for the brothers in the poorer environment.

To the extent that child anthropometry conveys information about a household's living standards, are they those in the present or in the past? Low weight for height can develop rapidly and at any age. Hence wasting reflects current household and individual circumstances, including seasonality in food supply or the impact of a recent episode of disease. Stunting, on the other hand, develops more slowly, with deficits in attained height increasing throughout a child's growth period if conditions remain unfavourable. However, the impact on stature of circumstances detrimental to growth is most marked during the first two years of life when the rate of growth is at its peak, and when the child is most vulnerable to nutritional insults of various kinds. Hence achieved stature may be thought of principally as reflecting a process of *failing* to grow in very young children and of *having failed* to grow in older children (United Nations, 1990, p.7). The greater is the extent of income mobility (in the sense of true income fully measured) the more noisy will be the information on current living standards conveyed by height data among older children.[6] Cross national comparisons of stunting among all children under 6 (the usual age group taken for comparison) therefore tell something about living standards in different countries averaged over several years, rather than for just the year in which the data were collected. And changes in stunting prevalence among this age group should be viewed as a lagged indicator of changes in living standards, something that is important to note in the context of the economic transition.

Weight for height and height for age may therefore convey different information about current living standards and the correlation between the two is often not strong. In our Uzbek data, the correlation of Z-scores was only 0.06 among all measured children (aged 6 to 72 months). But even in very young children aged up to 24 months, where the two indicators might be expected to be more closely related, the correlation was only 0.09. Recent studies have suggested that the nutritional factors

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[5] For the purposes of this calculation we order measured children within the household on age. Each child is then compared with the next child, so in a three child household the second child is compared with both the first and the third.

[6] There is considerable debate about the extent to which "catch-up growth" of height is possible if suitable interventions are provided or if the child's socio-economic conditions improve, leading to a better diet or reduced morbidity. (It goes without saying that catch-up growth of weight is possible.) Intervention at an early age appears to have the greatest positive impact (United Nations, 1990), although studies of the impact of late interventions are limited (Dasgupta, 1993, p.85). One example is that of Piyadasa (1996) who found that supplementation with milk or calcium increased the rate of growth in stunted Sri Lankan children aged 4-7 years by one fifth. The interpretation of height-for-age among older children as reflecting past circumstances clearly assumes that little catch-up is possible after the first two or three years of life.

associated with stunting and wasting may be quite different; Victora (1992) and other authors propose that while wasting may be due to a deficit in energy, stunting reflects rather the quality of the diet once the demand for energy has been satisfied, and may be due to a deficiency in one or more micronutrients. A number of micronutrients have been proposed, but a recent study (Piyadasa, 1996) would seem to indicate that an adequate intake of calcium is crucial for optimal growth.[7]

Anthropometric data are best viewed as another instrument in the bag of welfare measurement tools.[8] In some circumstances they are the best tool, as in assessment of the appropriate persons to receive emergency food aid in the situation of dire deprivation brought on by famine. In other circumstances they complement but do not necessarily dominate other tools. The genetic influence on body size introduces a lot of noise at the individual level but it does not mean that the data can tell us nothing about welfare below the household level. Focusing on the between-group variation, anthropometry can be used to investigate the welfare of groups of individuals - children in the case of this paper - as opposed to households. And investigation of anthropometry for different groups of individuals, in particular by gender, can shed light on average patterns of intra-household distribution.

3. Anthropometric status of children in Uzbekistan

Our investigation is based on the EUI/Essex Survey in Uzbekistan (EESU), which was conducted in the Summer of 1995. (Details of the survey are given in the Appendix.) This collected data on about 500 households in each of three regions that together contain over a quarter of the republic's population - the capital city of Tashkent, the important region of Fergana in the populous valley of the same name in the south-east of the country, and the autonomous republic of Karakalpakstan bordering the Aral Sea in the north-west. The three regions appear to contrast considerably in terms of average living standards (Coudouel et al, 1997). Tashkent, a city of over two million people and much the largest city in Central Asia, appears on economic indicators to be considerably ahead of all other regions in the republic. Karakalpakstan appears on the same indicators to be at the other end of the range and has suffered substantially from environmental degradation associated with the retreat of the Aral Sea. Fergana is sometimes viewed as a reasonably prosperous agricultural area (containing also some big urban areas) and scores relatively highly on several of the indicators based on information derived from official sources, although Coudouel et al (1997) also record that EESU income data do not show much clear water between this region and Karakalpakstan. The use of the anthropometric data in

[7] However, calcium intake is not the only nutritional factor involved and nutritional factors are by no means the only factors implicated in the aetiology of stunting; besides genetic potential, other factors include the frequency and severity of disease episodes, which in turn are related to a range of socio-economic factors such as educational level, hygiene practices, access to health services, clean water and good sanitation. The relative contributions of the various factors to promotion or retardation of growth in stature is likely to vary from one country to the next, and within a country, from one region to another.

[8] The problems in collecting accurate anthropometric data, which we have not reviewed here, should not be overlooked. See, for example, Kostermans (1994).

the ESSU provide an opportunity to shed more light on what is still a rather unclear picture of regional variation in living standards.

The basic anthropometric results for the 1,298 children aged 7-83 months who were measured in the EESU are given in Table 1. The data indicate that there was very little moderate or severe wasting in the sample of children from the three surveyed oblasts. Only 3 percent of children are more than two standard deviations below the reference median - barely more than in the NCHS reference population of healthy US children - although more than 1 in 6 children are between one and two standard deviations below and the mean Z-score (not shown) is -0.21, significantly different from zero (t=7.5). At the other end of the range, 8 percent of the children were at a level classified as overweight (more than one standard deviation above the reference standard). The prevalence of moderate and severe stunting (two or more standard deviations below the reference median) is notably higher than for wasting; 15 percent of the children are in this position and another third of the sample were between one and two standard deviations below. Thus nearly one half of the distribution is below one standard deviation of the reference median compared to only 1 in 20 who are one standard deviation or more above it. (The mean Z-score is -0.89.)

These results refer to the three regions taken together, weighted for their respective population sizes. However, Table 1 shows some substantial differences between the regions in height for age. Whereas only 7 percent of children in the capital are stunted, 20 percent are stunted in Fergana. Somewhat fewer children are stunted in Karakalpakstan than in Fergana - only 14 percent - but the hypothesis that the grouped Z-score distributions are the same in these two regions cannot be rejected on a chi-square test, and it is Tashkent city that stands out as being different from the other two. Weight for height shows little regional variation and it is notable, for example, how the grouped Z-score distributions are similar in the capital and in Karakalpakstan (mean Z-scores just differ at the 5 percent significance level), the two regions that on many welfare indicators are at opposite ends of the observed range.

Fergana and Karakalpakstan both contain large urban centres and in Table 2 we identify these separately from towns (urban areas with less than 100,000 inhabitants) and rural areas. As far as height for age is concerned, there appear to be two clear groupings. First, the prevalence of stunting in the four regional cities in our sample is no higher than that in the (much larger) capital. (There are no significant differences among the former.) Second, prevalence in towns and rural areas is almost identical at around 1 in 5 children, and some two and a half times that in the capital and other large urban centres. A focus on a simple "urban/rural" split would hide some of this difference, the prevalence of stunting in all urban areas being 10 percent, and 13 percent if we exclude Tashkent (which would get far less weight in a national sample).

A focus on stunting prevalence alone when considering height for age suggests that the better position of children in Tashkent compared to other regions is more to do with the capital being a large urban area than it being the capital *per se*. However, the mean values of the heights for age as a percent of the median, also shown in the

table, *are* significantly higher in Tashkent than in the other cities (t = 3.8) which serves as a warning against an exclusive focus on the lower tail of the distribution. (There is no significant difference between the means for towns and rural areas.) A final point to make about the height data in Table 2 is that they hide what appear to be differences between the rural areas in Fergana and Karakalpakstan, which have an incidence of stunting of 23 percent and 13 percent respectively. Hence it is rural Fergana where the incidence of stunting is highest in the parts of Uzbekistan covered by the EESU and the contrast in this region between the situation in the cities and in the countryside is thus particularly marked.

The lower part of Table 2 gives the results for weight for height. These follow a similar pattern to those for height for age but the prevalence of wasting remains low in all types of location, reaching a maximum of 4 percent in rural areas, and the differences in neither wasting nor mean weight for height are significant.

All the results in Tables 1 and 2 refer to boys and girls taken together. There are no significant differences in mean height for age or weight for height between the sexes or in the prevalence of stunting or wasting. (For example, stunting affects 14.6 percent of boys and 14.8 percent of girls.) Nor did the conclusion change when we conducted a more powerful test of the hypothesis of equal treatment of the two genders by focusing on differences between the sexes within households.[9]

The prevalence of stunting and wasting by age is shown in Figure 1, taking all three regions together. The pattern of change is consistent with the findings of many other studies: wasting is highest during the weaning period (6-24 months) when some 8 percent of children are affected - about double what is found in the reference population of this age - then decreases sharply as the child gets older; stunting on the other hand is lowest in the infant (<12 months) and no more prevalent in the EESU data at this age than is wasting, but then rises substantially over the next four to five years, with sometimes a partial recovery in the older child. The weaning age is a period of high nutritional risk for a child; nutrients from breastmilk alone become insufficient to support good growth, and supplementary weaning foods may be low in energy content, of poor dietary quality or prepared unhygienically. The weaning age is also the age when a child begins to explore his or her environment thereby increasing exposure to higher risk of disease.

How does the prevalence of stunting and wasting in the EESU data compare with those from elsewhere and hence what can we say about absolute levels of child welfare in Uzbekistan using other countries as a yardstick? We first consider findings from outside Central Asia. Carlson and Wardlaw (1990) review findings on child anthropometry from nearly 70 countries at a low and medium level of development. About a third had levels of wasting below that recorded in the EESU and a quarter had

[9] We calculated mean height for age and weight for height (in Z scores) separately by gender within each household. (Where, for example, there was one boy and two girls these means were equal to the boy's Z score and the average of those for the two girls.) We then tested for differences in the average values of these means in those households with a least one measured boy and one measured girl. Mean Z score of height for age for girls in such households was -0.991 and for boys -0.995.

lower prevalence of stunting.[10] The combination of a moderate prevalence of stunting with a low prevalence of wasting found in Uzbekistan is typical of a number of the more developed Latin American countries. For example, 9.6 percent of children (aged 0-71 months) were stunted in Chile in 1986 and only 0.5 percent wasted; figures for stunting among children aged 0-59 were 15.9 percent in Uruguay in 1987 and 15.4 percent in Brazil in 1989 (with wasting at 2.0 percent), a Latin American country at a somewhat lower level of development (Carlson and Wardlaw, 1990, pp85, 115, and De Onis et al, 1993, p.706). The figures for Uzbekistan are clearly far better than those for many countries in Africa and in South Asia (and for other South American countries) where the highest levels of both stunting and wasting are recorded. They do, however, repeat one marked feature of the results from many other countries, namely a higher prevalence of stunting in rural areas – Carlson and Wardlaw report that stunting prevalence was on average 1.5 times higher in rural areas and wasting prevalence 1.2 times higher (1990, p.23).

Table 3 compares the results for Uzbekistan with others available for Central Asia. National figures are available for Kazakhstan (the most populous country in Central Asia after Uzbekistan) for children aged under 3, from the 1995 Demographic and Health Survey (DHS). (Like the other surveys in the table, this survey was conducted in the Summer months.) We compare results with those for Fergana and Karakalpakstan only, dropping children aged over 35 months and in addition all those in Tashkent, who make up 25 percent of the weighted EESU sample. (By contrast, less than 5 percent of children in the DHS sample were from the Kazakh capital, and largest city, Almaty.) The results seem very similar. The overall level of stunting is around 15-16 percent in both countries and wasting is even less common in Kazakhstan than it is in the two Uzbek regions.[11] One difference is that the Kazakh data show a much sharper urban-rural gap in stunting incidence.

The second comparison is with three districts of the large Kazakh region of Kzyl-Orda, which borders Karakalpakstan to the north-east. Some interesting comparisons can be made here, between Kazalinsk and Karakalpakstan on the one hand and Fergana, Zhanakorgan and Djalagash on the other. Like Karakalpakstan, Kazalinsk borders on the Aral Sea and agriculture is similar in both areas, with a heavy emphasis on animal rearing. Zhanakorgan and Djalagash are fruit-growing regions, like parts of Fergana, and fewer households keep animals. (We exclude the four cities from the EESU data since urban areas of this size are not present in the three Kazakh districts concerned.) Table 3 shows that levels of stunting in Kazalinsk and Karakalpakstan are similar, as are the somewhat higher levels of stunting in Fergana, Zhanakorgan and Djalagash. The ranking of the Kazakh districts mirrors that of the Uzbek regions. Economic conditions in Kazalinsk and Karakalpakstan appear less favourable and both areas suffer from environmental degradation but the prevalence of stunting appears rather lower than in the other areas taken for comparison. We referred earlier to the importance of calcium for linear growth and it may be that milk

[10] The studies reviewed by Carlson and Wardlaw refer in the main to the mid 1980s and in general to children aged 0-59 months.

[11] If infants aged 0-5 months are excluded from the Kazakh results, as they are from the EESU sample, the incidence of stunting rises by two percent points (Macro International, 1996, p129).

consumption is greater in Karakalpakstan and Kazalinsk on account of the relative higher cattle ownership in these areas.

The final comparison is between the rural and small urban areas of Karakalpakstan in the EESU with Muynak, a remote district in the same region on the shores of the Aral Sea. Wasting was again low in Muynak in 1993 but stunting in this case was as high as 26 percent, suggesting that child (and household) welfare in the remoter areas in Karakalpakstan may be notably lower than in other parts of the region.

Several general conclusions are suggested by these comparisons and by the earlier results in this section. First, the low prevalence of wasting in all the different studies indicates that there was no major problem of aggregate energy deficit in Uzbekistan or Kazakhstan at the time the data concerned were collected.[12] Second, stunting levels appear similar in the two countries, at around the level found in several more developed Latin American countries and this provides one marker for the Central Asian countries in terms of average living standards. Third, no differences in the anthropometric status of boys and girls emerged in the EESU data, a feature repeated in the other studies covered in Table 3; on this measure of individual welfare, neither gender appears to have an advantage over the other.[13] Fourth, living standards as indicated by stunting prevalence appear markedly lower in rural areas than in urban areas (especially large cities), a finding that runs counter to the frequent claim that private plots enable rural households to maintain higher living standards than their urban counterparts.

4. Testing Hypotheses concerning Living Standards and Public Policy

In this section we test the three hypotheses outlined in the Introduction concerning (i) living standards in rural and urban areas, (ii) the impact of kindergartens on nutritional status, and (iii) the targeting of the Mahalla social assistance scheme.

(i) living standards in rural and urban areas

Height for age is clearly lower in the rural areas in the regions covered by the EESU than in the large urban areas, with small urban areas in an intermediate position. We now investigate these differences in more detail. Higher income can be expected to be associated with higher nutritional status (although the relationship is subject to debate (Alderman, 1993)). If when controlling for variation in observed cash income between urban and rural areas we find that nutritional status in the latter is in fact higher, this will suggest that unmeasured non-cash income in rural areas, particularly food grown on agricultural plots and consumed within the home, is

[12] National figures on the incidence of wasting are also available for Kyrgyzstan and show a somewhat higher level of 7 percent among 1,415 children aged under 7 in the World Bank sponsored Kyrgyzstan Multipurpose Poverty Survey of Autumn 1993 (Popkin and Martinchik, 1994, Table 4). (Information on month of birth was not collected in the survey, precluding calculations of height for age.)

[13] Carlson and Wardlaw find that in many less developed countries girls in fact enjoy slightly better anthropometric status than boys, the ratio of stunting and wasting prevalence between boys and girls for 39 countries averaging 1.1 and 1.3 respectively (1990, Table 6).

an important factor in sustaining household living standards in rural areas.[14] This in turn would underline the danger of the State treating cash income as an adequate measure of household welfare when targeting cash and in-kind benefits.

Our strategy is to estimate multivariate equations, regressing anthropometric status of the child on the location indicators and progressively adding in a variety of control variables. We report results for both height for age and weight for height as percentages of the reference medians. The equations are estimated by GLS, allowing for an unobserved household level random effect assumed constant across children in the same household (and uncorrelated with observable factors included in the regression).[15] Results are given in Table 4 for the estimated coefficients on the location variables only. (We comment in the text on the impact of some of the control variables.)

The specification in column 1 contains only the five location variables, for which the base is Tashkent city. Mean height for age in rural Fergana is over 3 percent points lower than in the capital, nearly 3 points less in the smaller urban areas (we refer to these as "towns"), and 2 points less in rural Karakalpakstan. The deficit in cities relative to the capital is between 1.5 and 2 percent. The variation across location in weight for height is similar in its pattern (although much smaller in relation to the standard deviation), with the noted exception of Nukus (the single Karakalpak city) where there is no difference from the capital.

Column 2 includes controls for household composition, including household size, the age of the child, and whether the household head is of Slav ethnicity. The mean values of all of these vary across location but their inclusion in the equations has no great impact, although the differences in mean height for age relative to that in the capital do all fall somewhat. One notable result is that a Slav household head is associated with a quite well determined increase in height for age of 2 percent points (but has no significant impact on weight for height). Height for age is lower in large households - by about 0.25 percent points for each other child present aged under sixteen.

Column 3 includes measured cash income. This variable refers to all income in the previous month whether it was received or not, the latter including wages or cash benefits due in that month which were not actually paid. Information on cash incomes in the EESU was collected in considerable detail, with each adult separately questioned about a wide range of different possible sources. The inclusion of the cash income variable (which is equivalised by dividing by the square root of household size) has no impact on the estimated location coefficients for height for age. Those for

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[14] Such a pattern is suggested by official budget survey data from pre-reform Uzbekistan, which show recorded calorie and protein intake in collective farm households as being higher than that in worker-employee households, holding cash income constant (Marnie and Micklewright, 1994, Figure 7).

[15] This household error can be thought of as proxying a variety of unobserved influences including common "environmental" factors and shared genetic inheritance. (Our earlier discussion indicates that the major part of genetic inheritance will enter via the individual and not the household specific error; and our treatment of genetic influences as additive is clearly unsatisfactory.) An LM test always rejected the hypothesis of no random effects.

weight for height fall but only by about one tenth. Even the simple correlation between household cash income and individual nutritional status is very low - the two measures of welfare appear to be weakly related. The hypothesis that the correlation coefficient between equivalised income and height for age is zero cannot be rejected. That between weight for height and income is significant at the 1 percent level but the estimated value is only 0.09. Similarly, in the regressions reported in Table 4, where we control for other factors, equivalised income has a completely insignificant impact on height for age. The estimated impact on weight for height is significant at the 5 percent level but is very small; an increase in income of one standard deviation raises weight for height by only 0.5 percent points.[16] The greater impact of cash income in the last month on weight for height makes sense, since this is a short-run measure of nutritional status. The lack of association with height for age may be interpreted in various ways; one is that cash income over a month is a poor indicator of permanent or full income.

The agricultural asset variables entered into the specification in the final column are intended to pick up important sources of other aspects of full income for households. Here we do find a substantial change in the estimated impact of the location variables. The difference between rural Karakalpakstan and Tashkent now disappears for both nutritional indicators and as far as weight for height is concerned there are no differences in any of the location types from the capital. However, when we look at the estimated coefficients on the agricultural asset variables we find that a number of them are negative. (In fact this must be the case in order to account for the change in the location impacts given that the cash income variable does so little). For example, children in households with any cash income from crop or stock sales in the last month are estimated to have height for age and weight for height that are lower by about 0.7 and 1.3 percent points respectively than for other children, although these effects are barely significant at the 10 percent level. (The income itself from this source is included in the cash income variable and the agricultural income dummy is intended to pick up households with sufficient involvement in private agriculture to engage in selling to others.) Larger private agricultural plots are associated with lower height for age.

Overall, the conclusion seems to be a rejection of the null hypothesis with which we started - anthropometric status is lower in rural areas even when we control for cash income. Further controls do help explain some of the apparent rural "effects". The specification in column 4 also includes some housing condition dummies; running water in the household, which is typically present in urban areas and typically absent in rural areas, is significantly associated with an increase in weight for height of 1.5 percent points.

(ii) the impact of kindergartens on nutritional status

The impact of kindergartens on nutritional status is of considerable policy interest. As elsewhere in Central Asia (Klugman et al, 1997) kindergarten enrolment

[16] These results are not changed much when we allow the effect of income to vary by oblast although there is some suggestion that the impact on weight for height is higher in Tashkent.

has fallen significantly in Uzbekistan, from 35 percent of the relevant age-group in 1991 to 26 percent in 1995.[17]

These falls in enrolment have in all probability reflected both demand and supply side factors, the latter including closure of some enterprise facilities. Whatever the explanation, the issue is whether this falling enrolment is a cause for concern for public policy. Kindergartens have a number of functions and hence positive impacts on household welfare. One possible effect is that of enhancing nutritional status among children, through provision of food that would not otherwise be eaten.

We investigate this issue by inserting a dummy variable for kindergarten attendance in the regression equations described above. About a quarter of the children in the EESU sample are in kindergartens. Table 5 reports the coefficient on the kindergarten dummy in regressions of height for age and weight for height under two different treatments of unobservable factors. Column 1 reports GLS regressions in which the control variables follow the specification in the final column of Table 4. This assumes unobservables to be uncorrelated with observable factors. However, unobserved factors may indeed be correlated with the kindergarten dummy, which in this case would partly proxy those factors. For example, "good" mothers (in some unobserved sense) may provide their children with more food and better living conditions but they may also be more likely to send their children to kindergarten so as to take advantage of the benefits offered. In this case a positive impact of the kindergarten dummy in a GLS regression of nutritional status could merely be proxying the unobservable factor of having a "good" mother.

The estimates in column 2 try to allow for this and are obtained with the fixed-effects estimator, exploiting the fact that we often observe more than one child per household. With a two child household this technique is equivalent to regressing the difference in nutritional status between the two children on the difference in their kindergarten attendance. Unobserved household factors such as a "good" mother which are common to the children drop out of the equation (their difference is zero) thus leaving an estimated kindergarten effect that should be uncontaminated. The disadvantage of this technique is that the kindergarten impact is estimated only from the within-household variation in kindergarten attendance, and none of that between households. The amount of such variation is low - in only 72 households is there at least one child under 7 attending kindergarten and one who is not. We cannot therefore hope for well-determined estimates.

The results show that with neither the GLS nor the fixed-effects estimator is there any impact of kindergarten status on height for age. However, it does seem that weight for height, the more short-term nutritional indicator, may be affected positively by kindergarten attendance. The GLS results indicate that weight for height is about 1 percent higher where the child is in a kindergarten, controlling for other observables factors (including, for example, age which is strongly correlated with kindergarten attendance), a difference which is just significant at the 5 percent level. The fixed

[17] Information supplied by the Ministry of Labour.

effect estimator yields an estimate which is similar in size but as expected it is poorly determined and significant at only the 13 percent level, although it is worth noting that a Hausman test fails to reject the hypothesis of no fixed effects. A considerably larger sample size would be needed to estimate the kindergarten effect with more precision.

(iii) the targeting of the Mahalla social assistance scheme

As part of its moves to provide more targeted support to those in need, the Uzbek government introduced a new means-tested social assistance scheme in the Autumn of 1994.[18] A key feature of this scheme is that support is administered by committees of the "Mahalla", a pre-Soviet traditional community organisation that has been revived under the government's auspices. There are several thousand Mahalla in the republic as a whole. The scheme is an important form of support for households. Initially granted a budgetary allocation of about 0.5 percent of GDP, some 1 in 5 households were apparently granted benefit under the scheme in 1995 for renewable periods of three months, at a level which is intended to be between 1.5 and 3 times the minimum wage.

The scheme combines on the one hand firm rules regarding applications and procedures for assessing them with, on the other, a large element of discretion for the Mahalla committees. Clear guidelines lay down the information that the Mahalla committees should take into account in assessing need but there is no attempt made by the central authorities to define when support must or must not be given and the committees' decisions are not subject to appeal.

The guidelines for assessing need indicate that the committees should collect information on a wide range of indicators that might be thought of as determining the household's "full" income, including household composition, labour force status of adults, cash incomes, durable good ownership and agricultural plot size and use. The guidelines also indicate examples of types of households who may be expected to benefit from the scheme, among whom households with large numbers of children head the list.

The Mahalla scheme is designed to take into account the usual sort of information on income and assets relevant to the assessment of need but also to allow local committees discretion, tailoring decisions to the local situation and other available knowledge of the circumstances of applicants. However, a strong discretionary element brings with it the risk of errors in targeting - discretion may be inappropriately applied to both exclude the needy and to include those not genuinely in need. In addition, ignorance of the scheme or a reluctance to publicly display need (Mahalla committee recommendations are voted on in a monthly public meeting) may lead to a failure to claim benefit.

We use the data on anthropometric status in the EESU to conduct a simple test

[18] The introduction of the Mahalla scheme coincided with a phasing out of remaining food subsidies, in particular those on bread and flour.

of the targeting of the Mahalla scheme, simply comparing mean height for age and weight for height in households with and without support from the Mahalla. Among households in the EESU with children for whom anthropometric data were collected, 16 percent reported receiving social assistance from the Mahalla in Tashkent, 24 percent in Fergana, and 28 percent in Karakalpakstan. The unit of analysis is the household and the measures we take are the minimum values among measured children in each household of height for age and weight for height as a percent of the reference median.

Looking first at the results for all households, the data indicate a clear difference in height for age. Households receiving assistance from the Mahalla have a minimum measured height for age which is on average 1.4 percent lower and the difference is quite strongly significant. Weight for height is also lower, by 1.2 percent but the difference is only significant at the 10 percent level. The data appear to indicate that on average Mahalla support goes to households with at least one child of significantly lower anthropometric status. The separate results for each oblast provide mixed support to this finding. The means in every case and for both measures are lower for households receiving support from the Mahalla. The differences are often not significant but the much smaller sample sizes at the oblast level need to be taken into account.[19]

In the case of weight for height, the more short-term measure of nutritional status, the possibility cannot be ruled out that receipt of social assistance has allowed weight to improve due to the household having a greater command over food resources as a result of the higher income provided by the scheme (although the very modest income effects found earlier in this section need to be noted). On this argument the finding of lower weight for height in households receiving support is quite a strong result since it will have emerged despite any positive impact of the support on nutritional status.

5. Conclusions and policy implications

This paper has used measurements of children's body size to quantify individual and household welfare and to investigate public policy. We began by giving the reasons for using such data and the problems of interpretation that arise. In these conclusions we concentrate on the substantive results for Uzbekistan and their implications for policy.

i) Overall Nutritional Status

With moderate levels of stunting and the virtual absence of wasting in the Uzbek data, it is reasonable to assume that energy deficiency is not a serious nutritional problem in the regions covered in the survey. However, the quality of the diet may be poor with deficiencies in one or more micronutrients. The results on

[19] For example, the Tashkent sample is less than a quarter of the size of the overall sample, so standard errors that are over twice as large are to be expected.

anthropometric status for the three Uzbek regions appear to be broadly in line with those found in Kazakhstan and provide an absolute measure of child welfare for the purposes of international comparison. We noted Latin American countries with a similar prevalence of stunting and wasting.

As in many developing countries, the weaning age appears to be a particularly vulnerable period of a child's life in Uzbekistan. A nutrition education programme should thus be considered, to address the question of diet quality and child feeding during the weaning age. This would need to take into consideration regional food consumption patterns, as well as regional food availability and food prices. No information on morbidity was gathered in the Uzbek survey; if the situation is similar to that found in the Kzyl-Orda region of Kazakhstan, sanitation, hygiene and levels of morbidity are likely to be unsatisfactory in rural areas and in small towns. Public health programmes need to address these issues.

ii) Urban-Rural Variation and Growth Monitoring

We found wide variation in anthropometric status between large cities, small towns and rural areas. On the one hand this suggests that nationwide programmes of nutritional intervention are not necessary, and that considerable savings in expenditure on interventions can be made with appropriate targeting. On the other hand it suggests that there are some parts of the country that are probably in need of quite urgent attention. Furthermore, while the situation is not yet serious in some areas, in the face of rapid economic change it is certainly advisable to consider some form of nutrition monitoring.

A number of options for monitoring are available, ranging from a full-scale national surveillance system to monitoring of nutritional status indicators only at selected "sentinel" sites. An option that may be particularly appropriate for Central Asia is the routine measuring of heights and weights of all children at entry to elementary school, which remains universal. Measurements could be taken either by teachers or by mobile teams of health personnel. With basic training (and periodic re-training) and investment in good equipment, such data are easy to gather and analyse, and would indicate those areas of the country in need of further investigation to select suitable social, economic, health or nutrition interventions.

iii) Urban-Rural Variation and the Measurement of Welfare

The anthropometric status of Uzbek children is notably lower in the rural areas covered by the EESU data, and our analysis does not indicate that this is mediated to any substantial degree by cash income. Cash income was found to have a low positive correlation with weight for height and no association at all with height for age. Rural children have worse nutritional status than urban children in most developing countries, and this has been associated with a variety of factors including lack of access to health care and a low level of education. While health care is widely available in rural Uzbekistan, it is possible that the quality of care is poorer than in urban areas although we have no information on this. Basic education has been virtually universal, as in other former socialist states, and our results gave no indication

that lower levels of maternal education in rural areas were an explanatory factor.

These results both underline the existence of lower living standards in rural areas and the limitation of monthly cash income as a measure of household welfare.

iv) The Impact of Kindergarten Attendance

Controlling for other observable factors, attendance at kindergartens had no positive association with height for age. However, the data did suggest a positive association of weight for height with kindergarten attendance. This association was not very well determined but seemed moderately robust to changes in the econometric treatment of the data. This result is consistent with the hypothesis that kindergartens have a positive impact on energy intake of children, which has a bearing on government policy on pre-school education.

v) The Targeting of Social Assistance

Nutritional status as measured by height for age was significantly lower for at least one child in households receiving means-tested support from the social assistance scheme administered by the Mahalla. On the face of it, this gives an encouraging picture of targeting in this new social assistance scheme, which has a substantial discretionary element. Weight for height is less obviously lower in households receiving support but we cannot rule out that this reflects in part the positive impact of receiving social assistance on this short-term nutritional measure.

Appendix

The European University Institute and University of Essex Survey in Uzbekistan (EESU) collected data on a range of household and individual characteristics via interviews conducted in the early Summer of 1995. There were questionnaires for the head of the household, for each adult in the household aged 16 or over, and for mothers of children aged under 7 in respect of each child of this age. Information was obtained on a range of subjects including demographic characteristics, housing conditions, employment, cash incomes in different forms, and agricultural assets and activity. (No information was collected on expenditure or consumption.) Anthropometric measurements of children aged less than 7 were collected in separate visits from the main interviews. The survey was conducted by EXPERT Centre, Tashkent, and the anthropometric measurements were made by persons receiving training from a team from the London School of Hygiene and Tropical Medicine.

In all, 1581 households responded to the EESU, representing an overall response rate of 85 percent. Refusals accounted for just under a third of non-response. (Details of sampling and response are given in Coudouel, 1997.) 851 responding households contained children aged over 6 months and under 7 but in 10 percent of these collection of anthropometric data proved impossible for one reason or another, including refusal to be measured. Measurement was successfully carried out on 1,298 children in 765 households.

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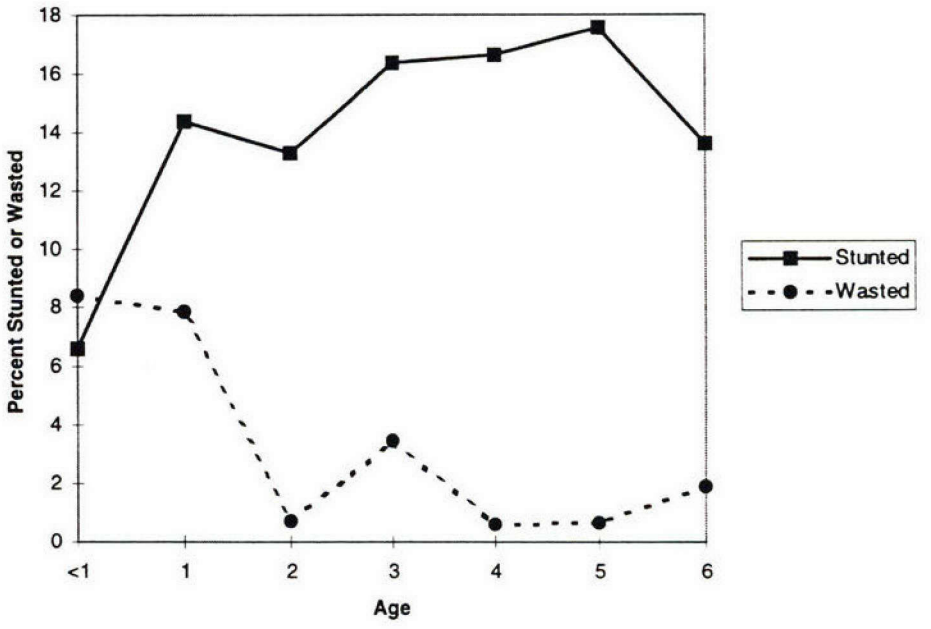
Figure 1 Variation of Stunting and Wasting by Age in EESU data



Notes:
See Table 1.

Table 1: Anthropometric status of children aged 7-71 months in three regions of Uzbekistan, Summer 1995

Range	Tashkent city %	Fergana %	Karakalpakstan %	Total %
i) Height for age				
≥+ 1 S.D.	9.9	2.3	2.8	4.6
-1 to +1 S.D.	57.7	41.7	49.3	48.3
-2 to -1 S.D.	25.3	36.2	33.7	32.4
≤ 2 S.D.	7.1	19.8	14.2	14.7
Total	100.0	100.0	100.0	100.0
ii) Weight for height				
≤ + 1 S.D.	10.7	4.8	8.9	7.6
-1 to +1 S.D.	74.7	73.8	73.0	73.9
-2 to -1 S.D.	12.6	17.6	15.1	15.5
≤ 2 S.D.	2.0	3.8	3.0	3.0
Total	100.0	100.0	100.0	100.0
Number of children	253	469	576	1298

Notes:

1. S.D.= standard deviation from median of NCHS/WHO reference standard.
2. Weights are applied to the data from Fergana and Karakalpakstan to adjust for oversampling of urban areas and to all data so as to produce a sample in which the proportion of households in each region corresponds to that in the population. In the weighted data, the shares of children in each region are 29% in Tashkent, 44% in Fergana and 27% in Karakalpakstan. (The last row of the table gives the unweighted numbers.)

Table 2: Stunting and Wasting in the EESU by Urban-Rural Location

	Tashkent city	Other cities	Towns	Rural areas
i) Height for age				
% ≤ -2 S.D.	7.1	6.0	19.2	19.9
mean height for age as % of median	98.2	96.7	95.6	95.5
ii) Weight for height				
% ≤ -2 S.D.	2.0	2.1	2.7	3.9
mean weight for height as % of median	100.3	98.8	98.2	97.5
Sample size	253	173	259	613

Notes:
"Other cities" defined as population over 100,000 and comprise Fergana (189,000), Marghilan (133,000) and Kokhand (186,000) in Fergana oblast and Nukus (186,000) in Karakalpakstan. (The population of Tashkent is 2,200,000). "Towns" are all urban areas beneath 100,000 population. See also notes to Table 1 on weighting.

Table 3: Stunting and Wasting in Central Asia

	Stunting %	Wasting %	Sample Size
i) Comparison with Kazakhstan DHS, 1995 (0-35 months)			
Kazakhstan			
Urban	7.5	3.7	300
Rural	21.8	3.0	417
Total	15.8	3.3	717
EESU, Fergana and Karakalpakstan (6-35 months)			
Urban	12.0	5.0	177
Rural	16.5	6.2	237
Total	15.0	5.0	414
ii) Comparison with Kyzl-Orda, Kazakhstan, 1994 (6-71 months)			
Kyzl-Orda			
Kazalinsk (1994)	14.1	1.2	256
Djalagash	20.4	1.0	382
Zhanakorgan	21.4	1.9	267
EESU (town, rural)			
Fergana	22.5	4.2	308
Karakalpakstan	15.4	3.1	454
iii) Comparison with Muynak, Karakalpakstan, 1993 (6-59 months)			
Muynak	25.9	3.6	532
EESU (town, rural)			
Karakalpakstan	14.9	3.5	369

Sources:
i) Kazakhstan Demographic and Health Survey (DHS): Macro International (1996), Table 10.7, p.129. The data were collected during May-September.

ii) Kyzl-Orda: Ismail and Hill (1996). The data were collected during June-August.

iii) Muynak: Morse (1994), Table 17, p.39.

Notes: See Table 1 for information on weighting of EESU data. The sample sizes refer to the unweighted data.

Table 4: Location Effects and Nutritional Status: GLS Regression Results

	1 No Controls	2 + Household Composition	3 + Cash Income	4 + Dwelling Characteristics and Agricultural Assets
Height-for-age as a percentage of reference median (mean = 96.3, SD = 4.4)				
City Fergana	-1.53	-1.30	-1.34	-1.16
	(2.9)	(2.4)	(2.5)	(2.0)
City Karakalpakstan	-1.88	-1.54	-1.55	-1.38
	(2.8)	(2.3)	(2.3)	(2.0)
Town	-2.70	-2.32	-2.34	-1.89
	(6.4)	(5.4)	(5.4)	(3.3)
Rural Fergana	-3.28	-3.04	-3.07	-2.08
	(8.3)	(7.5)	(7.5)	(3.3)
Rural Karakalpakstan	-1.97	-1.43	-1.49	-0.23
	(4.8)	(3.4)	(3.5)	(0.3)
Weight-for-height as a percentage of reference median (mean = 98.7, SD = 8.4)				
City Fergana	-1.93	-1.90	-1.66	-1.61
	(1.8)	(1.8)	(1.6)	(1.4)
City Karakalpakstan	0.54	-0.08	-0.02	-0.46
	(0.4)	(0.1)	(0.1)	(0.3)
Town	-1.70	-1.67	-1.54	-1.65
	(2.0)	(2.0)	(1.8)	(1.5)
Rural Fergana	-3.27	-3.30	-3.08	-1.89
	(4.2)	(4.1)	(3.8)	(1.5)
Rural Karakalpakstan	-1.54	-1.75	-1.42	-0.76
	(1.9)	(2.1)	(1.7)	(0.5)

Notes:

T-statistics are given in brackets; sample size is 1,298 children. The base for the location dummies is Tashkent city. The specification in column 2 includes 6 age dummies, dummies for low maternal education (failure to complete secondary school), a dummy for Slav head of household, and variables measuring the numbers of adults and children in the household. The specification in column 3 includes in addition a variable $Y/H^{0.5}$ where Y is the total household cash income in the last month (whether or not actually received) and H is the number of persons in the household. The specification in column 4 includes (in addition to variables in the previous specifications) dummies for running water and central drainage, plot ownership, ownership of cattle, sheep, fruit trees, vines and for receipt of cash income from sales of agricultural produce from the plot in the previous month.

Table 5: The Effect of Kindergarten Attendance on Nutritional Status

	Coefficient on Kindergarten Dummy	
	1. GLS	2. Fixed-Effects
Dependent Variable		
Height-for-age as % of reference median	-0.20 (t = 0.65)	-0.03 (t = 0.05)
Weight-for-height as % of reference median	1.19 (t = 2.01)	1.68 (t = 1.53)
sample size	1,298	765

Note:

The results in column 1 are obtained by GLS regression on the full sample of 1,298 children in an equation containing all the control variables listed in the notes to Table 3 as well as the dummy variable for kindergarten attendance. The results in column 2 are obtained by OLS on a transformed equation in which the dependent and independent variables are adjusted by subtracting their household-specific mean values and is estimated on the 765 multi-child households.

Table 6: Mean Anthropometric Status within Households by Receipt of Social Assistance from the Mahalla

	Height for Age as % of the reference median (mean of household minimum)		Weight for Height as % of the reference median (mean of household minimum)	
	with Social Assistance	without Social Assistance	with Social Assistance	without Social Assistance
Tashkent	96.64	98.04	95.56	98.60
	(t = 1.31)		(t = 1.55)	
Fergana	93.45	94.89	94.11	95.18
	(t = 2.45)		(t = 0.99)	
Karakalpakstan	94.24	95.13	95.90	96.39
	(t = 1.64)		(t = 0.47)	
All households	94.29	95.70	95.19	96.43
	(t = 3.62)		(t = 1.75)	

The results refer to the average values across households with and without Social Assistance of the minimum value within each household of height for age and weight for height among all measured children. The total number of households is 765 (159 in Tashkent, 289 in Fergana and 317 in Karakalpakstan). The t-test in brackets is of the hypothesis that the means are equal.

THE WORLD BANK/IFC/MIGA

OFFICE MEMORANDUM

FILE COPY

DATE: April 25, 1995

TO: Gregory K. Ingram, Administrator, Research Advisory Staff

FROM: Jeni Klugman, EC3HR

EXTENSION: 33270

SUBJECT: Research Proposal, "Nutritional Status and Household Welfare among Pre-School Children in Uzbekistan

1. Thank-you for your timely consideration and note of approval with respect to the above proposal.

2. The dissemination strategy that you suggest appears appropriate to reaching the "middle-ground" between Uzbek and Russian audiences and the academic community. An article will be written and submitted to the World Bank Research Observer to this end.

3. You noted the need to ensure similarly wide dissemination of the socio-economic data collected under the proposed household survey. There will be opportunity for the Bank (EC3HR) to ensure wider dissemination of the socio-economic data and subsequent analysis through such vehicles as a proposed poverty assessment for Uzbekistan (scheduled for FY97) that would be translated and discussed with the Government. There is also a forthcoming book on Household Welfare in Central Asia that I am co-editing with Professor Micklewright and others, which will include a chapter based on analysis of the socio-economic data collected in Uzbekistan.

cc. M. Selowsky, K. Krumm (ECAVP); Y. Huang (EC3DR); R. Liebenthal; C. Else (RAD)

REVIEWS

PROPOSAL

THE WORLD BANK/IFC/MIGA

OFFICE MEMORANDUM

DATE: March 9, 1995

TO: Gregory Ingram, RAD

FROM: Robert Liebenthal, EC3HR

EXTENSION: 33864

SUBJECT: Research Proposal: Nutritional Status and Household Welfare Among Pre-School Children in Uzbekistan.

1. Please find attached, for your approval, the above research proposal. We are requesting the Research Committee to provide funding of $31, 600.

2. If you have any questions about the proposal, please contact Jeni Klugman (33270).

cc. C. Else (RAD); Selowsky, Krumm (ECAVP); Klugman (EC3HR).

NUTRITIONAL STATUS AND HOUSEHOLD WELFARE AMONG PRE-SCHOOL CHILDREN IN UZBEKISTAN

Research Proposal
Summary

1. OBJECTIVES

The project will collect and analyze anthropometric data relating to pre-school children in Uzbekistan, the most populous of the Central Asian republics of the former Soviet Union (FSU) with almost 22 million inhabitants. These data will (i) allow analysis of the prevalence and correlates of malnutrition, about which little is known in Uzbekistan, and (ii) provide hard observational data on a measure of household deprivation. The proposed analysis will avoid the problems of measurement and interpretation of monetized measures of welfare that exist in economies in transition, and which are particularly acute in the rural economies of Central Asia.

2. RESEARCH ISSUES

A number of hypotheses will be tested. Among other things, analysis will test whether:

- nutritional status varies substantially among different regions of Uzbekistan. (Economic, demographic, geographic and other factors are such as to suggest that this is the case.)
- nutritional status is higher among rural households and especially in households engaged in substantial agricultural activity. (Such households have substantial non-monetized income in the form of agricultural produce consumed within the household.)
- nutritional status varies with type of child care available to the household - home versus kindergarten. (Kindergartens are often thought of as an important source of nutrition).

3. POLICY RELEVANCE

The research will contribute to evaluation of a range of policies relating to social protection during the economic transition and beyond in Central Asia. Evidence on the extent of malnutrition and its regional and socio-economic correlates will be of relevance to policy on health policy and programs. The data will help the evaluation of an important new targeted social assistance scheme on which the government of Uzbekistan is placing considerable emphasis and public resources. This scheme, administered by local committees, involves a detailed needs test but awards are discretionary. Evidence on variation in nutritional status with type of child care will contribute to the debate on the future of kindergarten provision in the republic including enterprise divestiture.

4. METHODOLOGY

The data will be collected as part of a household survey of 1,500 households being organized by a research team at the European University Institute (EUI), Florence. (The main survey is funded by other sources.) Field-work is planned for June 1995. The anthropometric module of the survey will be organized by a team from the Human Nutrition Unit, London School of Hygiene and Tropical Medicine (LSHTM), who already have extensive experience of anthropometry in Central Asia with an ongoing project in Kazakhstan. Attachment of the anthropometric module to the household survey means that the analysis of malnutrition will benefit from the rich array of socio-economic data in the main survey.

5. ORGANIZATION AND OUTPUT

The project will be managed in EC3HR by Jeni Klugman and will be undertaken in parallel with related projects managed by the same person. The first form of output will be a report suitable for dissemination within and outside the World Bank. (This will be translated into Russian and given to relevant counterparts in Uzbekistan.) The second form will be one or more academic papers. The Bank's research journals would be one possible publication outlet for these.

6. RESOURCE REQUIREMENTS

Support from the Research Committee of $31, 600 is requested.

NUTRITIONAL STATUS AND HOUSEHOLD WELFARE AMONG PRE-SCHOOL CHILDREN IN UZBEKISTAN

Research Proposal

1. Objectives

Children form a high proportion of the population of the Central Asian countries of the FSU. In Uzbekistan, the most populous of the Central Asian republics with almost 22 million inhabitants, about 40% of the population is aged under 12. Concern about the welfare of the population of Central Asian countries during the transition period and beyond is therefore in large measure a concern about child welfare.

Measurement by economists and other social scientists of child welfare typically focuses on the measurement of household poverty using monetized indicators of welfare such as household income and expenditure. The measurement of the incidence of poverty among households with children using such indicators (taking into account the well-known problems of equivalising for differences in household needs) then provides evidence on whether and to what extent poverty is a phenomenon concentrated on children. Design of social assistance schemes and other more pro-active measures to combat poverty can then take this information into account when targeting scarce public resources on the poor.

The proposed research adopts a different emphasis in the measurement of child welfare. The research will collect simple anthropometric measurements - height (stature) and weight - of pre-school children in Uzbekistan, that will be analyzed alongside the household's socio-economic characteristics. These data have two important attractions to any analysis of household and child welfare.

First, low height in relation to age, known as "stunting", and low weight in relation to height, known as "wasting", are important direct indicators of nutritional status. Stunting is an indicator of chronic malnutrition (a failure to grow) while wasting is an indicator of acute malnutrition. In both cases poor growth may have resulted from ill health as well as low or poor quality food intake. The nutritional status of children is a subject of direct interest if one is concerned about child welfare, and anthropometry is a simple and effective method of gaining information about it (e.g. United Nations, 1990). On a broader level, the nutritional status of children can be used as an indicator of household deprivation, while the prevalence of malnutrition in a region has been used as a measure of the region's development.

There has not been to date any systematic measurement of anthropometry in Uzbekistan. Recent reports from the Ministry of Health that 50% of children under the age of one suffer from stunting must be discounted. Stunting takes time to build up, i.e. a child has to fail to grow for some considerable period. It is not possible that such a high prevalence of stunting could be observed in children so young. Morse (1994) provides some concrete data based on a single remote district in the region of Karakalpakstan bordering the Aral Sea and finds 25%

of children aged less than 5 to be stunted and 12% wasted. However, these figures are unlikely to be representative of Uzbekistan as a whole, or even of Karakalpakstan.

Evidence from other FSU countries where anthropometric data have been collected (with World Bank involvement) using representative national samples do show evidence of both stunting and wasting. Data from the Russian Longitudinal Monitoring Study (RLMS) collected in the summer of 1993 show 14% of children of pre-school age to be stunted and 4% to be wasted. The Kyrgystan Multi-Purpose Poverty Study (KMPS) showed 7% of pre-school children to be wasted (Popkin and Martinchik, 1994). At present, these figures do not indicate a major problem of undernutrition, especially if they are compared to developing countries. However, national averages hide regional differences and differences among socio-economic groups. Wasting in Kyrgystan, for example, was found to be twice the national average in two out of seven oblasts. This confirms the evidence of worsening regional disparities within the Central Asian republics. Hence, periodic measurement of nutritional status is a useful adjunct to economic monitoring.

Second, since it provides hard observational data on easily interpretable interval scales, anthropometry avoids the problems of measurement of monetized measures of household welfare, such as income or expenditure. These problems can be acute in transition economies in which a substantial and growing amount of economic activity is not monetized, where monthly inflation is high and variable, and prices may vary substantially between regions.

Several examples of these problems may be given. Workers may be paid in-kind as well as in cash, and the value of this in-kind income is hard to assess. One apparently common feature of wage payment in Uzbekistan at present is payment in vouchers that can only be redeemed at certain local shops, rendering valuation in household budget surveys difficult. Given the predominately ruralnature of the country, many households in Uzbekistan have access to an agricultural plot an/d derive substantial amounts of income from the plot in the form of food produced and consumed within the household. The 1993 KMPS in neighboring Kyrgyzstan estimated the value of these plots output to exceed 20% of total household income.[1] Finally, there is no tradition of accurate price measurement in the Central Asian countries (although practices are beginning to improve under IMF advice and supervision) and the appropriate indices to adjust monetary welfare measures for regional price differentials do not yet exist in Uzbekistan.

These problems imply that considerable doubt must exist about the quality and interpretation of any monetized measure of household welfare based on households surveys in contemporary Central Asia. Even without these problems a profile of poverty - including urban/rural differences and regional variation - might not be robust to the choice of poverty

[1]However, there must be considerable doubt about the reliability of this estimate (and hence of the valuation at the level of the individual households in the sample) since the amounts of agricultural production and self-consumption were collected though recall over a long (12 month) period and the appropriate prices at which to value the amounts are open to debate (due to the high rates of inflation and the lack of market prices at the time of the survey for goods out of season).

indicator (Ravallion and Bidani, 1994). These considerations reinforce the value of anthropometric measurement; analysis of such data may modify the picture of household welfare obtained from monetized measures. For example, Popkin and Martinchik (1994, Table 6A) found that wasting among pre-school children in Kyrgyzstan did not decline monotonically with measured income (including the estimated value of self-consumption of agricultural production). Figures for wasting in Kyrgystan by region display quite a low correlation with regional figures for head-count ratios of poverty (on an expenditure basis) from the same survey data found by Falkingham and Ackland (1994).

In order to alleviate the drawbacks of monetary measures of household welfare in Uzbekistan, an important feature of the proposed research is that the anthropometric measurements will form part of a household survey of the sort traditionally used by social scientists to evaluate poverty. This survey will collect a range of both monetized and non-monetized data. Funding for the survey has already been secured (from the EU TACIS scheme, Save the Children Fund (UK), and a separate World Bank project on kindergarten divestiture in Central Asia) so that the additional research based on the anthropometric data will benefit from it at zero cost. The proposed research will be able to relate the anthropometric data to various socio-economic characteristics of households, so as to assess the household correlates of nutritional status of children.

The next section gives more details of the issues that will be addressed by the research.

2. Research Issues

The research will go well beyond the aim of quantifying the extent of malnutrition, although this will be an important first step. In particular, the research will go on to test a number of hypotheses including the following:

(i) Nutritional status (as indicated by anthropometry) varies substantially between different parts of Uzbekistan.

Uzbekistan is a large country (about the size of Spain) and economic, demographic, geographic and other factors are such as to suggest that there could be large differences in household welfare across the country. Evidence from official budget survey data[2] show large variations in average values of monetized measures of household welfare (Coudouel, Marnie and Micklewright, 1995). For example, mean per capita cash income varied by a factor of four. The research will investigate whether similarly large regional differences occur in nutritional status of children. To take an important example, it is often believed that the remote region of Karakalpakstan has a high incidence of poverty. The comparison of anthropometric

[2]The official budget survey suffers significant methodological problems, including, those of sample design. See Atkinson and Micklewright (1992).

measurements of children in Karakalpakstan with other regions will shed light on this issue.[3]

(ii) Nutritional status is higher in rural households and those households engaged in substantial amounts of agricultural activity.

Traditionally, poverty in the Central Asian republics during the Soviet period was seen as a problem that was particularly acute for rural households. This view was based on the apparent differences in incomes recorded in official budget survey data between the families of "worker/employees" and the families of collective farm workers. However, it is clear that even prior to the transition the available household data under-valued the incomes of collective farm households (Marnie and Micklewright, 1994). The period since the break-up of the Union in 1991 has seen aggregate output and real wages fall substantially in Uzbekistan, while the prices of basic food commodities have been liberalized recently. Anecdotal evidence within Uzbekistan, and the pattern found in other former socialist countries undergoing economic transition (Rose, 1993), suggests that part-time production of agricultural produce to be consumed within the home has risen in importance and value. Moreover, this is a form of income that is of importance for many households other than those classified as collective farm (or former state farm) households. Access to agricultural plots is very high throughout rural areas. The research will therefore test the hypothesis that nutritional status is higher in rural areas, despite seemingly lower cash incomes, and especially among households intensively involved in agriculture. In addition, multivariate analysis will test for differences controlling for cash incomes.

(iii) The nutritional status of pre-school children varies with the type of child care.

A variety of types of child care exist in Uzbekistan. Some stay at home with their mothers or other family members. Nationally, about 40% of pre-school age children are in formal kindergarten facilities provided by enterprises and municipalities. (The relative importance of each method is changing and the impact of current shifts will be investigated as part of other Bank-sponsored research, as described below.) Enterprise kindergartens formed a substantial in-kind work benefit as a result of subsidies from enterprises and charges in municipal kindergartens have also been below cost. Kindergartens traditionally provided substantial amounts of food to children although anecdotal evidence suggests that quality and quantity of food has declined in the last 2-3 years. The research will test the hypothesis that children attending formal kindergartens have a higher nutritional status *ceteris paribus* on account of the guaranteed food intake that these provide. This analysis will enrich the study of kindergarten use that is being undertaken in a separate World Bank contract (see section 5).

[3] The research will take a representative sample of households in the included regions so it will also be able to assess whether the results for Muynak district in Karakalpakstan found by Morse, 1994, hold for the region as a whole.

3. Relevance for Policy

Analysis of the foregoing issues will have relevance for several important aspects of government policy in Uzbekistan. The following are examples.

First, measurement of nutritional status of children will provide the Ministry of Health with reliable information on the extent of malnutrition, its correlates with socio-economic characteristics, and its variation across the regions covered by the survey. (Section 1 noted that the Ministry's current estimate of the extent of stunting among very young children in Uzbekistan is quite unrealistic.) The identification of particular groups at risk will help the development of health policy and programs. The "promotion of rational nutrition" is a foremost government policy objective, and prominent in the Ministry of Health's conception of a basic package of health care. The research will help to inform policy makers about the types of interventions that are appropriate, given reliable information about the extent of malnutrition and its correlates.

Second, nutritional status as an indicator of household deprivation will inform the evaluation of the focus and financing of local social assistance. In September 1994 the government of Uzbekistan introduced an important new targeted cash social assistance scheme to be administered by local committees, or "Mahallah". (This coincided with the removal of some substantial food price subsidies.) Families "with many children" are the first mentioned in the list of eligible family types in the guidelines given to the Mahallah for the scheme's administration. A budgetary allocation equivalent to about 1% of GDP was made and this scheme is now the sole program in Uzbekistan providing needs-tested assistance to households. Nationally, 1 in every 10 households received assistance in the last quarter of 1994.

To date there has been no evaluation of the scheme. The household survey of which the anthropometric module will form part contains a detailed block of questions on application to and assistance received from the scheme, with a view to assessing Type I and Type II errors in targeting. The anthropometric data will provide an important extra dimension to the assessment of targeting. Are families with malnourished children those that are receiving support from the Mahallah scheme? If not, then this would suggest the need for further development of the income and asset tests that are applied and for measures for encouraging take-up. (One possibility is that anthropometric measurement could even be included as one of the pieces of data taken into account in deciding on an application for benefit.) Regional allocation of funds for the Mahallah scheme is currently on the basis of a 1989 survey of families receiving an income-tested benefit. The research will help to evaluate the appropriateness of this budget allocation process - as well as other aspects of regional expenditure and health policy.

Third, evidence on nutritional status of pre-school children at home compared to those in kindergartens (controlling for socio-economic characteristics of the household) should inform the debate on the future of kindergarten provision in Uzbekistan, and their role in maintaining adequate nutritional status. If children in kindergartens are found, *ceteris paribus*, to have higher nutritional status than children looked after at home then state financing and provision of

kindergartens may be seen to provide direct welfare benefits to children beyond the benefits to early childhood development and allowing mothers to work. Conversely, if no differences are found in nutritional status then the debate on kindergarten provision can center more on their relevance for female labor supply alone. At the same time, the research would investigate the extent to which children from poor households have access to formal childcare, and the impact that such access has on their nutritional status. Either way, there will be implications for funding, cost recovery, and the extent to which the state should pick-up the provision that enterprises may wish to divest themselves of.

4. Methodology

The methodology to be employed in the research will take the following form:

i) Anthropometric data will be collected on pre-school children only, that is children aged under seven years. Genetic differences in growth potential among children of this age are small and they are the focus of many studies of nutrition. Restriction of measurement to this age group reduces survey costs but at little cost to the analytical value of the research. The data to be collected are height (stature) and weight, the simplest measures to obtain (and thus to train a survey team to collect), the ones whose dependability has been most widely studied, and those that are most commonly used.

ii) The module of anthropometric data will form part of a household survey of 1,500 households being organized by a research team led by John Micklewright, European University Institute (EUI). Field-work is planned for June 1995. The survey will be the first household survey in Uzbekistan to be carried out using accepted Western methods of sample design and survey method. (A three-stage sample design in each included region is being used and separate interviews will be conducted with both the head of household and each adult.) The survey will be conducted by the Expert Center, Tashkent, who have built up a reputation in the last 2-3 years for survey work, having received considerable advice and training in both sampling theory and survey methods from Michael Swafford, Paragon Research International, and Leslie Kish, University of Michigan.

The anthropometric module will be organized by a team led by Suraiya Ismail, Human Nutrition Unit, London School of Hygiene and Tropical Medicine (LSHTM). The LSHTM team has considerable experience of nutritional measurement (including anthropometry) in Central Asia through an on-going study of anemia in the Kyzl-Orda region of Kazakhstan (an oblast bordering Uzbekistan). Emphasis will be placed on accurate measurement of anthropometry (an issue of considerable importance - see Kostermans, 1994). The LSHTM group will provide direct training in anthropometric measurement (based on their training programs used in Kazakhstan) to 2-person measuring teams that will collect the anthropometric data. These measuring teams will be distinct from the interviewers collecting the main survey data. The EUI and LSHTM research groups will jointly analyse the data to test the hypotheses outlined above,

drawing on their respective skills in analysis of socio-economic data and anthropometric data.

iii) The survey will be carried out in three of the fourteen regions (oblasts) in Uzbekistan, with data from 500 households collected in each region. (Sample design in each region will produce a self-weighted representative sample of households.) These regions are Karakalpakstan, Fergana, and Tashkent city, which together represent nearly 30% of Uzbekistan's population. These regions provide examples of the three main types found in Uzbekistan. Karakalpakstan is a remote region in the North-West of the country bordering the Aral Sea. It contains the lower reaches and delta of the Amu Darya river, the most important river in Central Asia. There is salination and other environmental degradation of the region associated with the retreat of the Aral Sea, over-irrigation, and excessive use of agro-chemicals in higher reaches of the Amu-Dayra. Fergana is the largest of the three regions of Uzbekistan in the important "Fergana valley" (more accurately, "basin") in the east of the country, parts of which are also in Kyrgystan and Tajikistan. The Fergana valley is the agricultural heartland of the core Central Asian republics. Tashkent city (as distinct from Tashkent oblast), the nation's capital, has over 2 million inhabitants and was the fourth largest city in the FSU. The Russian ethnic minority (about 6% of the total population of Uzbekistan) is heavily concentrated in Tashkent.

Official budget survey data on mean per capita (money) household incomes suggest Karakalpakstan to be one of the two poorest regions, Fergana (and the other regions in the Fergana valley) to be close to the national average, and Tashkent city to be the richest region at twice the national average. The restriction of the new EUI survey to three regions obviously entails that the sample collected will not be nationally representative in a formal sense but the large sample sizes will allow us to make stronger statements on the regions included. This should allow, for example, a much clearer answer as to whether nutritional status in Karakalpakstan, a region of considerable interest about which concern is often expressed by the Government and donors, is notably different.

iv) Analysis of the anthropometric data will start by using standard techniques to classify stunting and wasting. These are height and weight as percentage of the median, and the number of standard deviations that these differ from the mean, or Z score. Following usual practice as laid down in WHO guidelines, median, mean, and standard deviation, in these calculations refer to a reference population of healthy US children. The incidence of stunting and wasting by region and household characteristics will then be analyzed. The hypotheses outlined above (and other hypotheses) will be tested with both bivariate and multivariate analysis. One technique for the latter will be the use of binary probit or logit models, treating stunting and wasting as discrete phenomena. An alternative will be to preserve the continuous nature of the data and to use regression techniques to analyze height and weight directly (or transformed values in relation to the reference population). Multivariate analysis will be able to take into account a wide

range of socio-economic indicators of the household.

5. Organization, Relationship to other Activities and Output

The research project will be managed in EC3HR by Jeni Klugman. The work will be undertaken in parallel with Impact on Women of Kindergarten Divestiture in Central Asia (funded by the ECA WID fund), also managed by Jeni Klugman. This latter project is funding collection of data (and its analysis) through a kindergarten module attached to the same survey of Uzbekistan as the anthropometric module in the proposed research.

Output will take two main forms. First, a report will be written suitable for dissemination within and outside the World Bank. This report will analyze the research issues outlined in Section 2 and relate these to the policy issues outlined in Section 3. Besides reporting on the results of the study in Uzbekistan, the report will try to draw out the relevance of the work for other Central Asian countries. It will be translated into Russian and given to relevant counterparts in Uzbekistan, including the Ministry of Health and the Ministry of Labor (which is responsible in Uzbekistan for social protection policy). The report would be presented by one of the leading researchers at a seminar at the World Bank in Spring 1996.

Second, the work will also be written up in the form of one or more academic papers, which will be circulated prior to publication as EUI and LSHTM Working Papers and presented at academic seminars. A natural possibility would be one paper aimed principally at nutrition specialists and one aimed principally at economists and other social scientists. The World Bank's Economic Review or Research Observer would be obvious possible publication outlets.

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Correspondents / Participants

Subject / Title
Resource Requirements for research proposal

Exception(s)
Personal Information

Additional Comments

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Withdrawn by	Date
Sherrine M. Thompson	June 20, 2023

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