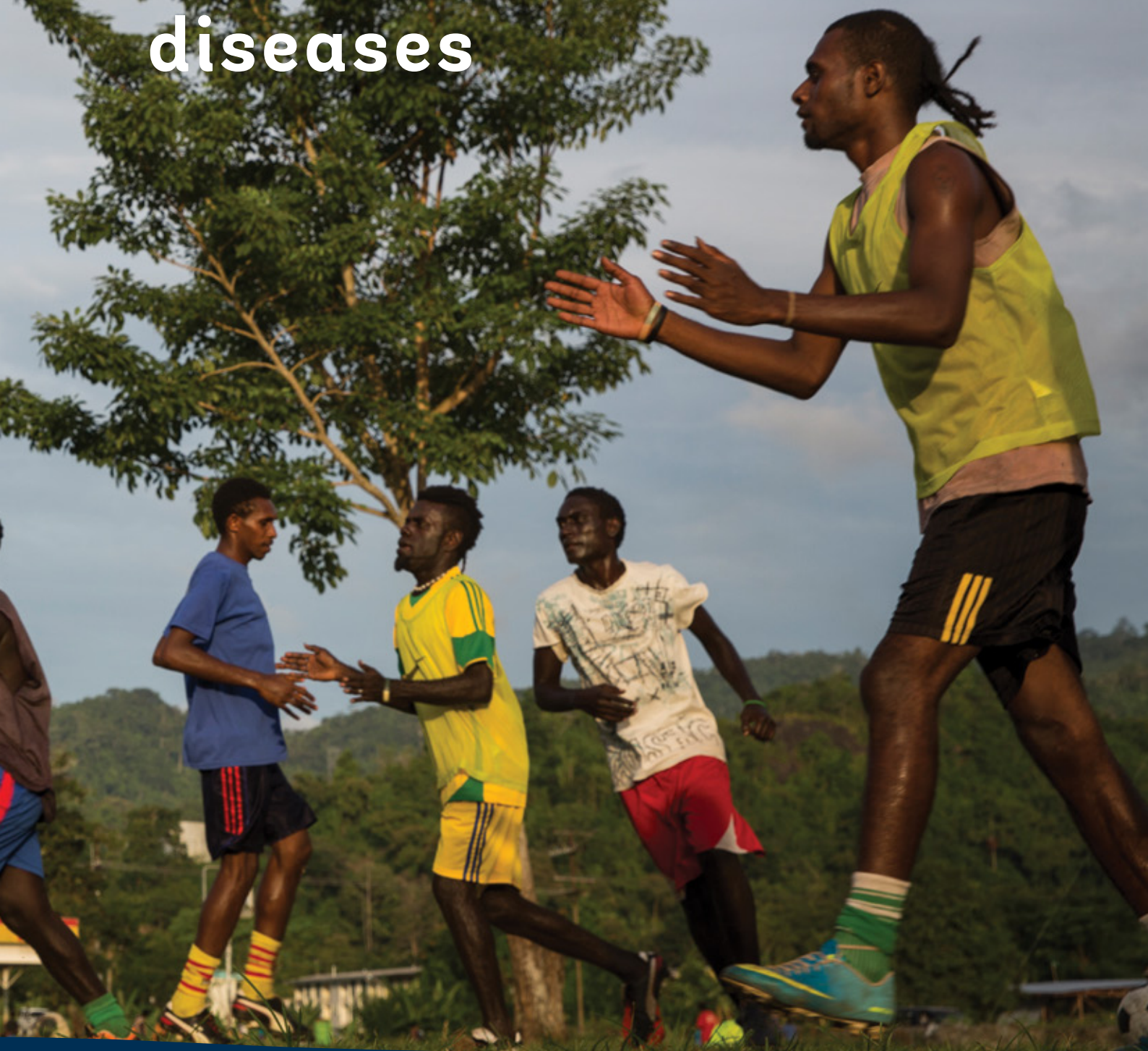


| Health & non-communicable diseases



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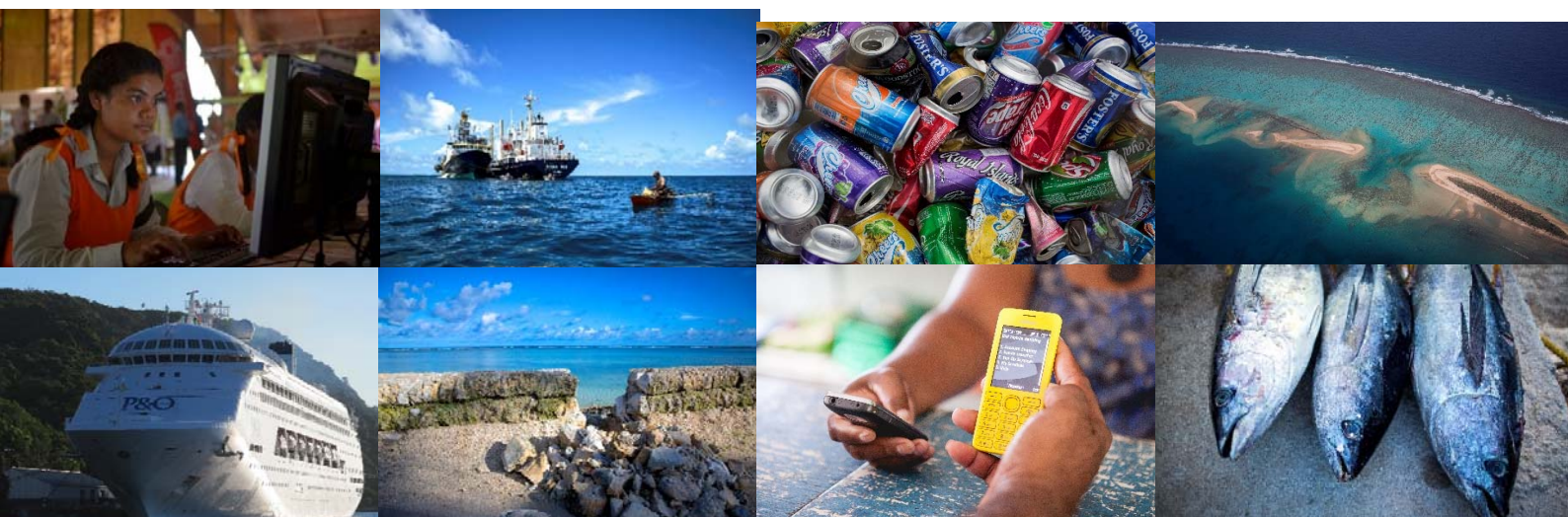
Pacific Island countries face unique development challenges. They are far away from major markets, often with small populations spread across many islands and vast distances, and are at the forefront of climate change and its impacts. Because of this, much research has focused on the challenges and constraints faced by Pacific Island countries, and finding ways to respond to these.

This paper is one part of the Pacific Possible series, which takes a positive focus, looking at genuinely transformative opportunities that exist for Pacific Island countries over the next 25 years and identifies the region's biggest challenges that require urgent action.

Realizing these opportunities will often require collaboration not only between Pacific Island Governments, but also with neighbouring countries on the Pacific Rim. The findings presented in Pacific Possible will provide governments and policy-makers with specific insights into what each area could mean for the economy, for employment, for government income and spending.

To learn more, visit www.worldbank.org/PacificPossible, or join the conversation online with the hashtag #PacificPossible.





June 2016

BACKGROUND PAPER

Pacific Possible:

Health & Non-Communicable Diseases

Xiaohui Hou, Ian Anderson, Ethan-John Burton-Mckenzie



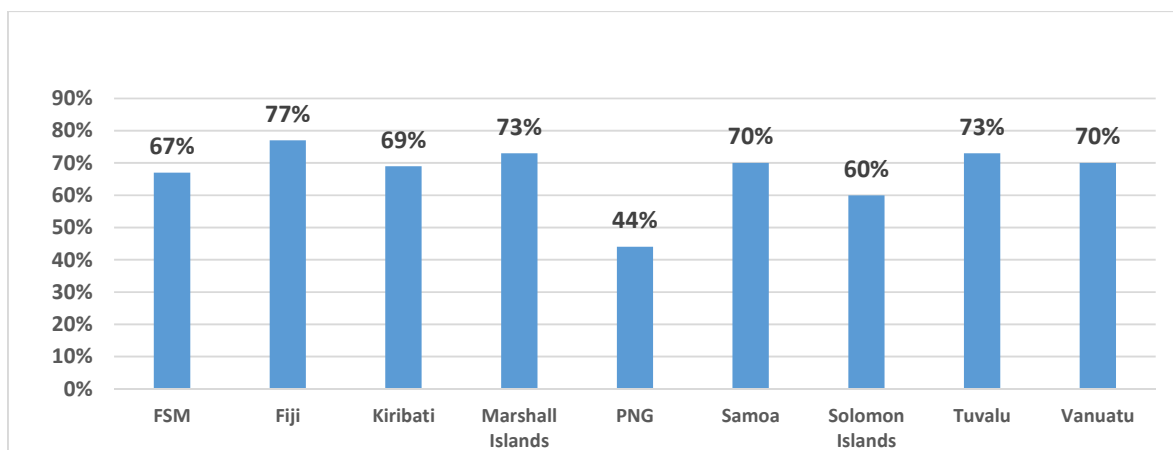
Context: Health as a Development Issue

Health has direct and indirect effects on economic growth. Good health has intrinsic value, but also interacts in various ways with the pace and pattern of social and economic development (Horton & Lo, 2013; Sen, 1999; Spence & Lewis, 2009; WHO, 2001; World Bank, 1993). At the macroeconomic level, good health increases worker productivity and reduces absenteeism; increases educational learning and the returns from investing in education; and reduces or postpones the use of medical resources freeing up financial space for other purposes (D. Bloom & Williamson, 1998; McCarthy, Wolf, & Wu, 1999; Ranis, Stewart, & Ramirez, 2000). At the household level, good health – and good health systems – helps individuals maximize their human potential; avoid financial distress and impoverishment; and break the inter-generational cycle of maternal ill health, stunting and impaired productivity of children, and consequential poverty (Barker, 1990; Bhutta, 2013; Black et al., 2008). The world has seen rapid and sustained improvements in many health outcomes. For example, global life expectancy for both sexes increased from around 65 years in 1990 to 71 years in 2013. However, many challenges remain. Currently, noncommunicable diseases (NCDs) – especially cardiovascular diseases, cancer, diabetes and chronic respiratory disease (WRPO, 2012)(WRPO, 2012) kill around 38 million people each year. Almost three-quarters of NCD deaths occur in low- and middle-income countries (WHO, 2014a).

The NCD Challenges in the Pacific

Pacific Island countries (PICs) face a particular challenge with respect to noncommunicable diseases (NCDs). The latest *Global Burden of Disease 2013* study, covering 188 countries, showed the rising importance of NCDs as a cause of global death and disability (GBD 2013 Mortality and Causes of Death Collaborators, 2013). NCDs are now the leading cause of death in most countries in the Pacific, ranging from an estimated 60 percent of deaths in Solomon Islands to 77 percent of deaths in Fiji (figure 1) (WHO, 2014a). NCDs are also an important driver of *premature* (< age 70 years) deaths in most of the Pacific, with rates measurably higher than lower-middle-income global averages. Over half (54 percent) of all male deaths and nearly half (48 percent) of all female deaths were premature in Nauru (WHO, 2011b).

Figure 1 Estimated Percentage of Total Deaths Caused by NCDs



Source: WHO.

Diabetes is particularly prevalent in the Pacific. As shown in table 1, the Pacific contains seven of the top ten diabetes-prevalent countries in the world.

Table 1 Prevalence Rates of Diabetes: Top Ten Countries in the World

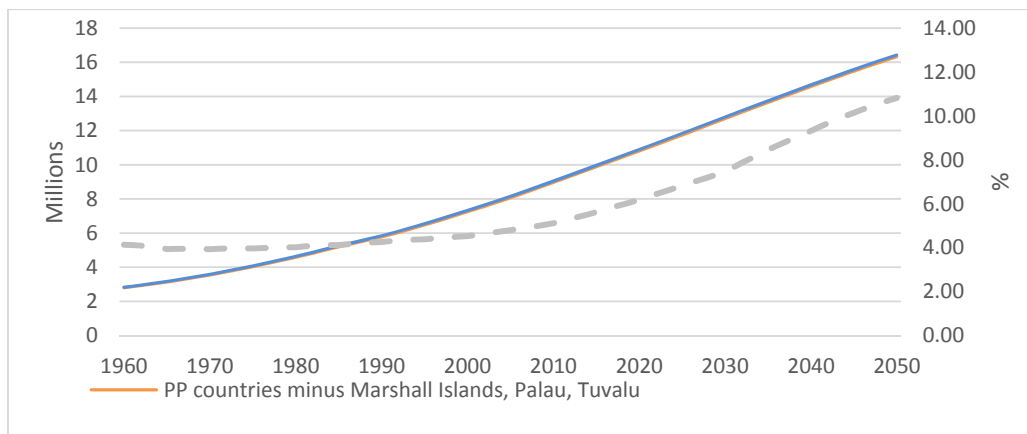
Ranking	Country	Prevalence of diabetes, as percentage of 20-79 year olds, in 2015 (age adjusted)
1	Tokelau	30
2	Nauru	24.1
3	Mauritius	22.3
4	Cook Islands	21.5
5	Marshall Islands	21.3
6	Palau	20.9
7	Saudia Arabia	20
7	Kuwait	20
7	Qatar	20
10	New Caledonia	19.6

Source: IDF Diabetes Atlas 7th Edition (International Diabetes Federation, 2015).

The percent of people affected by NCDs will rise substantially in the Pacific in the coming decades. This projected increase is driven by at least two forces. The first is the interaction between two major demographic trends, as illustrated in figure 2. PICs have high rates of population growth, which adds to public health needs but prevents a potential “demographic dividend” that could stimulate economic growth. Most Pacific countries have relatively high total fertility rates and low contraceptive prevalence rates that are more akin to the global average for least developed countries. In figure 2, the absolute population growth is largely driven by Papua New Guinea, but the trends are similar for most Pacific countries. In addition, the share of those aged 60 and older

has begun to increase and is expected to grow very rapidly in the coming years. Since NCDs disproportionately affect this age group, the incidence of these diseases can be expected to accelerate in the future.

Figure 2 Population Growth and Aging in the Pacific Island Countries

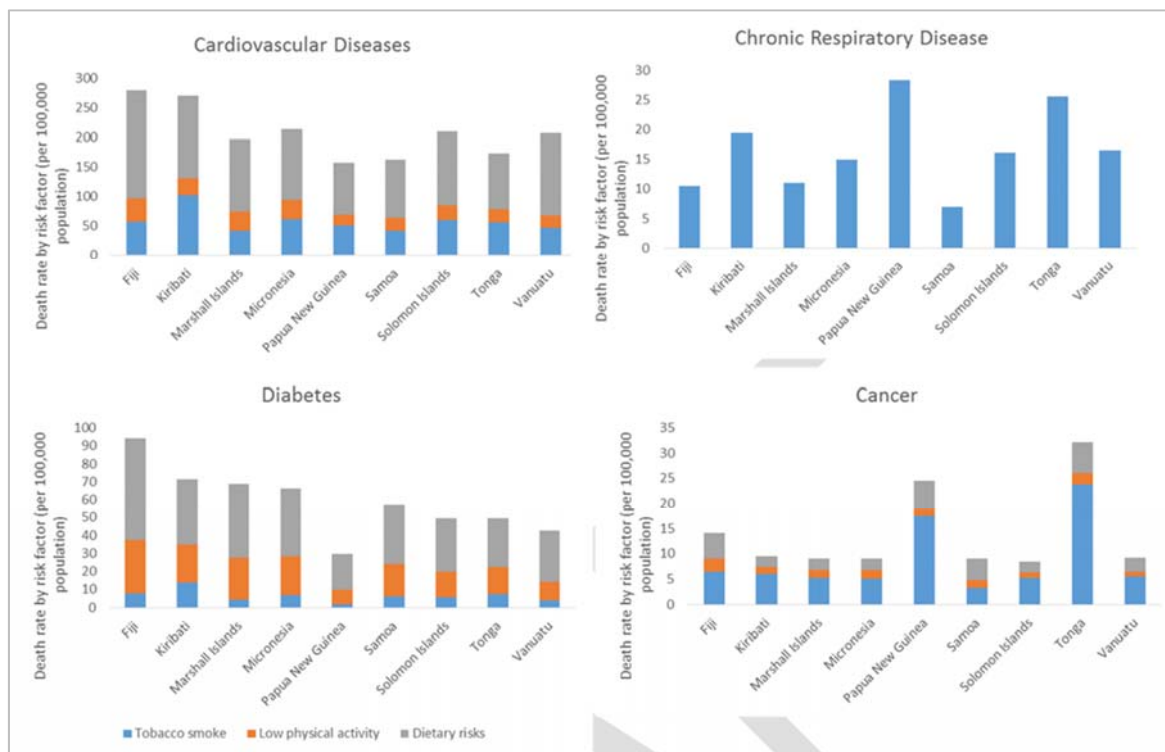


Source: WDI based on (1) United Nations Population Division. World Population Prospects, (2) United Nations Statistical Division. Population and Vital Statistics Report (various years), (3) Census reports and other statistical publications from national statistical offices, (4) Eurostat: Demographic Statistics, (5) Secretariat of the Pacific Community: Statistics and Demography Programme, and (6) U.S. Census Bureau: International Database.

The second force is the high level of NCD risk factors prevalent in the Pacific. Behavioral risk factors, including tobacco use, physical activity, and unhealthy diet, are responsible for most of deaths due to NCDs. Figure 3 presents the NCDs death rates attributable to behavioral risk factors of individuals for nine countries. Tuvalu and Palau were excluded due to lack of available data. The results were aggregated across both genders and all ages.¹ Dietary risk (e.g. diet high in sweetened beverages, diet high in trans-fat, diet high in sodium etc.) is the greatest risk factor for cardiovascular diseases induced deaths in the Pacific. Dietary risk factors also constitute the highest behavioral risk factors for death due to diabetes. Low physical activity imposes significant risk of death caused by cardiovascular diseases, diabetes, and cancer.

Figure 3 NCD Mortality Rates Attributable to Behavioral Risk Factors

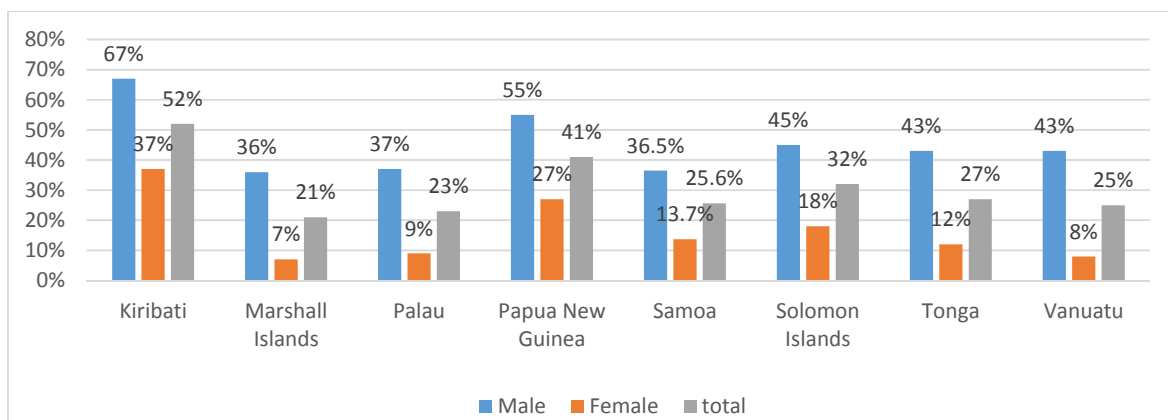
¹ These risk factors are not mutually exclusive such that an NCD death may be attributable to multiple risk factors.



Source: Institute for Health Metrics and Evaluation (IHME).

Tobacco use is the only risk factor common to all four main NCDs and exacerbates virtually all NCDs. Tobacco use is the most significant behavioral risk factor of chronic respiratory disease (CRD) and cancer (figure 4). WHO notes that “tobacco is the leading behavioral risk factor causing substantially large number of potentially preventable deaths worldwide...one death every six seconds” (WHO, 2012). Tobacco smokers lose at least one decade of life expectancy compared to those who never smoked (Jha et al., 2013). Prevalence of tobacco consumption in the Pacific is much higher than the global average of 21 percent (figure 4). In 2012, adult males in Kiribati and PNG had the 3rd and 5th highest rates of smoking in the world with prevalence rates of 67 percent and 55 percent respectively (Ng et al., 2014). Tobacco consumption among males in Tonga, Solomon Islands, and Vanuatu is also quite high; 43 percent, 45 percent, and 43 percent respectively.

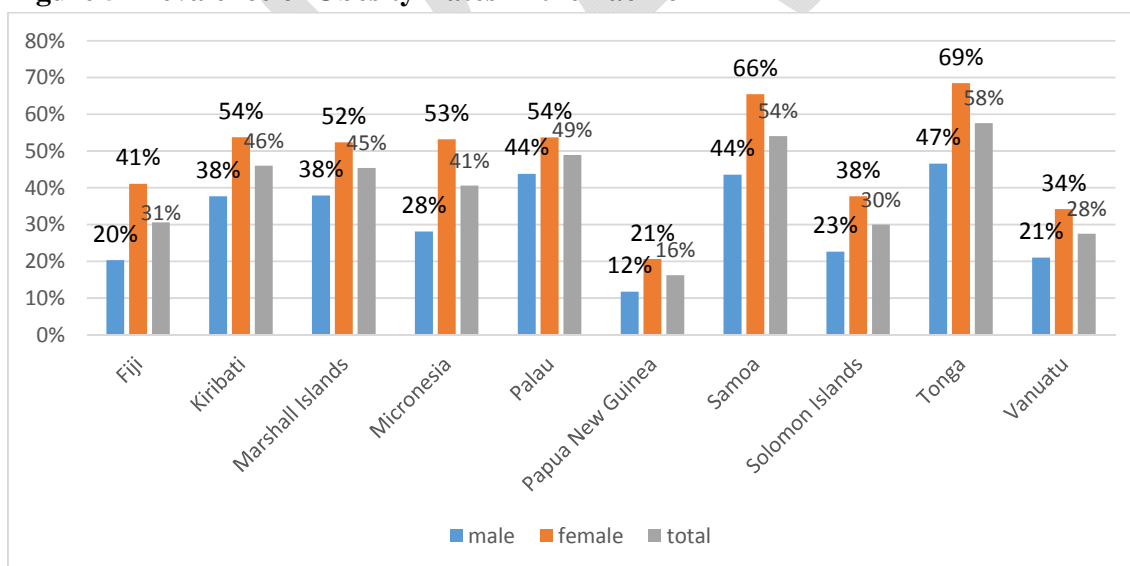
Figure 4 Prevalence of Tobacco Consumption in the Pacific



Source: World Health Organization (WHO), Noncommunicable Diseases Country Profiles 2014.

The behavior changes lead to key metabolic/physiological changes. One key metabolic risk factor is obesity or overweight status. **The Pacific has high overweight and obesity levels.** The top seven most obese countries in the world are in the Pacific. As seen in figure 5 below, over one-fourth of the adult population in most PICs is clinically obese (Body Mass Index equal to or greater than 30). Tonga and Samoa have the highest obesity rates (58 percent and 54 percent, respectively). This is much higher than the 13 percent global average. School age obesity and overweight percentages are also high in many countries (Anderson, 2013a).

Figure 5 Prevalence of Obesity Rates in the Pacific



Source: World Health Organization (WHO), Noncommunicable Diseases Country Profiles 2014.

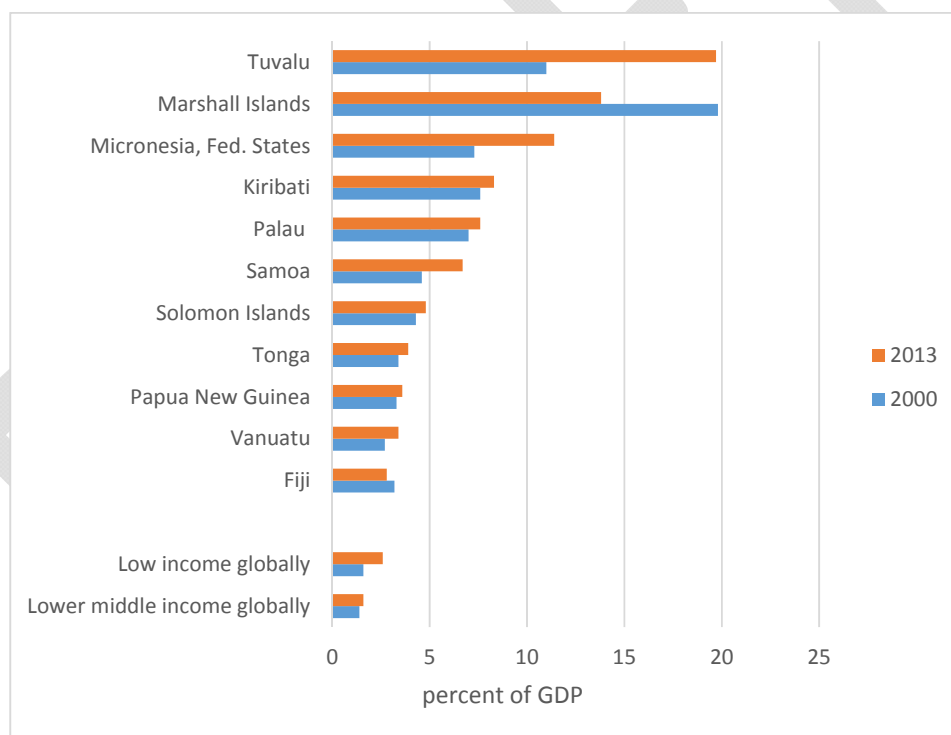
Other trends and risk factors also point to a substantial worsening of the situation. More than 70 percent of women have insufficient physical activity in FSM and Marshall Islands; and over 30 percent of adult men and women in Vanuatu suffer hypertension (Kessaram et al., 2015). While

rates of physical inactivity and alcohol consumption have decreased in both Samoa and Tonga over the last ten years, rates of obesity have barely changed in Tonga and have increased in Samoa (WHO, 2014a).

The Financing Challenge: NCDs Place Increasing Pressure on Government Budgets

PICs also face a significant health financing challenge that affects development (Anderson, 2013a, 2013b, 2013c). Public expenditure on health including external grants, is already much larger as a percentage of GDP in the Pacific than lower-middle-income countries globally (figure 6). Tuvalu, where public expenditure on health was 19.7 percent of GDP in 2013, has a ratio that is more than six times the global average for lower-middle-income countries. Nine countries in the Pacific have a larger share of public expenditure allocated to health as a percentage of GDP than the global average for upper-middle-income countries.

Figure 6 Public Health Expenditure as % GDP, 2000 and 2013



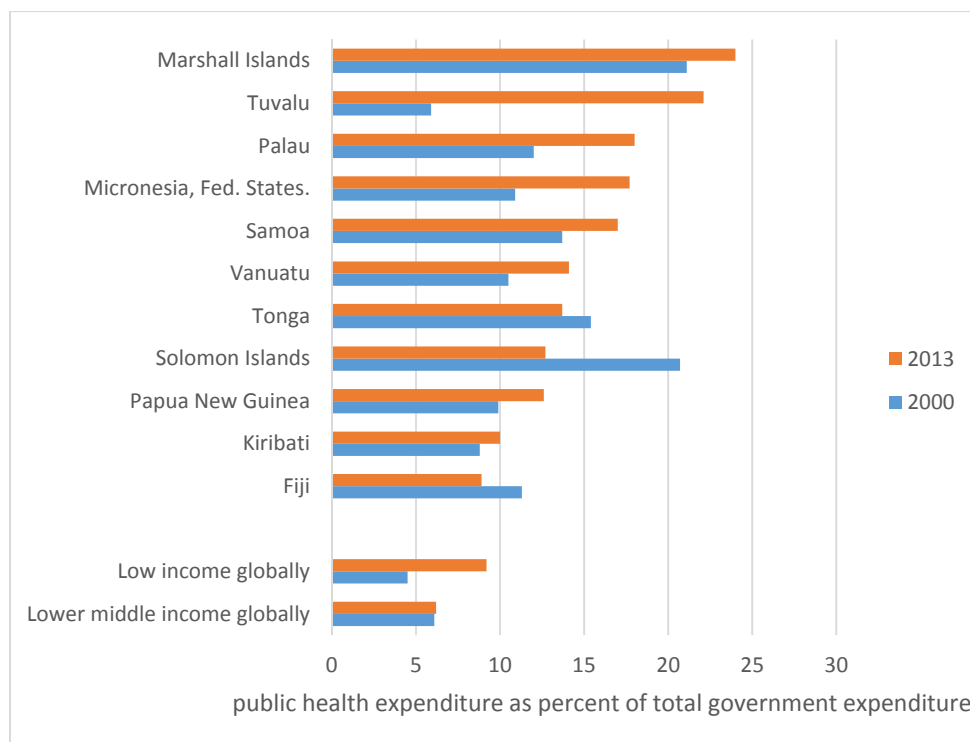
Source: WDI.

The share of public health expenditure is growing for most countries in the Pacific, raising questions about long-term financial sustainability. Figure 6 shows that nine of the 11 Pacific Island countries increased their share of public expenditure on health as a percentage of GDP between 2000 and 2013 (latest year available). This pattern is consistent with the global trend in which most countries increase public health expenditure as their economies and financial resources

grow. However, the Pacific is presented with the challenge of sustaining increased public health expenditure in the face of historically low rates of economic growth; low rates of government tax revenue as a percentage of GDP; and high vulnerability to external economic shocks and natural disasters. All of this raises the question as to whether the expansion of public health expenditure as a share of the economy is financially sustainable.

Health expenditure is already absorbing a significant – and growing – share of government expenditure. Thus, the financial and political sustainability of continuing increasing public expenditure in health become very important. Figure 7 illustrates the public health expenditure as a percentage of total government expenditure. To put this chart in perspective, it is worth noting that only nine of 61 countries in Sub-Saharan Africa with high health burdens allocate 15 percent of government expenditure to the health sector, a goal set as part of the Abuja Declaration in 2001. Four countries in the Pacific have exceeded that percentage, and all countries in the Pacific exceed the global public health expenditure average of 6.6 percent for lower-middle-income countries. Figure 7 shows that eight of the 11 countries, for which comparable data is available, have seen an increase in the share of government health expenditure since 2010. Again, this raises questions about the long-term financial sustainability of government health expenditure when PICs face modest or volatile economic growth and limited capacity to generate tax revenue due to relatively small private sectors. There are also important questions about the overall effectiveness, efficiency, equity, and quality of existing service expenditure (Anderson, 2013a, 2013b, 2013c; Anderson, Ivatts, Somanathan, & Rolfe, 2014).

Figure 7 Public Health Expenditure as a Percentage of Total Government Expenditure, 2000 and 2013



Source: WDI.

NCDs are a major driver of overseas medical referrals: a significant and often fast-growing component of government health expenditure that benefits a small fraction of the population.

PICs, especially those with small populations, understandably do not have the facilities and specialized personnel to treat more complicated cases of cancer, heart disease, diabetes or other diseases. Several countries therefore support overseas referrals to Australia, Fiji, New Zealand, India or elsewhere to receive specialized medical care. The government usually pays for the travel, as well as hospital and treatment costs (which can be for an extended period) of the patient and, in some instances, accompanying family members. The public policy and public financing challenge is to ensure such schemes are cost-effective compared to alternative use of the finances. The effective management of these programs is difficult, especially for smaller island countries. Recent research (details available on request) found that over one-third of the government health budget can be allocated to overseas referrals for the benefit of around one percent of the population. An earlier study by the Ministry of Health in Samoa noted that the overseas treatment program absorbed 15 percent of total public health expenditure in 2009/10, to the private benefit of less than 0.1 percent of the nation's population. The overseas treatment program absorbed 11 percent of total public health funding in 2008/09, and this had grown to 15 percent by 2009/10.

Diabetes places particular health burdens on individuals and households, and financial burdens on PIC governments. Diabetes is usually a life-long disease and can have disabling complications including blindness and amputations. Diabetes has particular financial consequences for PICs because drug treatment is usually required for the duration of the patient's

life. For example, recent analysis (Anderson et al., 2013) found that one insulin-dependent patient in Vanuatu requires the equivalent drug resource allocation of 76.4 other citizens, on average, in that country. Only 1.31 percent of the total population could be treated with insulin for diabetes, or 5.3 percent treated with the full regimen of anti-hypertensive drugs, before the total government drug budget in Vanuatu was fully spent. In brief, government funding for diabetes-related insulin was simply unaffordable and unsustainable. Diabetes can also lead to kidney damage that requires dialysis. While dialysis clinics in the Pacific are generally less expensive than overseas referrals, dialysis raises some fundamental questions about the affordability and financial sustainability of dialysis treatment in the Pacific context (see Box 1).

Box 1 The National Kidney Foundation (NKF) of Samoa

There are several positive aspects to the NKF of Samoa. NKF has a clear mission statement: “To actively pursue the reduction of the incidence of kidney failure and kidney related diseases, with sustainability in the provision of quality holistic care for patients already with end stage renal failure.” Access to hemodialysis (“dialysis”) for kidney failure has been increasing, from 89 patients in 2012/13 to 116 in 2014/15. A total of 188 dialysis therapy sessions were given to 54 “holiday patients”, which NKF believes “will continue to rise as more overseas Samoans are confident with the services offered.” NKF screened 874 people for kidney disease as part of its outreach program, and the total number of people on the Pre Dialysis Register is 745 as of June 30, 2015. NKF has been able to attract in-kind overseas specialist assistance valued at around ST\$500,000 (US\$192,000) annually.

However, there are also worrying trends in terms of overall effectiveness, cost-effectiveness, equity and “opportunity cost”, and the financial sustainability of NKF operations. The NKF’s latest annual report acknowledged that the mortality or death rate in the NKF dialysis patients “has been high”: 29 out of 116 patients (25 percent) died in the last fiscal year. Cost effectiveness is questionable: total NKF expenditure through June 30, 2015 was ST\$6.5 million. The average patient treatment cost is ST\$56,312 (US\$21,708). This is more than five times the GDP per capita of Samoa. Average dialysis expenditure per patient of US\$21,708 is also more than 100 times the average government expenditure on health per capita in Samoa of US\$214 in 2012 (WHO, 2014b). In other words, one dialysis patient at NKF absorbs, on average, the equivalent government health allocation of more than 100 other Samoan citizens. This raises questions of equity and “opportunity cost” as other, higher impact interventions could be provided for the amount of resources currently allocated to dialysis patients. It is difficult to determine the gender and socio-economic profile of the 116 patients or whether there is equitable access to dialysis treatment from public sources.

Finally, and importantly, the overall affordability and financial sustainability of the dialysis

program is questionable. The long-term financial sustainability of NKF operations is also a challenge bearing in mind that the Samoan government provides more than 95 percent of NKF's overall income, and patient fees contribute less than three percent. Future long-term affordability and sustainability of NKF operations is a particular challenge when more than two-thirds of patients at the NKF currently have diabetes, and the “feeder pool” is so large.

Source: National Kidney Foundation of Samoa Annual Report 2013/14 and 2014/15 (National Kidney Foundation of Samoa, 2015).

Long-term Macroeconomic Impacts of NCDs

The global evidence increasingly shows that NCDs result in long-term macroeconomic impacts on labor supply, capital accumulation, and GDP growth (Abegunde, Mathers, Adam, Ortegon, & Strong, 2007; Abegunde & Stanciole, 2006; Daar et al., 2007; Mayer-Foulkes, 2011; Nikolic, Stanciole, & Zaydman, 2011; Suhrcke & Urban, 2010). NCDs directly affect the *quantity* of the labor force through premature death of workers, or disability as the result of stroke or diabetic-related blindness and amputation. NCDs also affect the *quality* of the labor force through a variety of channels including absenteeism, co-morbidity including mental health issues, and disability. Premature death and disability caused by NCDs can also have indirect and longer-term effects as well. If young children are taken out of school to look after a relative with diabetic blindness then the possibility for the next generation to improve their own living standards is compromised. There are particularly adverse long-term social effects if young girls are taken out of school to look after sick relatives (Hill & King, 1995). NCDs affect the savings potential and capital accumulation of individuals due to direct out-of-pocket spending, which could otherwise be invested in productive assets for households. This is a particular problem in Asia where out-of-pocket expenditures are high, and can lead to impoverishment. Out-of-pocket expenditure is much less of a problem in the Pacific where government health expenditure absorbs most of the burden. Pacific Island governments are increasingly aware that rapidly rising public expenditure on NCDs has a high opportunity cost in terms of resources that could have been allocated elsewhere, both health and non-health investment, such as rural roads and electricity generation.

There is only limited published research on the impact of NCDs on Pacific economies, with most research focusing on the impact on government health budgets (Anderson, 2013a; World Bank, 2014). There is little hard data, and virtually no peer reviewed literature, on the broader economic impacts including the effects of premature death, absenteeism, and disability on workforce participation, or savings and investment.

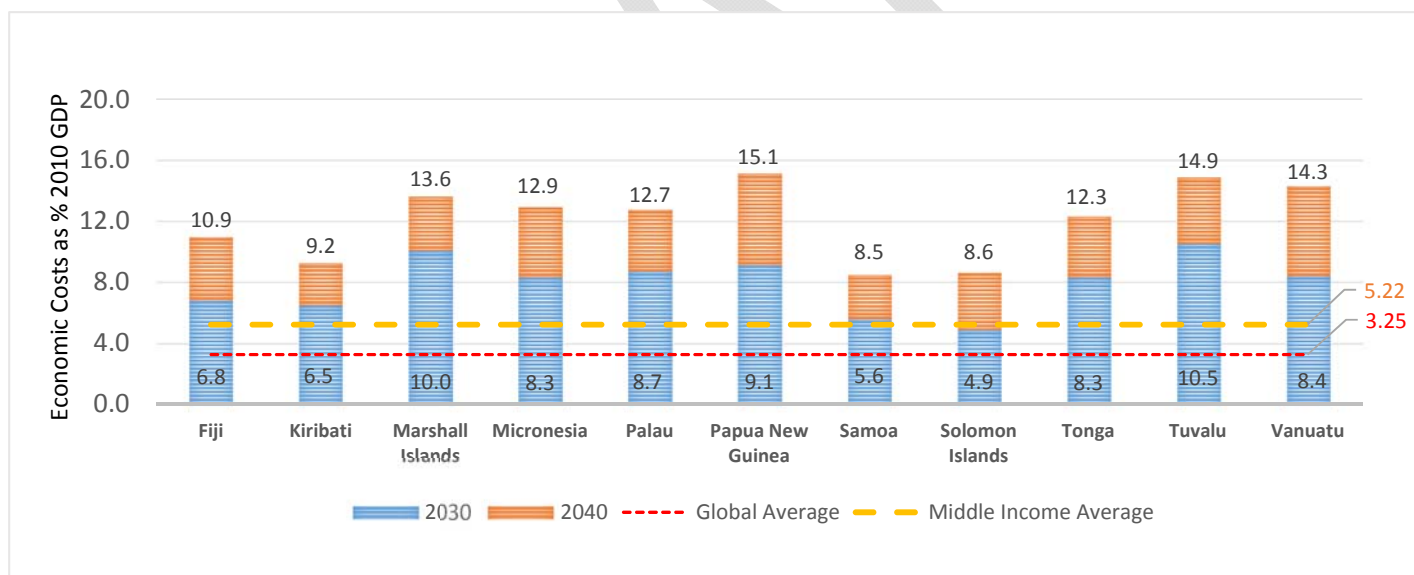
In the absence of hard data on the broader economic costs of NCDs in the Pacific, modeling was undertaken for *Pacific Possible*. The modeling estimates the economic costs of NCDs using, respectively, a “value of lost output” approach for NCDs *mortality* (i.e. death) and a “cost of illness” approach for NCDs *morbidity*. While the methods are not all encompassing of the total

economic burden that NCDs pose, they provide a lower bound estimate of the severity of the problem that the Pacific nations face. Details of the method are in annex 2. The approach uses similar methods as Bloom et al. (2011) used to estimate the global economic costs of the NCDs, which was presented in the World Economic Forum in 2011.

NCD Mortality Burden

A key finding reveals the NCD mortality burden is much greater in the Pacific Island countries than global standards. The estimated effect of four major types of NCDs (cardiovascular diseases, chronic respiratory diseases, diabetes, and cancer) on the global economy is approximately 3.25 percent of the 2010 global GDP, as illustrated by the red dotted line in figure 8. The orange dotted line represents the average NCD burden for middle-income countries as a proportion of middle-income GDP. The projected 2030 economic burden for eight of the Pacific countries analyzed (PNG, Vanuatu, Tonga, Fiji, Marshall Islands, Micronesia, Palau, and Tuvalu) is significantly higher than the middle-income average burden. Kiribati, Samoa, and Solomon Islands are near to the middle-income average burden in 2030.

Figure 8 Economic Burden of NCDs as a Proportion of GDP, 2030 and 2040



Source: Staff calculation.

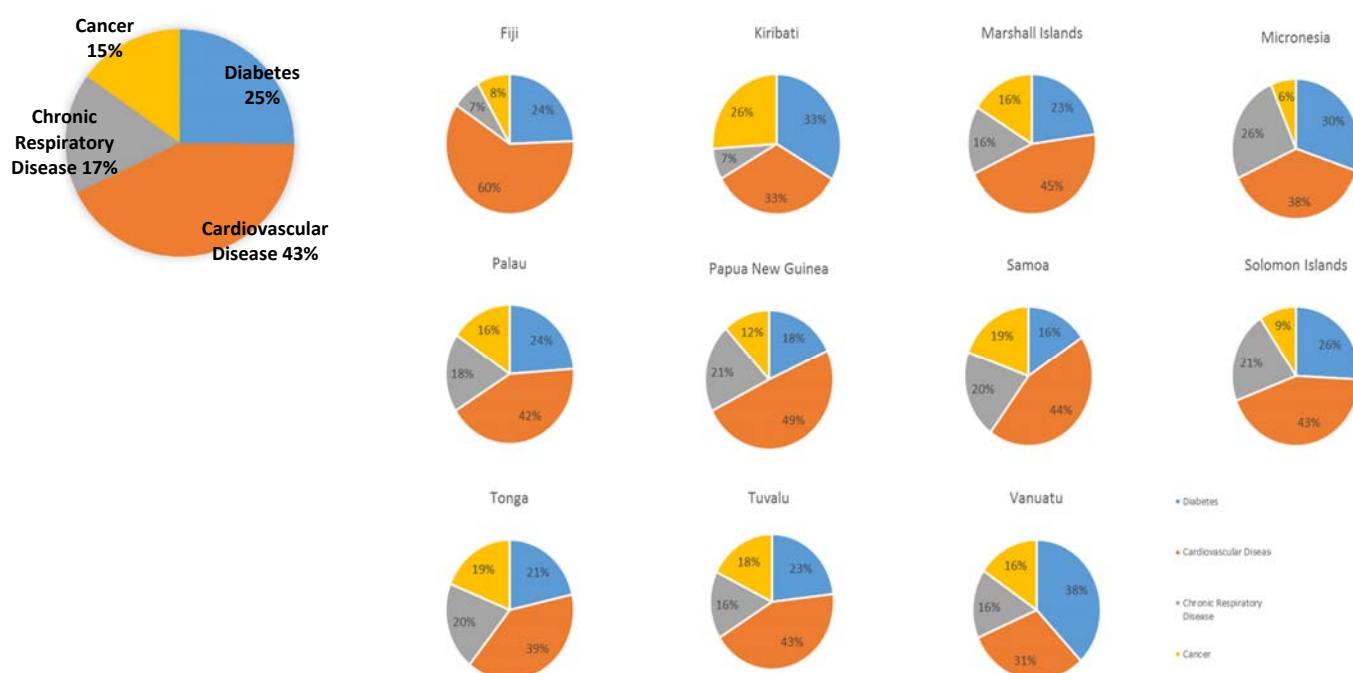
The economic burden is estimated to escalate even further from 2030 to 2040. That is because a premature death due to NCDs has a long-term impact on the economy through the loss of the deceased's potential productivity in the workforce. If no action is taken, the economic burden of NCD mortality is projected to increase significantly.

The direness of the situation is similar for the five smaller Pacific nations. Due to lack of data, estimates for the five smaller Pacific nations required more assumptions. However, the burden is expected to increase from 6.5 percent to 9.2 percent in Kiribati, 10.0 percent to 13.6 percent in the Marshall Islands, 8.3 percent to 12.9 percent in Micronesia (F.S.M), 8.7 percent to 12.7 percent in Palau, and 10.5 percent to 14.9 percent in Tuvalu. The paucity of age disaggregated labor force participation rates required the assumption that these five countries, for which only aggregated labor force participation rates are available, assume the average disaggregation rate for the countries with available data. This average was calculated based on Fiji, Samoa, Solomon Islands, Tonga and Vanuatu. Papua New Guinea was excluded due to its resources driven economic profile compared with all other 10 countries included in the *Pacific Possible* study.²

Cardiovascular disease accounts for the greatest mortality burden in the Pacific Islands, followed by diabetes. The disease mortality burden breakdown is presented in figure 9. Cardiovascular disease is projected to account for 43 percent of lost economic output in the 11 Pacific countries, compared with 51 percent globally. However, diabetes contributes a far greater economic burden at nearly one quarter (24 percent) of lost economic output, on average, compared to the global share of just 6 percent. This is partly due to the relatively high incidence and prevalence of diabetes in the Pacific. Of the 11 countries analyzed, in 2040, Fiji will suffer the highest cardiovascular burden at roughly 60 percent. In 2040, Vanuatu will suffer the highest diabetes burden at roughly 38 percent, even higher than the burden from cardiovascular disease.

Figure 9 Average Share of the Lost Economic Output by Diseases in the Pacific Countries, 2040

² **Other necessary assumptions include:** first, the start technology level, national savings rate, and capital depreciation rate for Tuvalu is equal to the average of the available countries (less Papua New Guinea); second, because external data for labor force participation are required, the corresponding population estimates are used in place of the population data inbuilt into the WHO EPIC model. The external population data was disaggregated by age bracket using the same rates found in the WHO EPIC population data; and third, DALY numbers from IHME are not available for Tuvalu and Palau. In order to scale up the five EPIC diseases to meet the four major NCD types, the average DALY scale factors of the nine remaining countries are used.



Source: Staff calculation.

The biggest driver of lost output is the potential loss of labor due to early death from NCDs.

Table 2 illustrates the potential loss of effective workers due to NCDs by the year 2040. In 2040, NCD mortalities will potentially reduce the labor force by 9 percent to 30 percent across the 11 countries. Again, cardiovascular disease will have the greatest impact, causing an especially high amount of lost labor in Fiji and Micronesia. Diabetes is especially severe in Vanuatu, which has almost double the burden than any of the other countries. It should be noted this is the estimated overall potential labor loss to the labor force, not the employed labor force. Thus higher employment levels will be associated with greater potential economic loss. In another words, the actual economic loss may be less if there is high unemployment or under-employment. However, there will inevitably be large social losses with every premature death, which is not counted in the model, such as the premature death of parents that result in orphans.

Table 2 Percentage of Lost Effective Labor Force in the Year 2040 due to NCDs

Country	Diabetes	Cardiovascular Disease	Chronic Respiratory Disease	Cancer	Total
Fiji	3.7	10.0	1.2	1.5	16.4

Kiribati	3.5	3.6	0.8	3.0	10.8
Marshall Islands	3.5	7.2	2.3	3.1	16.2
Micronesia	8.6	11.3	8.2	1.8	29.9
Palau	3.1	5.7	2.5	2.4	13.8
Papua New Guinea	2.7	7.2	3.1	1.8	14.7
Samoa	1.7	5.6	2.8	2.4	12.4
Solomon Islands	2.4	3.8	2.3	1.0	9.4
Tonga	3.8	7.1	3.7	3.9	18.5
Tuvalu	3.7	7.1	2.6	3.2	16.6
Vanuatu	7.1	5.7	3.1	3.1	18.9

Source: Staff calculation.

In summary, four results stand out in terms of projected economic costs of NCD mortality analyses in the Pacific. First, the economic burden of NCDs is greater than expected for middle-income countries; second, although cardiovascular disease is the biggest contributor to the mortality burden in the Pacific, diabetes plays a far greater role in the Pacific countries compared to the global average; third, the economic burden is increasing with time, especially as incomes rise; and fourth, in the absence of these four NCDs, the labor force could be at least nine percent, and up to 30 percent, larger across the eleven Pacific countries.

NCD Morbidity Burden

The estimation of NCD morbidity economic costs is more complicated than NCD mortality costs. When an individual dies prematurely from an NCD, that person ceases any further contribution to economic activity and no additional medical costs are incurred. However, in the case of NCD morbidity, individuals can continue partially or fully contributing to productive activities. Their contribution is difficult to estimate in advance. They also continue to require medical treatment including drug costs and health worker time. Again, those costs will vary a great deal according to the severity of the disease.

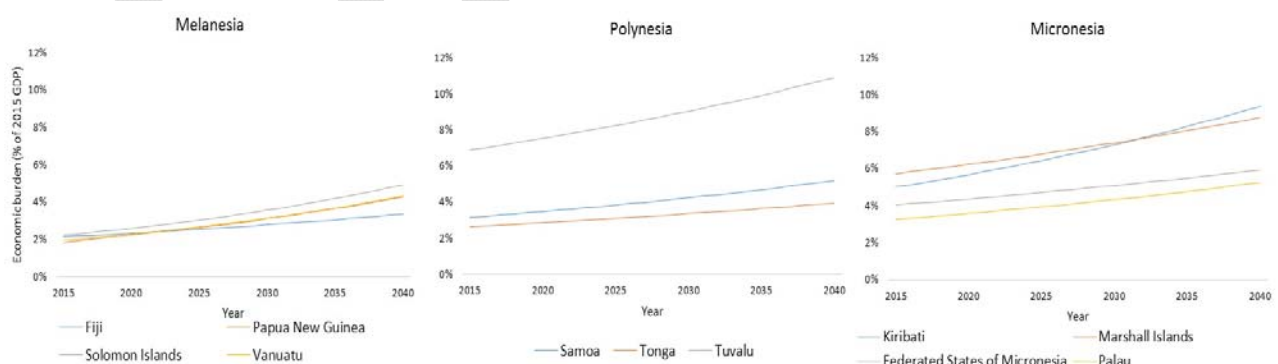
The morbidity burden is estimated using a cost-of-illness approach, restricting the initial analysis to diabetes due to data limitations. The prevalence of diabetes projections comes from the Global Status Report on Noncommunicable Diseases 2014, which provided the 2014 prevalence rates of raised blood glucose. The rates are disaggregated by gender for ages 18 years and over. The 2015 and 2040 (International Diabetes Federation) diabetes prevalence rates allow projections, using a constant growth rate, for growth rates ranging from 0.99 to 3.13 percent yearly, dependent on the country. Three major areas contribute to the economic cost of NCD morbidity: medical costs, loss of income, and the loss of tax revenue. Details of method are listed in annex 2.

The diabetes morbidity burden is scaled up to the four noncommunicable diseases using relationships derived in the mortality analysis. The 2040 morbidity burden for the other three NCD categories is calculated using the country-specific disease burden proportions in 2040 from the mortality estimates (figure 10). The projection for all other years is then scaled back to 2015 by assuming that the three disease burdens grow at the same rate as the diabetes morbidity burden. An implicit assumption of this method is that those countries with higher diabetes morbidity costs will also have higher cardiovascular diseases, chronic respiratory disease, and cancer prevalence rates.

The estimated morbidity burden associated with diabetes ranged between 2.5 percent and 7.4 percent of country-specific GDP in 2015. Figure 10 shows the results. The data is organized by the three major geographic areas in the Pacific: Melanesia, Polynesia, and Micronesia. The costs are expected to grow, reaching levels of 4.0 percent to almost 12.0 percent by 2040, with the biggest share attributable to loss of income. The economic burden due to diabetes is highest among Polynesian countries, particularly in Tuvalu. Melanesian countries are currently experiencing a lower economic burden due to diabetes, but the burden is projected to rise quickly. The cost of diabetes is already quite high in most Micronesian countries and will continue to rise.

Melanesian countries face a double burden of diseases. The prevalence of NCDs is rapidly increasing, particularly in urban areas. This burden will be further compounded by the high stunting rates for children under five, particularly in Papua New Guinea. Research has shown that stunted children are more prone to developing NCDs in adulthood (Jinabhai, Taylor, & Sullivan, 2005; Martins & Sawaya, 2006; Sawaya, Martins, Hoffman, & Roberts, 2003). The steep slope of the burden curve, over the analysis time period, indicates the severity of the problem if no action is taken to reduce diabetes morbidity.

Figure 10 The Economic Burden of Diabetes Morbidity as a Proportion of Country Specific GDP, 2015

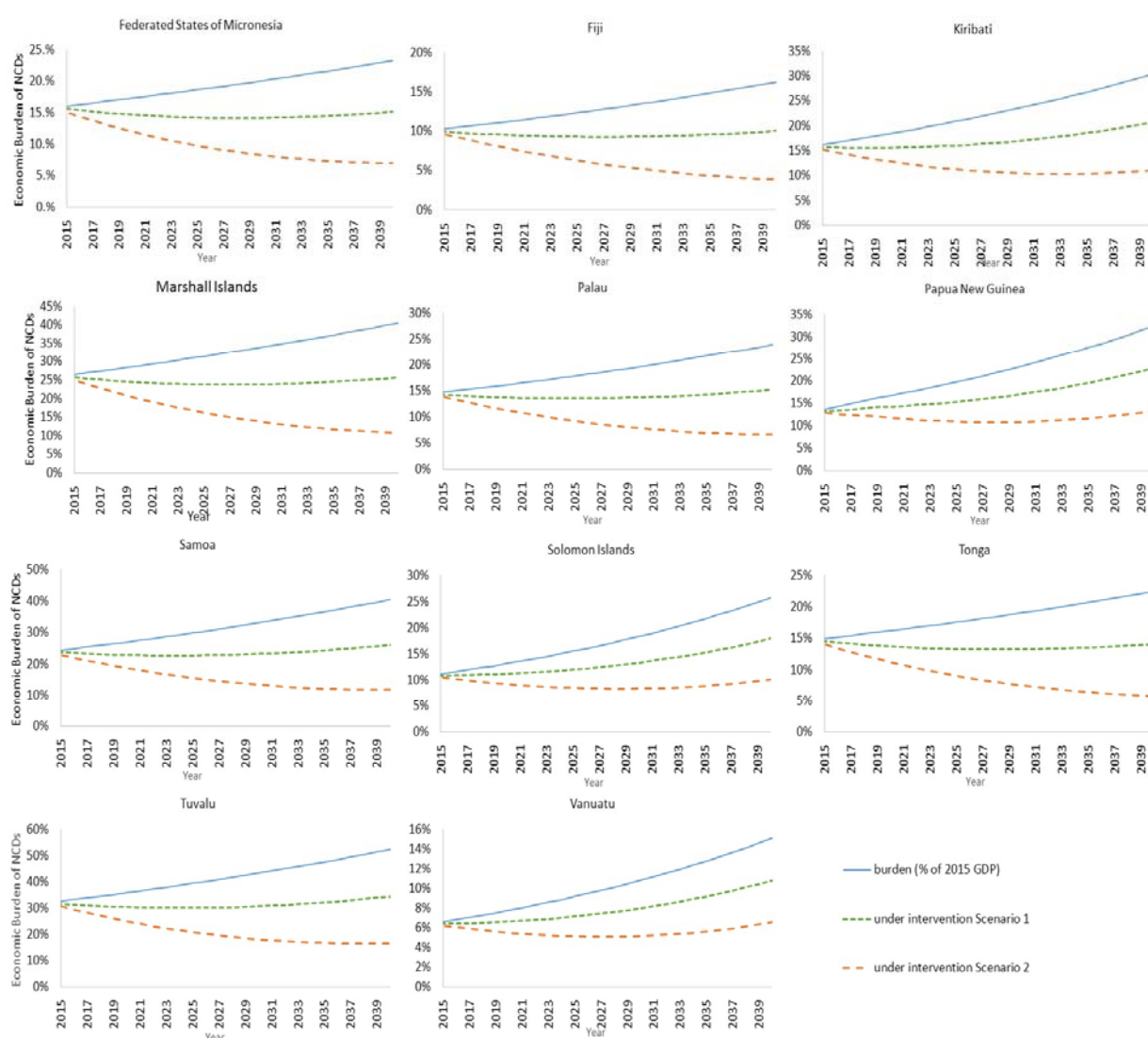


Source: Staff calculation.

The overall national cost curve associated with NCD morbidity can be modified or bent

through interventions targeted to reduce disease prevalence. Figure 11 illustrates two scenarios. In Scenario 1, NCD prevalence was reduced by three percent over the previous year with a discount rate of five percent. In Scenario 2, NCD prevalence was reduced by six percent over the previous year with a discount rate of five percent.

Figure 11 The Economic Burden of NCD Morbidity as a Proportion of Country Specific GDP, 2015 (status quo and intervention scenarios)



Source: Staff calculation.

Scenario 1 resulted in a significant burden reduction but the cost curve still increased for most countries included in the analyses. However, Scenario 2, resulted in downward trends of NCD

morbidity for all countries except Papua New Guinea, Solomon Islands, and Vanuatu, such that by 2040 the economic burden would actually be less than the 2015 burden estimates as a proportion of 2015 GDP.

It is important to note this modeling suggests the cost curve for treating NCDs can be bent at a national level with important benefits for economy; but the appropriate types of interventions will vary according to countries. The modeling demonstrates that bending the cost curve may result in substantial economic, as well as obvious health benefits. Intervention methods to reduce incidence will vary for individual countries according to the incidence and prevalence trends, risk factors, cost of prevention and treatment, and availability of trained health workers and specialized equipment. Thus the costs of interventions are not incorporated in the model.

Responding to the NCD Crisis: Prevention is Possible and Achievable, but Urgent Action is Required

NCDs are preventable. Multiple factors inside – and beyond – the health sector are driving the rise in NCDs, therefore a multisectoral approach is essential. Continued and intensified leadership from the health sector in promoting population-wide tobacco control and scaling up the Package of Essential NCD interventions (PEN) for high-risk groups is therefore essential. Pharmaceutical and similar treatments have a vital role to play in preventing and treating NCDs, however, ‘medicalising’ the NCD response through drugs and medical interventions alone is inadequate. The social determinants of health need to be addressed. Changes in lifestyle provide a simple, low-cost and effective way to combat NCDs while saving scarce health resources. Stakeholder analysis identifies numerous areas where multisector approaches are needed. Development partners also have an interest in supporting a multisector approach through their investments in infrastructure, other sectors, and trade policies.

Pacific Island Forum leaders declared that the Pacific region was facing a “human, social and economic crisis” from NCDs at the 42nd Pacific Islands Forum in 2011. More specifically:

Leaders expressed their deep concern that non-communicable diseases (NCDs) has reached epidemic proportions in Pacific island countries and territories (PICTs) and has become a ‘human, social and economic crisis’ requiring an urgent and comprehensive response. Leaders expressed alarm that 75 percent of all adult deaths in the Pacific are due to NCDs the majority of whom are in the economically active age bracket and that many more times this number suffer severe side effects that undermine their capacity to contribute further to economic development. Leaders expressed grave concern that NCDs can undermine the achievement of the Millennium Development Goals (MDGs) which for a region that is already struggling to meet the 2015 targets provides an even greater challenge. Conscious of the assessment by the World Economic Forum ranking NCDs as one of the top global

threats to economic development, Leaders noted with concern the huge economic costs of NCDs in the Pacific and in particular the rapidly rising expenditure on NCDs comprising well over 50 percent of the total health budget of many island countries. Leaders were particularly concerned that if allowed to continue unabated NCDs has the potential to undermine labor supply, productivity, investment and education, four of the main factors driving economic growth with potentially devastating consequences, especially in Pacific island countries and territories. Leaders recognised the seriousness of the threat that NCD poses to the people in Pacific Island countries and territories and the urgency to address it and declared the 'Pacific is in an NCD Crisis' (Secretariat of the Pacific Community, 2011).

In recognition that NCDs are largely preventable, the Pacific leaders tasked Pacific development partners to work with countries to prepare an *NCD Roadmap Report* with analysis and NCD response options for the Pacific region and individual countries within the region. The analysis and recommendations in the *NCD Roadmap Report* were based on the best available international evidence for effective, feasible, and “best buy” strategies, as well as widespread consultation among key stakeholders including PICs and their development partners. The *NCD Roadmap Report* was then presented to a Joint Forum Economic and Pacific Health Ministers’ Meeting in the Solomon Islands in July 2014. This was the first joint meeting of ministers responsible for economics and finance, and ministers for health in the Pacific. The economic and health ministers in attendance reconfirmed that NCDs undermine social and economic development, and underscored the fiscal and broad development implications of NCDs.

They also jointly agreed to the following five strategic action areas (Secretariat of the Pacific Community, 2014):

- i. Strengthen tobacco control by an incremental increase in excise duties to 70 percent of the retail price of cigarettes over the medium term;
- ii. Consider a tax increase for alcohol products as a way of reducing harmful alcohol consumption;
- iii. Consider policies such as targeted preventative measures, taxes, and better regulation to reduce consumption of local and imported food and drink products that are high in sugar, salt, and fat content as they are directly linked to obesity, diabetes, heart disease, and other NCDs in the Pacific;
- iv. Improve the efficiency and impact of the existing health budget by reallocating scarce health resources to targeted primary and secondary prevention measures for cardiovascular disease and diabetes, including through the Package of Essential Noncommunicable Disease Interventions; and
- v. Strengthen the evidence base to enable better investment planning and programme effectiveness, thereby ensuring that interventions work as intended and provide value for money.

The Importance of Implementation

Implementation is a key part of the national and regional response following the declaration of a NCD “crisis” and the adoption of the *NCD Roadmap* in the Pacific. It is quite common for good policy to be developed and laws enacted in developing countries, only to find that actual implementation is neglected or not given adequate resources and attention (Thomas & Grindle, 1990). Many factors contribute to weak implementation: inadequate financing and resourcing; weak or ambiguous lines of accountability; weak monitoring and evaluation; perceptions that leaders and managers are no longer interested in the issue; and opposition to change by vested interests.

Weak implementation has economic and political costs. The economic costs are the ineffectual use and wasted time of leaders and managers who developed a policy that was not implemented properly. This imposes a particularly high cost in the Pacific where the time, energy, and political/bureaucratic capital of skilled leaders and managers is a precious resource that should not be wasted. The political cost is the erosion of leaders’ credibility and authority when the population fails to see tangible follow up to a declared crisis.

Regional sharing of information and lessons learned may further enhance NCD policy implementations at the country level. Nearly all Pacific countries share some things in common when it comes to implementation of NCD responses. Sharing lessons learned from successes and failures in the following areas would be very helpful across the region: the scale-up and implementation of the Package of Essential NCD interventions (PEN); the expansion and strengthening of NCD preventive care; the broadening of health promotion in primary care settings to relieve pressure on hospitals; and the implementation of tobacco control policies, particularly with domestic, loose-leaf tobacco producers.

On the other hand, differences in implementation capacity need to be recognized. A one size fits all approach cannot be applied when some countries have just one or two public health officials available to work on NCDs, while others have potentially more available staff. Individual countries are in the best position to determine implementation priorities, how to budget and resource implementation, and how to hold agencies and individuals responsible and accountable for results.

The section below summarizes the implementation to date of the key policy priorities that were recommended under the *NCD Roadmap*, which all countries in the Pacific should and can implement.

Tobacco control

There has been some progress around the recommendations for tobacco control. Tobacco is the leading, preventable cause of NCDs and tobacco control has recently been identified as the

“the single best health policy in the world” (Savodoff & Alwang, 2015). All 11 countries covered by the *Pacific Possible* report – with the exception of Tuvalu – have increased taxes on tobacco or are in the process of doing so.

However, there are significant gaps in the implementation of tobacco control recommendations. First, if the Pacific is to reduce NCD impacts and achieve the Pacific leaders’ stated declaration of achieving a “Tobacco Free Pacific” by 2025, all countries need to raise the absolute level of tobacco prices, and most still need to significantly raise the level of excise duties to 70 percent of retail prices. Second, countries need to proactively measure and analyze the sales, additional revenue, and consumption trends of tobacco in light of excise duties and other interventions. It does not appear that any Pacific Island countries established a baseline of sales and revenue prior to the increase in excise duties. Unfortunately, the lack of evidence base does not allow policy makers to fine tune policies and meet government objectives or to defend themselves against the inevitable criticisms of the tobacco industry. Third, countries need to invest in, and widely publicize, the implementation and prosecution of existing laws and regulations, including laws against the still widespread practice of selling cigarettes to children (Anderson, 2013a; World Bank, 2014). Fourth, countries in the Pacific need to work together and share strategies to control the consumption of home-grown and loose leaf tobacco, which is usually beyond the reach of excise duties (Hou, Xu, & Anderson, 2015).

Reducing consumption of unhealthy food and drinks

Reducing consumption of unhealthy food and drinks that are associated with NCDs is an important strategy for the Pacific. As noted previously, parts of the Pacific have some of the highest levels of obesity in the world. The change in diet from traditionally consumed fish and fruits to highly processed imported foods including biscuits, noodles, and high fat products such as turkey tails and mutton flaps, is a factor contributing to obesity levels, particularly when combined with increasingly sedentary lifestyles (DiBello et al., 2009; WHO, 2010c). High consumption of sugar sweetened beverages (SSBs) is also of concern because significant sugar levels – often around eight to 10 teaspoons of sugar per medium sized bottle – are in a liquid form and therefore ultimately damage the body’s metabolic system and insulin response, leading to diabetes (Malik et al., 2010). Excessive alcohol consumption is associated with domestic violence, traffic accidents, and certain cancers. Excessive consumption of salt is a risk factor for hypertension. However, many factors affect dietary choices including the price and availability of healthier fruits and vegetables, advertising, and knowledge and awareness of the benefits of healthy eating. Increasing taxes on unhealthy products, including SSBs, is one option under consideration because price changes can, in the right circumstances, affect consumer behavior.

There has been some limited progress in efforts to reduce the consumption of unhealthy

foods, especially sugar-sweetened beverages (SSBs) and salt.³ Tonga, Samoa, and Vanuatu all increased the tax on sugar-sweetened drinks. There are also ongoing efforts to introduce food safety regulations requiring nutrition labels on processed foods. A number of countries have draft regulations awaiting adoption. But there have also been some setbacks. In April 2014, Kiribati reduced a 70 percent import duty specific to soft drinks to zero percent and replaced it with VAT & excise taxes of 40 percent. Of the few countries that have raised the price of unhealthy foods and drinks, none have measured the change in consumption levels to see if the policy is working or cost effective. There is little information available about reducing salt consumption, including in processed foods. Nor is there good information to promote the growing and marketing of more nutritious foods, including fruits and vegetables. Development partners are also considering options for analytical work regarding the impact of taxes on unhealthy food and drink consumption and the potential risk factor reduction for obesity and NCDs such as diabetes.

Improving the efficiency and impact of the health budget

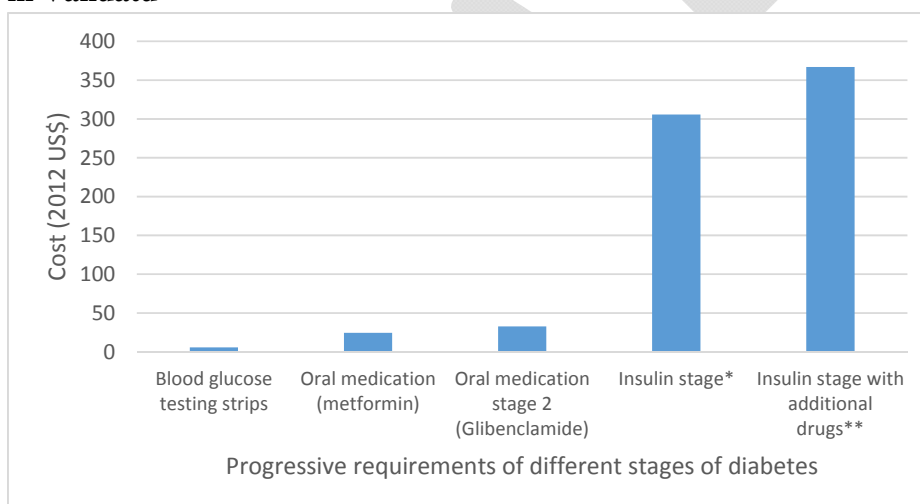
Improving the efficiency and impact of the existing health budget by making better use of existing financial, human, and other resources in the health sector is a major strategic priority for countries. The starting point for responding to the growing challenges in the health sector is to make sure that ministries of health are making the best use of existing financial and human resources. There is a good deal of capacity to strengthen the planning, priority setting, resource allocation, and financial management of existing budgets in the Pacific Island countries. Such efforts would help free up existing resources that can be allocated to higher impact and more sustainable investments. The World Health Organization estimates that around 20-40 percent of health expenditure globally is wasted or could be better allocated, and has identified 10 areas where efficiencies can be improved (WHO, 2010b).

Reallocating scarce resources to well-targeted primary and secondary preventions is particularly relevant to achieve improved health outcomes in a way that is affordable, cost-effective, and financially sustainable. PICs cannot afford to finance treatment of many expensive or complex NCDs at this stage in their development. However, PICs can afford to finance well-targeted and evidence-based primary prevention programs (interventions designed to prevent an adverse health event from occurring in the first place) and secondary prevention programs (interventions that occur after an event, such as a heart attack, that are intended to reduce incidence re-occurrence or further health deterioration). Primary and secondary prevention strategies for diabetes and hypertension are particularly important policy priorities for most countries in the Pacific given the high health, financial, and economic burdens that those diseases impose on countries. Recent studies in Vanuatu (Anderson et al., 2013) show, for example, that slowing the

³ High consumption of SSBs is unhealthy because significant loadings of sugar – often around eight to 10 teaspoons of sugar per medium sized bottle – are in a liquid form and therefore ultimately damage the body's metabolic system and insulin response, facilitating diabetes. Excessive consumption of salt is a risk factor for hypertension.

progression of diabetes in a person through well-targeted primary and secondary prevention has significant financial benefits to government, as well as health benefits to the individual. Every person who adopted a healthy lifestyle and was able to avoid diabetes or keep it under control would avert direct drug costs to government of up to \$367 per person per year. Effective and targeted secondary prevention is an especially strategic and potentially cost-effective intervention. That is because the pool of people at risk of progressing to insulin is limited, so targeting can be better focused. But it is also because those who stabilize their condition through adherence to medication and improved lifestyle choices can avoid the necessity of insulin injections, and save the government around US\$275 per patient per year. Figure 13 shows there is a similar step wise increase in the pharmaceutical costs of treating hypertension in Vanuatu. Those able to avoid or control hypertension by adopting healthy lifestyles would avert drug costs to government of up to US\$75 per person per year: the equivalent of current government spending, on average, for 18 healthy citizens. Effective and well-targeted primary and secondary prevention similarly yields health benefits for the individual and significant and sustained cost savings to government.

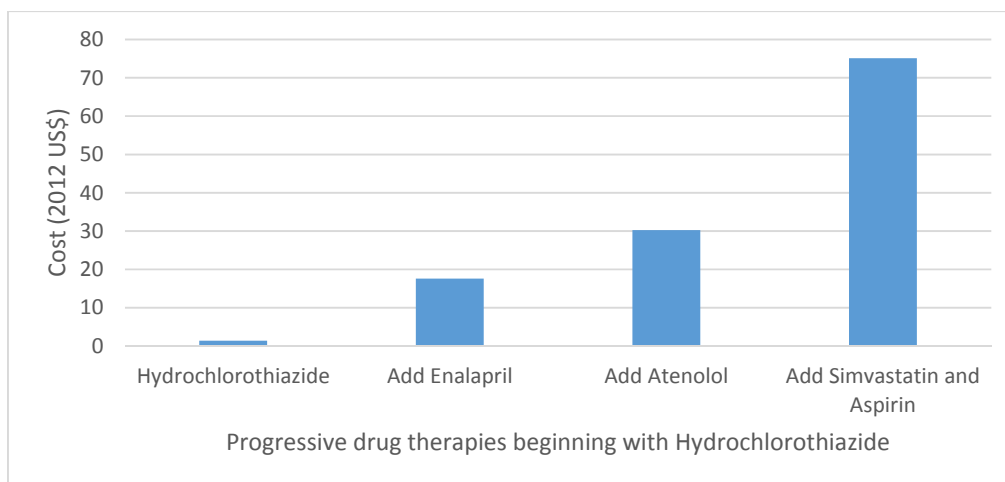
Figure 12 Average Pharmaceutical Cumulative Costs per Annum for One Diabetes Patient in Vanuatu



Source: (Anderson et al., 2013)

Note: data was collected in October, 2012. The average annual cost at each stage of treatment was based on the actual unit cost of the main drugs and the dosage used at the various stages in treating diabetes in Vanuatu.

Figure 13 Average Pharmaceutical Cumulative Cost per Annum for One Hypertensive Patient in Vanuatu



Source: Anderson et.al. (2013).

Note: data was collected in October 2012. The average annual cost at each stage of treatment was based on the actual unit cost of the main drugs and the dosage used at the various stages in treating hypertension in Vanuatu.

There has been some positive movement toward implementing the *NCD Roadmap* recommendation to improve the efficiency and impact of the health budget. The Cook Islands, Fiji, FSM (Pohnpei), Kiribati, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu have all commenced implementing the WHO supported *Package of Essential NCD (PEN) Interventions for Primary Health Care in Low Resource Settings* (WHO, 2010d). When used judiciously and adapted to each country's disease burden, risk factors, cost structures, and health system capacities then such an approach should identify and deliver the "best buys" for diagnosing and treating NCDs.

But there is more to be done to improve the allocation and technical efficiency of public expenditure, and increase equitable outcomes. The *Roadmap* and other World Bank reports (Anderson, 2013c; World Bank, 2014) show that dialysis treatment for diabetes is largely ineffective (in one PIC two-thirds of patients died within two years), inefficient (annual treatment costs were 12 times the national GDP per capita, four times higher than WHO's recommended benchmark for cost-effectiveness), and inequitable. Recent analysis of the pharmaceutical diabetic costs in Vanuatu found that less than two percent of the population could be treated with insulin before the total government drug budget was exhausted. That analysis confirmed the overwhelming importance of allocating scarce resources to primary and secondary prevention efforts for high risk groups if treatment is to be financially sustainable for governments (Anderson et al., 2013). It is unclear whether Pacific Island governments are, in fact, focusing scarce resources on targeted prevention. Indeed, a well-conducted study that is awaiting publication found that one PIC allocates around one-third of its total government health budget to overseas treatment referrals for just 100 patients. Despite a lack of transparency and accountability in the use of public funds, it appears that the health outcomes for this older and privileged group were limited and modest at best, raising fundamental questions about the efficiency and equity gains in reallocating health resources. There are also broader, untapped, areas beyond just NCD treatments for

increasing the effectiveness and equity of public health expenditure in the Pacific, including public financial management, improving health worker supervision and management, and improving quality and effectiveness of diagnostic / clinical services (Anderson et al., 2014).

Strengthening the evidence base for improved investment

Strengthening the evidence base is key to improving investment planning, program effectiveness, and ensuring value for money spent. PICs, and their development partners, need to know that they are allocating scarce financial and human resources to programs that are well-targeted, effective, and provide value for money. Many PICs are now undertaking WHO supported STEPS surveys,⁴ thereby gaining up-to-date insight into the prevalence and incidence of risk factors for NCDs. For example, Tokelau, Cook Islands, Solomon Islands, and Kiribati have undertaken a sample STEPS survey; Tuvalu has one underway; Nauru and PNG are planning STEPS; and the Marshall Islands is planning a hybrid survey. French Polynesia, Cook Islands, Fiji, and Samoa are now in advanced planning or already undertaking surveys.

There are still major gaps in the cost and consequence evidence base of NCDs and in documentation and sharing of best practices in the Pacific context. In PICs, there is very little data collection and analysis to help countries understand the financial cost of NCD prevention and treatment. In addition, there is a lack of data surrounding the broader economic costs of productivity losses to industry and government due to NCD related absenteeism; the equity and financial sustainability implications of public expenditure on NCDs; or the “best buys” for preventing and treating high burden / high cost NCDs in the context of the Pacific. Few, if any countries – or their development partners – are undertaking baseline studies prior to commencing interventions or seeking to measure the financial and broader resource cost (including human resources) of scaling up interventions, especially to more remote areas. Expanding the evidence base of “what works”, for whom, and at what cost, starting with a few key countries in the Pacific, would be a useful knowledge product and regional public good that policy makers throughout the Pacific could use to improve their resource allocation decision making.

Other actions that PICs could and should take

The *NCD Roadmap Report* also identified more than 30 important multisector actions that can be taken by 16 different ministries⁵ outside of the Ministry of Health, as well as

⁴ STEPS is not an acronym. Instead, it is a term used to cover the WHO STEP wise approach to Surveillance of risk factors and diseases. Further details on STEPS is available at <http://www.who.int/chp/steps/en/>.

⁵ The 16 ministries outside of the Ministry of Health where important multisectoral action could and should occur are the Prime Minister’s Department; the Attorney General’s Office; the Ministries of Agriculture, Communications, Customs and Excise, Education, Finance and Economic Planning, Labour and Industry (including the Public Service Commission), Police, Sport, Trade, Urban Planning (including town councils), Transport, and the National Statistics Office.

development partners and the private sector to reduce NCDs. Each of the recommended multisector actions identifies the key ministry or stakeholder responsible for the intervention; the proposed action; the expected, tangible, benefit in reducing NCDs; suggested specific indicators to verify progress; likely financial cost and/or increased government revenue implications; the likely feasibility and obstacles to implementation; and political implications, including possible “winners and losers”. Examples of specific actions include the need for the prime minister’s office to use its convening power and authority to establish, and then actively chair, a regular meeting of a multisector task force to supervise progress in addressing NCDs and ensure inter-sectoral collaboration. The Ministry of Agriculture could more actively promote the farming and marketing of fresh fruit, vegetables, and fish (perhaps by supporting investments in refrigeration at local markets) and restrict the use of land for small-scale tobacco leaf production. The Ministry of Communication could counter the aggressive marketing of unhealthy food and sugar-sweetened drinks, especially those deliberately targeted at children. Examples of specific, feasible actions that should be implemented by the other 14 ministries, development partners, the private sector, and civil society are available in annex 6 of the *NCD Roadmap Report* (World Bank, 2014).

[NCD: Poverty, Gender, and Climate Change](#)

NCD and Poverty

The burden from NCDs disproportionately affects low-income groups. Although acquisition of an NCD is more likely among the wealthy in a low- or middle-income country, the poor are less prepared to manage a disease (D Bloom et al., 2011). The NCD burden on low-income households is exacerbated due to the correlation with lower levels of education. Lower educational achievement at younger years leads to greater NCD susceptibility in adulthood. Households going through financial difficulties result in children being nine times more likely not to attain any educational qualifications, and thus three and a half times more likely to contract an inhibiting illness than a child from a financially secure household (WHO Regional Office for the Western Pacific, 2007).

The poverty and low-income segments of the population thus suffer from an NCD trap. Although not exclusive to NCDs, a vicious cycle exists where poverty - in the form of lower education, employment, and economic deprivation - leads to higher prevalence and more severe NCDs, and in turn results in economic impacts on individuals and households. The economic impacts, such as increased health expenditure, which is a greater proportion of income for the poor, job loss, and reduced productivity, tends to continue the poverty status (Murthy et al., 2001).

Lower-income groups are more susceptible to NCD risk factors. Because high-fat, lower-fiber foods are usually cheaper than healthier alternatives, poorer people are generally more constrained to purchase low-cost food. In the Pacific, part of this problem is attributed to changing lifestyle

patterns as there is more reliance on high-fat and high-sugar imported foods (WRPO, 2007). One example is mutton flaps, a low-quality rib meat (Watson & Treanor, 2016). Dietary choices, more sedentary lifestyles, and genetic factors have led to the obesity problem in the Pacific. Unfortunately, as a nation's per-capita income rises above US\$2,500, the probability of obesity is greater among lower socio-economic status groups than their higher economic status counterparts (Monteiro, Moura, Conde, & Popkin, 2004). As of 2015, just three of the 11 Pacific Possible nations do not meet this threshold.

Prevention and treatment of NCDs is lower among those in poverty. Poverty reduces the chance that NCDs such as diabetes and cancer will be prevented or treated in its early stages (Johnson et al., 1995). In addition, if diagnosed, poverty reduces the probability of complications being diagnosed early due to the inability to access, or lack of available quality healthcare. There is a correlation between low levels of education and NCD awareness in poverty groups and even if symptoms are recognized, this segment of the population is often unable to afford primary care (WHO, 2000). Furthermore, although diseases such as cardiovascular disease is more prevalent among the poor, surgery is less likely to be classified as urgent for disadvantaged patients, and poor patients are less likely to be offered surgery once a NCD has developed (Pell et al., 2000).

NCD and Gender

Noncommunicable diseases do not discriminate across males and females. Males have a greater risk of acquiring cardiovascular disease, while women are more prone to diabetes (WHO, 2002). The greater diabetes prevalence in females is often due to the more sedentary lifestyle that women lead, causing obesity which is more prevalent among Pacific women than men (Ng et al., 2014; WRPO, 2007). Obesity among the poor also appears earlier in women (Monteiro et al., 2004). Unfortunately, diabetes is further known to precede the onset of heart disease and stroke (Hu, 2013). The result is that, although cardiovascular disease is often more commonly associated with men's health issues, it is in fact the number one killer of women globally (WHO, 2013). After developing CVD, the health burden for women is more severe than for men, as women tend to wait longer to seek treatment after the onset of symptoms, and require longer hospital stays following a stroke or myocardial infarction (Allen & Szanton, 2005; Pilote et al., 2007).

Alcohol and tobacco consumption contribute to NCD prevalence across the genders. Hypertension is more common among males, partially attributable to their greater alcohol consumption (WHO, 2007). Males also consume more tobacco than females, resulting in a greater number of smoking-related NCDs among men (WHO, 2011a). In the case of Papua New Guinea, the male smoking prevalence is more than double that of females (Eriksen, Mackay, Schluger, Gomeshtapeh, & Drope, 2015). About half of all lifetime smokers die early from smoking; on average a smoker's death is 15 years premature (WHO, 2011a). The smoking prevalence of boys and girls in more than half of the world indicates no significant difference across the genders (Warren et al., 2008).

This bodes poorly for future generations as the gap between male and female smoking prevalence is closing. Future health policies should begin to address the closing gender gap in smoking and identify ways to educate the female population particularly because they are more adversely affected by tobacco use.

Caring for a family member with an NCD can make the term ‘noncommunicable’ seem communicable. Designated caregivers often must interrupt their education or withdraw from the workforce which in turn impacts their security and health (Brands & Yach, 2002). The caregiver can no longer work and save money and due to the strong link between poverty and disease, the caregiver is more likely to contract an NCD. Because females are more likely to assume the caregiving position, the aforementioned relationship is more burdensome for females than males. The correlation between the poor – often women and children – and ill health requires more gender-specific health policies (Brands & Yach, 2002).

NCD and Climate Change

Climate change and climatic factors increase the burden of noncommunicable diseases. “In low- and middle-income countries with long coastlines [relative to country size], millions of people will be affected by flooding, leading to displacement and poverty among ‘environmental refugees’” (Kjellstrom, Butler, Lucas, & Bonita, 2005). As discussed, there is a significant link between poverty and NCDs. Growing sea levels and extreme weather events also damage agricultural systems and increase instances of malnutrition.

Climate change can also have direct physiological effects. Heat exhaustion is one of the main climate change contributors to the burden of NCDs. Studies have shown that during heat waves, developing countries have reported increased mortality (Hajat, Armstrong, Gouveia, & Wilkinson, 2005). This increase is mainly due to an “overloading” of the cardiovascular and respiratory systems, and is more common among individuals who already suffer disease or weakness of these systems (Parsons, 2003). Heat waves are also known to increase hospital admissions, and consistently hot, arid climates can increase dehydration amongst the population resulting in the occurrence of kidney stones (Cramer & Forrest, 2006; Knowlton et al., 2009).

Obesity escalates heat exposure symptoms. Obese individuals reach higher core body temperatures more rapidly than their non-obese counterparts, initiating the associated symptoms of cardiovascular diseases (Dougherty, Chow, & Kenney, 2009). This problem is exacerbated if much of a country’s production is in primary industry where labor-intensive work is necessary. Growing global temperatures, combined with the Pacific’s humid, tropical environment, will escalate the impacts of obesity in the Pacific Islands (Bridger, 2003). Therefore, rising temperatures related to climate change present an additional challenge in curbing the burden of NCDs in the Pacific

Islands.

Conclusion

It is clear why Pacific Island leaders have formally declared NCDs a “crisis” in the region. NCDs affect the overall development process and prospects. As this report shows, all countries in the Pacific are dealing with the challenges of communicable diseases, reproductive health, and rapid population growth. In addition, PICs are experiencing a rapid rise in the incidence and prevalence of NCDs: in many countries at rates that are among the highest in the world. Unfortunately, the capacity to respond to these growing challenges is constrained because of the already high absolute and relative levels of government expenditure on health. Given generally low or at least volatile economic growth, and limited capacity to increase tax revenue from a nascent private sector, governments have increasingly limited scope to allocate more resources for health in a way that is financially sustainable. The *NCD Roadmap* has a suite of evidence-based, feasible, affordable, cost-effective and in some cases, cost-saving interventions specifically designed for the Pacific Islands. The recommendations involve key programs from the Ministry of Health, a wide range of other multisectoral ministries, and stakeholders. Pacific Island countries that successfully pursue measures to prevent and control NCDs will be able to bend the cost curve of NCD treatment and generate broader budgetary and macroeconomic benefits.

Annex 1 Summary of NCD Prevalence and Risk Factors in the Pacific, 2010

Indicator	Fiji	Kiribati	Marshall Islands	Micronesia (Federated States)	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Total population 2014 (UNDP)	886,000	110,000	53,000	104,000	21,000	7,464,000	192,000	572,000	106,000	10,000	259,000
Premature NCD Mortality 2012* (%)	30.8	...	...	...	...	26.4	...	24.1	...	...	...
Alcohol 2012**	3.0	2.8	...	3.1	...	3.0	...	2.0	1.6	1.5	1.2
Current Tobacco Smoking 2012	...	...	...	...	26.4	...	33	...	29.6	...	...
Insufficient Physical activity (adults)	15.7	39.6	47.6	36.6	...	12.0	15.3	34.0	21.6	...	7.1
Raised blood pressure 2014	24.0	21.8	22.8	23.6	24.3	23.7	22.2	24.3	22.4	23.5	24.8
Raised blood glucose 2014	16.9	21.1	19.6	18.7	22.7	12.8	23.5	13.4	23.6	19.9	16.0
Overweight and obesity 2014 (18+ years)	70.4	72.3	74.9	63.0	78.4	56.7	72.0	55.6	71.8	72.1	64.2
2014 Mean Body Max Index (BMI)	27.2	29.6	29.2	29.4	29.4	25.3	31.7	25.5	31.9	29.3	26.2

* Probability of dying between exact ages 30 and 70 from any of cardiovascular disease, cancer, diabetes, or chronic respiratory disease.

** Per capita Consumption of pure alcohol (litres) Crude adjusted projected estimates

Source: (WHO, 2010a).

Note: These are the statistics used by the WHO in its *Global Status Report on NCDs 2014*. Individual countries may have different estimates.

Annex 2 Data Source and Methods

This study estimates the economic burden of NCDs for each year over the 2015-2040 period, focusing on the Pacific Island nations: Fiji, Kiribati, Marshall Islands, Micronesia (F.S.M), Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Two methods were used to estimate the mortality and morbidity burden using a 'value of lost output' and 'cost of illness' approach respectively. While the methods are not all encompassing of the total economic burden that NCDs pose, they provide a lower bound estimate of the severity of the problem that the Pacific nations face.

Data source

The following data sources were used for the mortality burden analysis: labor force projections from the International Labour Organization (ILO); disease-specific mortality projections, country macro parameters, and population projections were provided by the WHO Global Burden of Disease Estimates; and GDP per capita estimates were sourced from World Bank staff estimation.

The following data sources were used for the morbidity burden analysis: The Global Status Report on Noncommunicable Diseases 2014, provided 2014 raised blood glucose prevalence rates - representative of diabetes prevalence rates - for 18-year-olds and over. From the International Diabetes Federation's (IDF) projected diabetes prevalence rates for 2015 and 2040, a constant growth rate in diabetes prevalence was calculated for years 2015 through to 2040 and applied to the Global Status report figures. Estimated medical costs per diabetic were also sourced from IDF. While employment and GDP figures, to derive GDP per employed, were sourced from World Bank staff estimation.

Mortality Burden

The economic burden of NCDs mortality in the Pacific countries was estimated using the WHO EPIC model which takes a 'value of lost output' approach to disease mortality burden (Abegunde & Stanciole, 2006). This tool estimates country-specific economic output (GDP in 2010 US\$) using a standard growth model that relates aggregate output to capital and labor inputs, augmented by technology. NCDs mortality enters the model with a two-fold effect on aggregate output: first, NCD mortality depletes the labor force, and second, capital accumulation is impeded as savings are diverted to NCD associated healthcare consumption.

The economic burden of NCDs is estimated by taking the difference between the status quo (SQ) projections of country output, also known as the 'business-as-usual' output, and the counterfactual (CF) scenario output, described as the projected output had there been no NCD mortality cases. The SQ output projections are simply the product of year-specific population projections and GDP

per capita, while the CF output draws its roots from the simulation of a Solow growth model of the following form (Solow, 1956):

$$Y_{i,t} = A_{i,t} K_{i,t}^{\alpha} L_{i,t}^{1-\alpha}$$

$Y_{i,t}$ describes the output in country i in year t ; A gives the level of technology which is exogenous to the model and grows at a constant rate of one percent each year; K and L are the aggregate stock of capital and labor respectively, and α represents the capital share.

The full-time equivalent labor force, under the CF scenario, is derived by augmenting the status quo labor force projections with the labor force that would be added from averted deaths each year. Additional labor added to the country's economy from an averted death, has a multi-period effect which is dependent on the age when death was averted. The capital accumulation of a country is restricted when expenditure from savings is diverted to healthcare consumption instead of physical capital accumulation.

Initially, the model estimates the number of lives added to the population from averted deaths. This is done by multiplying the number of deaths averted with the survival rate of any other cause of mortality for that year and age group. This figure is also supplemented by the added population from averted deaths in previous years, who survive all other mortality causes year on year. The additional population is multiplied by age-group and country specific employment rates, as well as an experience factor. The WHO EPIC model assumes no one under the age of 15 is in the labor force.

The NCDs impact on capital, under the CF scenario, feeds into the following equation:

$$K_{i,t+1} = sY_{i,t} + (1 - \delta)K_{i,t}$$

where δ denotes the rate of capital depreciation, and s represents the saving rate. Capital accumulation under the CF scenarios differs to the SQ scenario because of varying levels of labor driven output as labor is augmented to SQ estimates with averted deaths. The aggregate factors each year are solved simultaneously. The savings rate, capital depreciation rate, and capital share are assumed to be constant across years and exogenous to the model.

The WHO EPIC tool estimates the CF output by country and disease per simulation (choosing from diabetes, ischemic heart disease, cerebrovascular disease, chronic obstructive pulmonary disease (COPD), and breast cancer). To reflect the burden of the four main NCDs of the UN High-Level meeting (cardiovascular diseases, chronic respiratory diseases, diabetes, and cancer), the EPIC diseases are scaled up using DALY's data from the Institute for Health Metrics and Evaluation (collected August 2015). This is done by deducing relative share of an EPIC disease's (i.e. breast cancer) DALYs to its domain disease (i.e cancer) by country, and scaling up the EPIC disease relative to their domain disease proportion.

Morbidity Burden

The morbidity burden is estimated using a cost-of-illness approach, restricting the initial analysis to diabetes due to data limitations. The prevalence of age-standardized adjusted diabetes projections comes from the Global Status Report on Noncommunicable Diseases 2014, which provided the prevalence rate of raised blood glucose for 18 years of age and older in the year 2014. Using the International Diabetes Federation's diabetes prevalence rates for 2015 and 2040, a constant growth rate gives projections for 2015 through to 2040 with growth rates ranging from 0.99 to 3.13 percent yearly, dependent on the country. Loss income and medical costs are estimated following the Bloom et al. report. The disability prevalence among low- and middle-income countries is estimated to be eight percent (Barcelo, Aedo, Rajpathak, & Robles, 2003). This percentage was also adopted by the World Economic Forum (D Bloom et al., 2011). Medical costs are applied to diabetics 15 years of age and over while the loss of income and tax loss are only accounted for 20- to 65-year-old diabetics. The method also assumes that an individual driven to early retirements from diabetes does so at the beginning of the year.

The medical care costs associated with diabetes is drawn from IDF Diabetes Atlas 7th Edition, which provides healthcare expenditure by country for the years 2015 and 2040. A constant growth rate between the two years provides the medical cost associated with all other years of analysis. The loss in tax revenue is calculated as that year's tax that would have been paid had the individual not been removed from the workforce due to diabetes. This the lost tax revenue is calculated at the average income level tax rate by country. The GDP per employed from World Bank staff estimation was used to represent the expected income of an individual by country. One strong assumption made is that the country-specific tax rate is constant across all years.

In order to produce estimates for Kiribati, Marshall Islands, Micronesia, Palau, and Tuvalu, additional assumptions over and above the other six *Pacific Possible* countries were required. First, the 2015 and 2040 population statistic was disaggregated by age bracket using the average rates from the available six countries; second, prevalence rates by age group from the Global Status Report on Noncommunicable Diseases 2014 began at 18-years-old while the closest sub-population available is from 15+-years-old.

Taking the human capital approach to estimating the productivity costs of disability, the value of lost income is estimated using the value of GDP per employed multiplied by the disability prevalence.⁶ The economic costs is the difference in income between employment and unemployment. The summation of these economic burdens gives the lower bound estimate of total economic burden due to diabetes morbidity.

The diabetes morbidity burden is scaled up to the four non-communicable diseases using relationships derived in the mortality analysis. The 2040 morbidity burden for the three other NCD groups is calculated using the country-specific disease burden proportions in 2040 from the mortality estimates (figure 9). The projections for all other years is then scaled back to 2015 by

⁶ Where disability benefit information is available, disability benefit should also be considered to be an economic burden to the economy.

assuming that the three disease burdens grow at the same rate as the diabetes morbidity burden. An implicit assumption that results from this method is that those countries with higher diabetes morbidity costs will also have higher cardiovascular diseases, chronic respiratory disease, and cancer prevalence rates.

A particularly interesting outcome of a reduction in diabetes prevalence is that the cost curve associated with diabetes morbidity can be bent. Re-estimation of the cost curve is illustrated under two scenarios. The first scenario reduces the diabetes prevalence, beginning at the year 2015, by three percent on the status quo prevalence, with this three percent discounted by five percent each year. Furthermore, the reduction is compounded so that the reductions in one year is added to the proportion of reduction in every year following. The second scenario uses the same method, however, the initial reduction begins at six percent.

Limitations

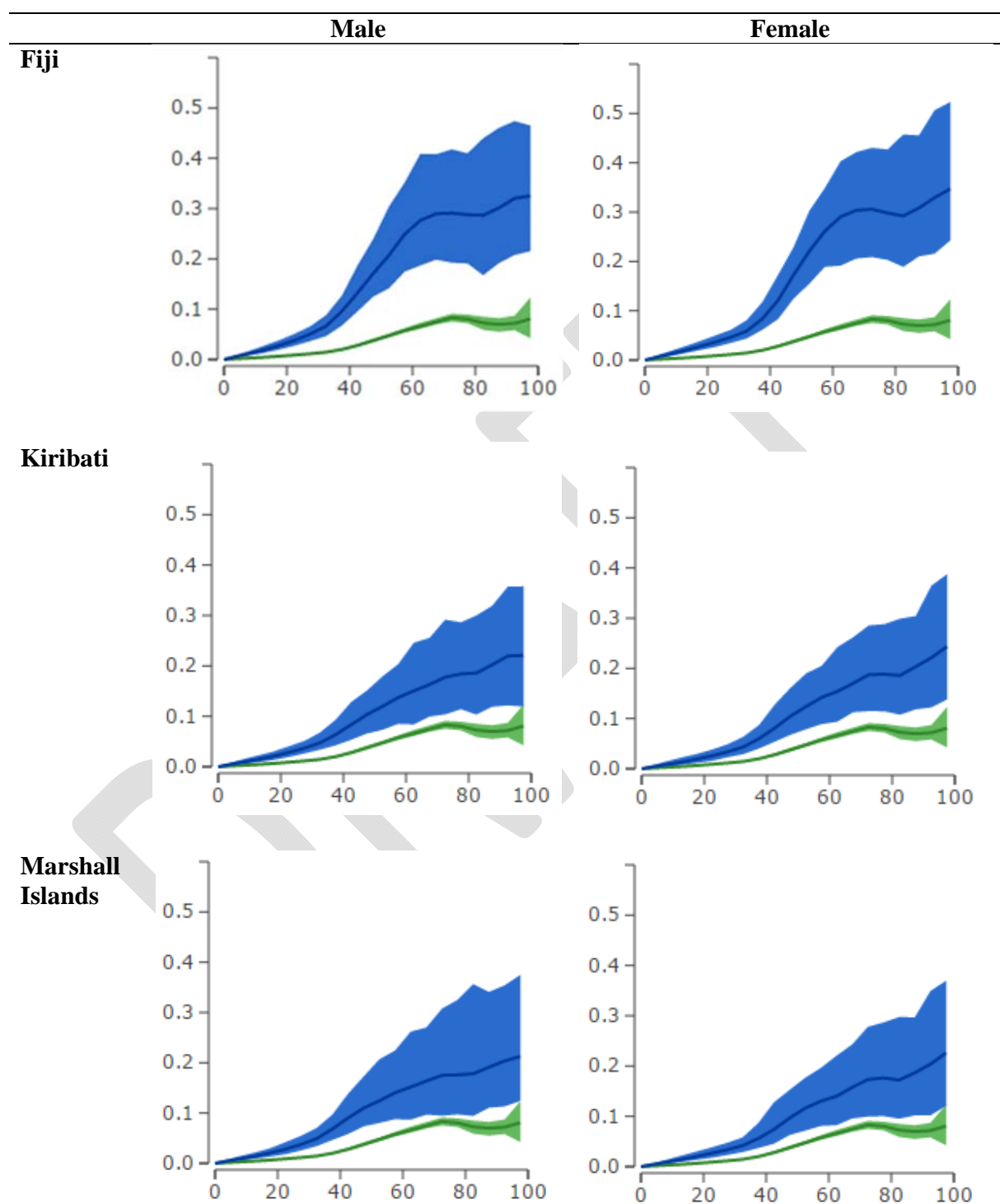
There are a number of caveats that this study needs to acknowledge.

This study does not take into account the distribution of NCDs across income levels. It is well known that disease is not impartial and that the less educated are encumbered by more than their equal share of the disease burden. The less educated tend to earn lower wages while the assumption states that an individual cured of a disease would on average earn the expected wage of an economy. Therefore, the estimated loss of output may be overestimated.

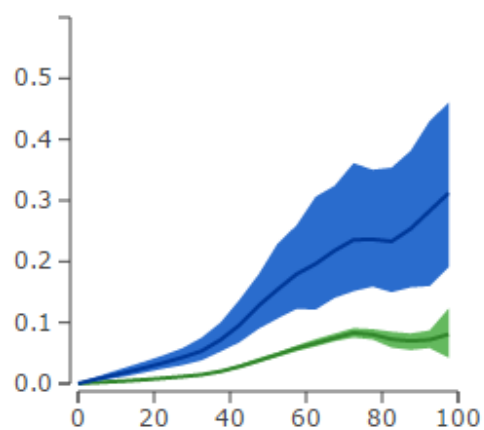
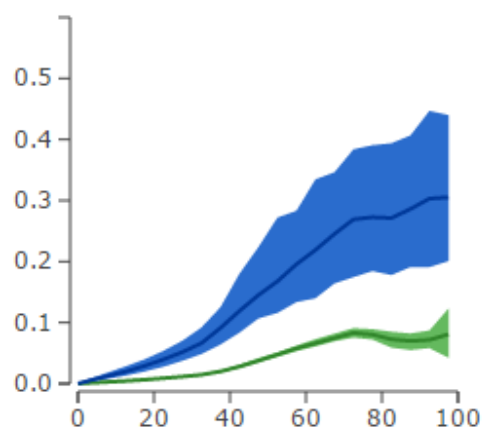
Second, the costs associated with diabetes morbidity are not all encompassing. Among the costs not calculated in this study are the loss of income (and productivity) for those who are withdrawn from the labor force to look after diabetic family members. Temporary disability, as in the case where a diabetic is withdrawn from the workforce for a short period, is not accounted. The Pacific Island countries are known to receive a high number of remittances. The lack of inclusion for this form of income may cause overestimation in the lost income estimates. However, the households with diabetics receiving remittances may use this income to ease the burden of diabetes i.e. to supplement the family members caring for the ill. These remittances, used to ease financial burden associated with disease, can then be considered an indirect cost of morbidity. The degree to which this is the case is difficult to determine.

Third, tax rates are often changed intermittently and, for some countries, the tax rate is a fixed fee within an income range, plus a proportion out of every unit over the lower bound of the bracket. Under such scenario, a constant tax rate was calculated and given as the fixed fee plus the proportion out of every unit up to the GDP per employed, as a proportion of the GDP per employed, using this rate for all years.

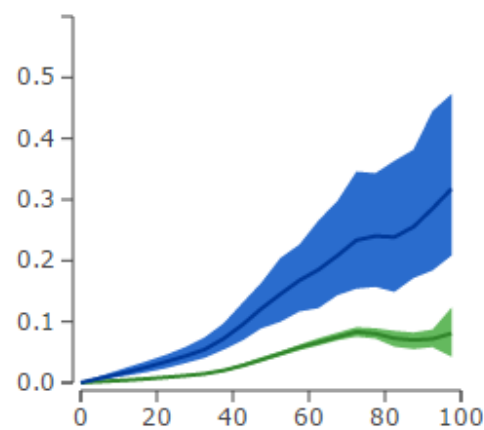
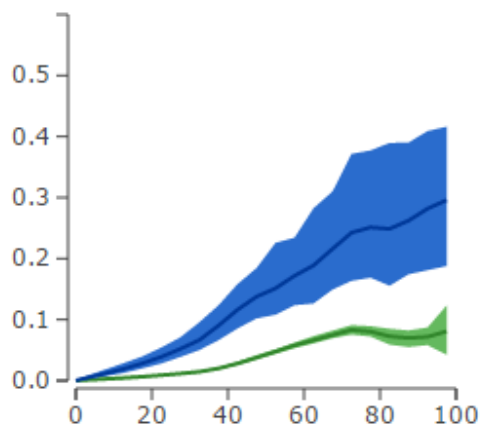
Annex 3: Diabetes Prevalence Rates by Age, 2013



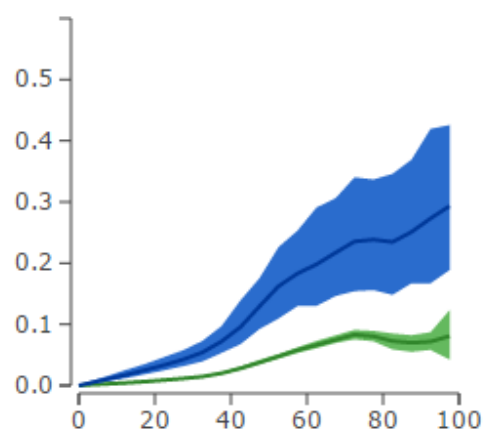
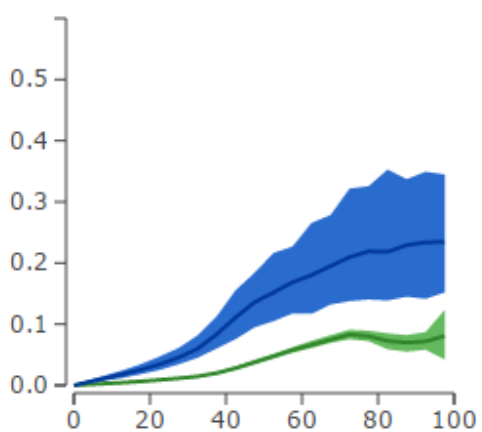
Micronesia (F.S.O)



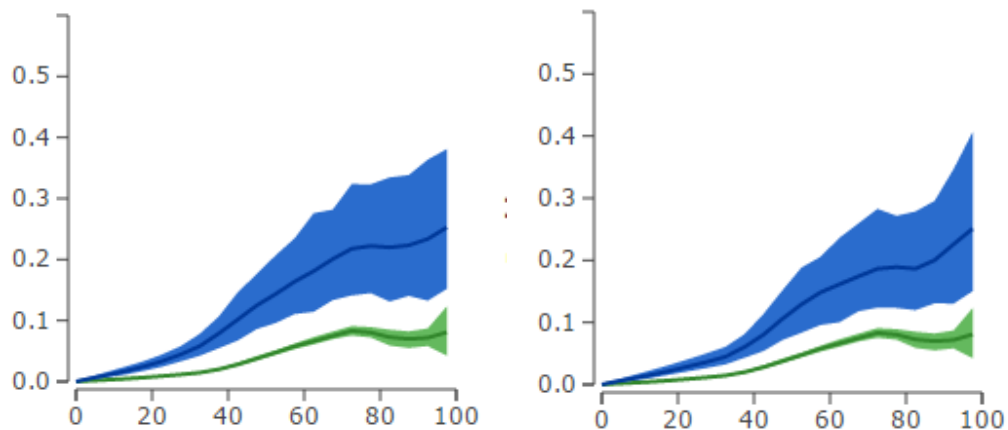
Papua New Guinea



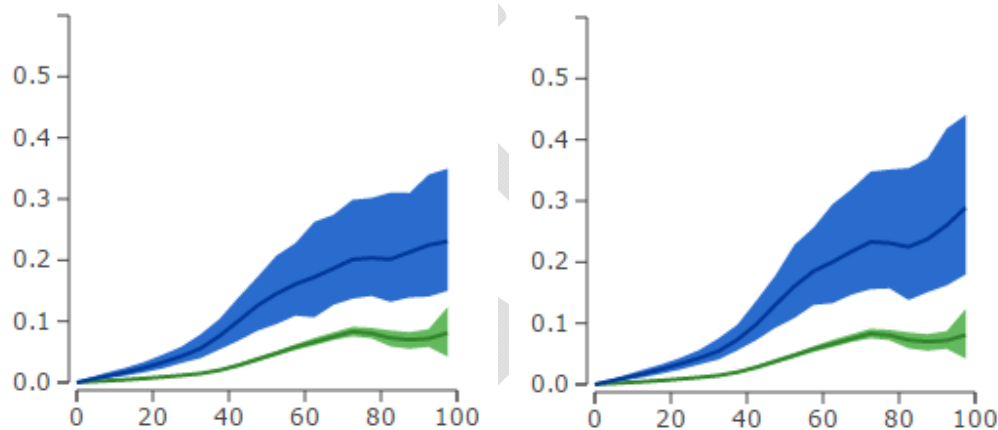
Samoa



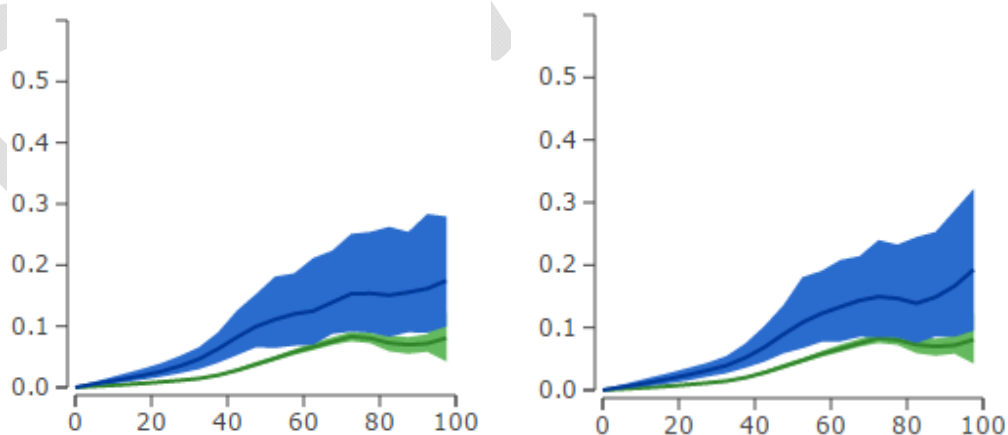
Solomon Islands



Tonga



Vanuatu



Source: International Health Metric and Statistics.

Note: Graphs from the Institute for Health Metrics and Evaluation (IHME) Epi Visualization Tool, y-axis for each graph is the prevalence rate, x-axis is age, dark green line is the global prevalence rate encompassed by its light green confidence level, dark blue line represents country specific prevalence rate encompassed by light blue confidence interval, results based on modeling.

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