

The costs and affordability of drug treatments for type 2 diabetes and hypertension in Vanuatu.

Authors: Ian Anderson,¹ Amanda Sanburg,² Howard Aru,³ Len Tarivonda,⁴ Susan Ivatts,⁵ Rufina Latu,⁶ Jacob Kool⁷.

Corresponding author: Ian Anderson, 69 Blackwood Terrace, Holder, ACT, 2611, Australia. Telephone: +61 2 6288 4989. Email: ian.anderson.economics@gmail.com

Key words: costs and affordability of preventing and treating Type 2 diabetes and hypertension; developing countries; benefits of health promotion and prevention; Vanuatu.

¹ Centre for International Health, Curtin University, Western Australia; Economist Consultant to the World Bank,

² Principal Pharmacist*, Ministry of Health, Vanuatu

³ Director General*, Ministry of Health, Vanuatu

⁴ Director, Public Health*, Ministry of Health, Vanuatu

⁵ Senior Health Specialist, The World Bank.

⁶ Technical Officer, World Health Organization

⁷ Country Liaison Officer*, World Health Organization

*At the time of the data collection and submission of the manuscript for publication

The costs and affordability of drug treatments for type 2 diabetes and hypertension in Vanuatu.

Abstract

Non-communicable diseases (NCDs), including diabetes and hypertension, pose increasingly significant health, policy and financing challenges in Vanuatu, a lower middle income Pacific Island country. Pharmaceutical costs to Government are becoming unsustainable.

We show how pharmaceutical cost to Government rise in large, step-wise, patterns as diabetes or hypertension progressively becomes more severe. For diabetes, pharmaceutical costs to Government increased more than four-fold from \$5.59 per patient per year (pppy) to \$24.55 pppy in Vanuatu in late 2012 as a person moves from regular testing of blood glucose levels to first stage oral medication. Pharmaceutical costs increased again to \$ 367 pppy when insulin and other associated drugs are required. For hypertension, pharmaceutical costs to Government increased more than twelve times as the patient advances from first line drugs to additional drug therapy (\$1.38 pppy to \$17.58 pppy), eventually rising to \$75 pppy if additional drugs are required.

Progression of diabetes and hypertension to more advanced stages squeezes an already tight Government health budget. One patient requiring insulin absorbs the equivalent drug allocation of 76.4 other citizens. Only 1.31% of the total population could be treated with insulin, or 5.3% treated with the full regime of anti-hypertensive drugs, before the total Government drug budget for the country was fully spent.

Primary and secondary prevention of diabetes and hypertension is therefore a particularly important policy priority. 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. Those able to avoid or control hypertension through adopting healthy lifestyles would avert costs to Government for drugs of up to \$ 75 per person per year: the equivalent of what the Government currently spends on average on 18 other citizens.

Introduction: diabetes and hypertension as a development issue.

Non-communicable diseases⁸ (NCDs), including diabetes⁹ and hypertension¹⁰, are increasingly being recognised as a development issue (2-5). The World Health Organization (6) estimates that two thirds of global deaths in 2008 were caused by NCDs, more than all other causes combined. Around 80% of these deaths occurred in low and middle income countries (6). NCDs also account for half of all global disability (7). The UN Secretary General’s report to the UN General Assembly High Level Meeting on Prevention and Control of NCDs of September 2011 concluded that:

“Non-communicable diseases affect the developing world and lower-income populations hardest. Strong evidence links poverty, lack of education and other social determinants to such diseases and their risk factors. A vicious cycle is created by the epidemic, whereby non-communicable diseases and their risk factors worsen poverty, while poverty results in rising rates of such diseases. The prevention of non-communicable diseases would reduce poverty, particularly since the majority of expenditures for treatment in low- and middle-income countries are paid privately or from out-of-pocket health-care systems. At the same time, because of the magnitude of the illness, the disabilities and premature deaths they cause and the long-term care required, non-communicable diseases reduce productivity and increase health-care costs, thereby weakening national economic development.”

⁸ The World Health Organization (WHO) states that “Noncommunicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression. The four main types of NCDs are cardiovascular diseases (like heart attacks and strokes), cancers, chronic respiratory diseases (such as chronic pulmonary disease and asthma) and diabetes.” 1. WHO. WHO Noncommunicable Diseases Fact Sheet. 2011.

⁹ WHO definition of diabetes is available at <http://www.who.int/mediacentre/factsheets/fs312/en/index.html>

¹⁰ There are different definitions of hypertension, and disagreements about appropriate cut-off levels. This paper defines hypertension as blood pressure of 140/90 mm Hg or higher.

The World Bank noted at the same UN High Level Meeting on NCDs that “what makes the NCD challenge particularly daunting for many developing countries is that, compared to their higher-income counterparts, they will face higher levels of NCDs at earlier stages of economic development, with fewer resources, and with less time to respond effectively” (8). Recent studies estimate that almost three quarters of people with hypertension – around 639 million – live in developing countries, and that a number of the risk factors for hypertension seem to be more common in developing countries than in developed regions, including tobacco use, rapid urbanisation, and possibly genetic factors (9).

Of particular concern are the high rates of *premature* (that is, under 60 years of age) deaths from NCDs in the Pacific, as this indicates loss of potentially productive social and economic years. Figures One and Two below show the relatively high rates of premature deaths from NCDs for males and females in the Pacific compared to other lower-middle income countries.

Figure One

Source: WHO (2011) *Noncommunicable Diseases Country Profile*

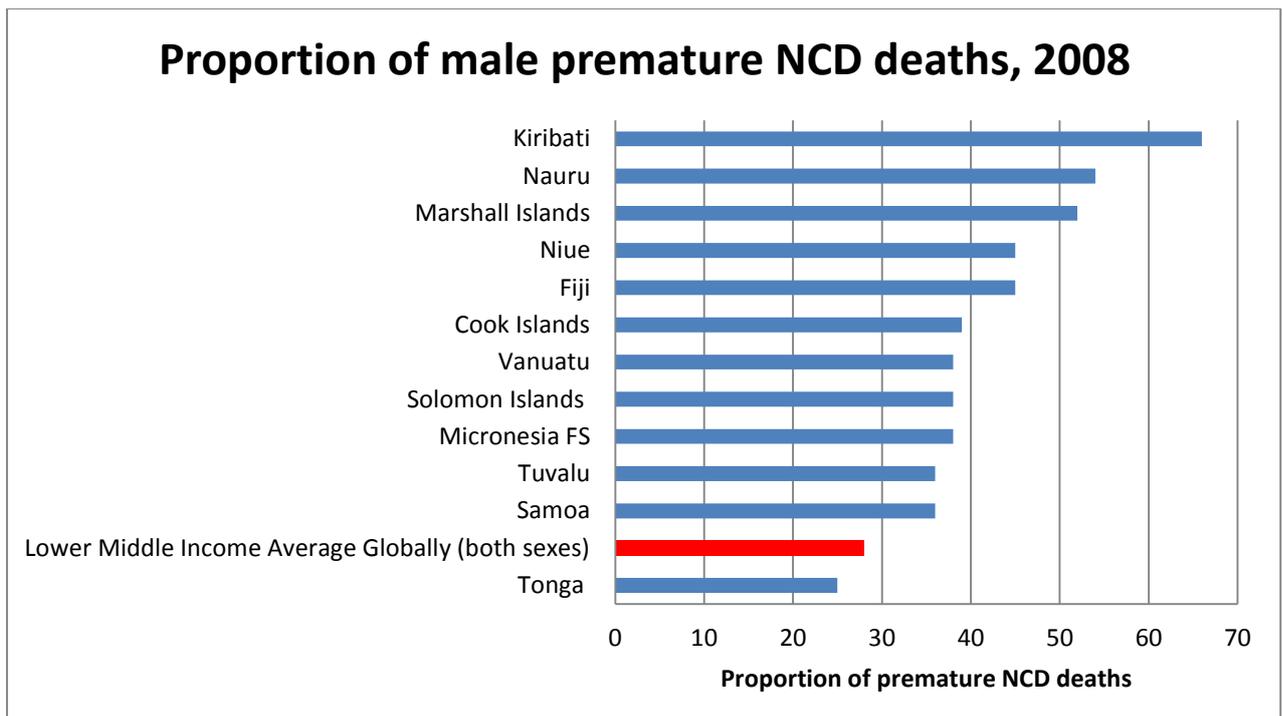
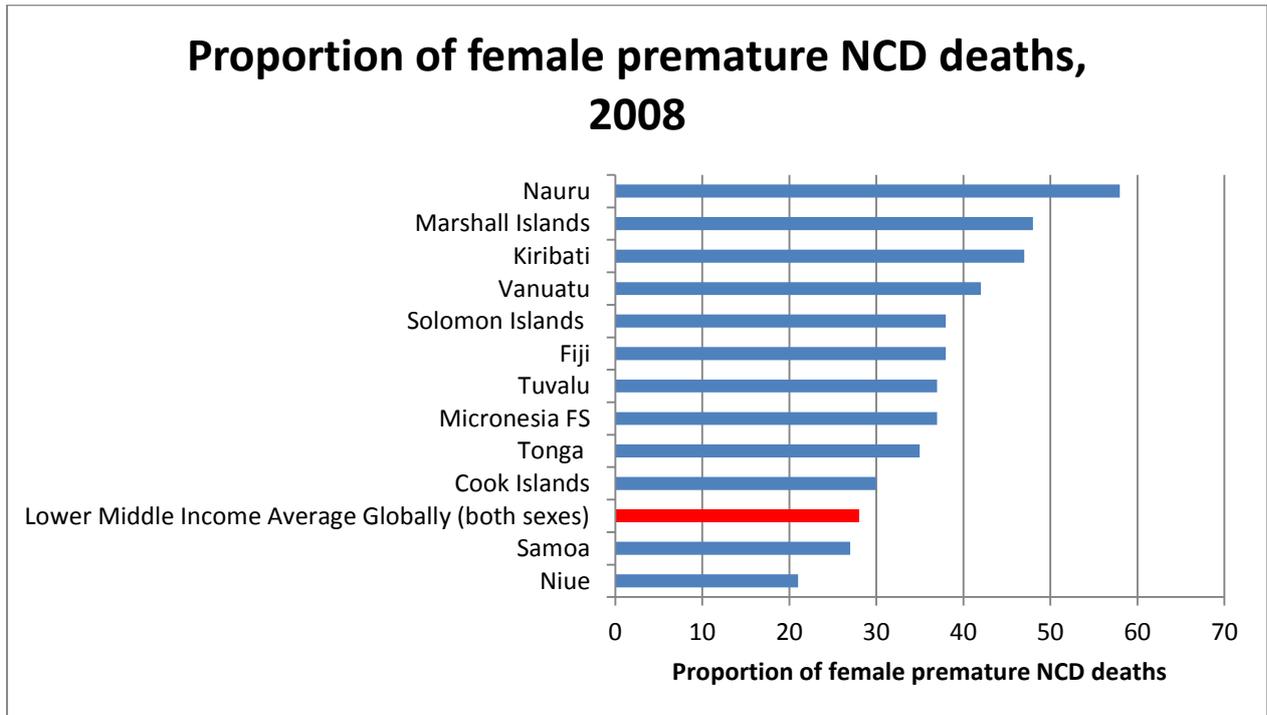


Figure Two

Proportion of female premature NCD deaths 2008

Source: WHO (2011) Noncommunicable Diseases Country Profile



Diabetes and hypertension impose large – but often preventable – health, financial, and economic burdens on individuals, health sectors, and governments (10-12). WHO estimates that 346 million people worldwide have diabetes; that 80% of diabetes deaths occur in low and middle income countries; and projects that diabetes deaths will double between 2005 and 2030 (13). The International Diabetes Federation argues that diabetes caused at least \$¹¹ 465 billion in health care expenditure globally in 2011, 11 % of total health care expenditure of adults (14). Diabetes is a particular challenge in developing countries where an estimated 80% of people with diabetes live

¹¹ Current United States dollars used throughout this article unless otherwise stated.

(15). Hypertension is also a significant and growing problem: almost three quarters (639 million) people with hypertension now live in developing countries, but with limited access to essential health services (9). Diabetes and hypertension impose broader economic costs too. The prevalence of diabetes for people of working age (less than 60) is higher in lower and middle income countries than it is in high income countries (14). This suggests that, other things being equal, fewer people are available full time in the work force to generate revenues for services to the very young and the elderly: the dependency ratio worsens¹². Cardiovascular diseases and hypertension can result in disabling strokes, and diabetes in loss of limbs and vision, further reducing the potential for economically productive lives.

Diabetes and hypertension are significant challenges in the South Pacific (16-21). A recent study involving pooled data of 2.7 million people globally found that those in Oceania had the highest fasting plasma glucose (6.1 mmol/L for men and women) of any region in the world (22). Over one third of the adult population has raised blood pressure in eight out of the ten Pacific Island countries, and three quarters of the population are overweight in seven out of ten countries, for which data is available (23). The average weight of a woman in Tonga has increased by 21.1 Kg in the last 30 years to reach 95 Kg. For men, the increase is 17.4 Kg to reach 95.7Kg (24). Increased food availability, rapidly changing diets, physical inactivity and possibly genetic factors help explain the rise in obesity and overweight prevalence.

Vanuatu faces several health challenges. Vanuatu is a relatively small (population 249,528) lower-middle income (GNI per capita of \$US 2750)¹³ country ranked 125 out of 187 countries in the United Nations Human Development Index for 2011. Vanuatu faces a double burden of disease: NCDs now contribute to 70% of all deaths, while maternal, newborn and nutritional disorders contribute a

¹² This requires further study in the Pacific, where levels of unemployment and under-employment can be quite high to begin with. The study by Falconer for example found that 40% of patients with diabetes in Vanuatu were not employed.

¹³ Vanuatu has an estimated Gross National Income of 4,330 'International Dollars': a notional figure that reflects the costs of goods and services, and therefore the Purchasing Power Parity (PPP) of income in that country.

further 25% (23). NCDs now contribute over half (56%) of years of life lost, whilst communicable diseases still contribute over one third (35%) (23). Latest reports from UNICEF state that nearly 7 per cent of all children in Vanuatu are severely stunted and 20 per cent moderately stunted (25).

Diabetes and hypertension are growing health challenges in Vanuatu. Diabetes is the sixth known cause of death in 2011 and the third highest NCD reported: 294 new cases of diabetes were reported in 2011 (26). There is no formal diabetes register in Vanuatu at present. However, based on usage data from the Vanuatu Central Medical Store, approximately 62 people are currently being treated with insulin. This is likely to be an underestimate because of the often asymptomatic nature of early stage diabetes and consequent under-diagnosis. Limited capacity for vigorous, nation-wide, screening for early detection of diabetes is also a major cause for underestimation. Hypertension is also a challenge. A recent WHO supported NCD STEPS survey¹⁴ found that approximately 30.8% of males and 26.7% of females of the 4671 surveyed adults had raised blood pressure. Around 95% of males and females of that sample were found to have raised blood pressure but were not currently on medication.

Of particular concern is the prevalence of risk factors for diabetes in Vanuatu, potentially feeding a pipeline of significantly increased and widespread incidence of the diseases. WHO estimates that rates of mean fasting blood glucose for women rose from 4.6 mmol/l in 1980 to 5.3 mmol/l in 2008, and from 5.2 to 5.4 for males over the same period (23). The NCD STEPS survey found that almost one in five adults had impaired fasting blood glucose, a risk factor for Type 2 diabetes. More than one fifth (22 %) of adults of working age (25 – 64 years) have three or more risk factors for acquiring any NCD. Only around 10% of adult men (7.5% - 11.9%) and 5% of adult women (3.6%-8.5%) did not demonstrate signs of any of the major NCD risk factors (27).

¹⁴ The survey involved a multi stage cluster sampling that then surveyed 4671 adults aged 25-64 between July and October 2011.

Demographic pressures will add to these risks, and the cost burdens to Government. Vanuatu currently has a youthful age structure, with a median age of 20.5 years. However 35% of the population are also aged between 25 and 59 years (28). Ageing of the population will therefore see an increase in heart, vascular and diabetes related deaths and disability in future years unless strong preventive measures are taken. Importantly, the current relatively youthful demographic structure does not necessarily translate into a capacity to then finance public health care costs: only 23,584 people contributed to the National Provident Fund in 2010, which the Ministry of Finance see as a proxy for the size of the formal workforce. Even if the size of the formal economy increased, there is no income tax in Vanuatu to generate revenue for Government, including an increasingly over-stretched public health system.

Method

It is important to understand the pharmaceutical costs of treating diabetes and hypertension for four reasons. First, the Government of Vanuatu bears virtually all the costs of pharmaceuticals and other health services as there are negligible co-payments or insurance reimbursements. Second, and as a result, the pharmaceutical budget is an important part of public expenditure. Total expenditure on the pharmaceuticals line item in the budget was \$1.37 million (Vt 123.5 million) in 2012, making it the fourth largest item of expenditure within the budget for health that Government appropriated from its own resources. That budget line item included budgets for vaccines, laboratory consumables, dental and X rays. After allowing for these items, the Government's Central Medical Store has, in effect, a budget of \$998,000 (Vt 90 million) for drugs and dressings. With a population of around 249, 528 this gives a notional allocation for drugs from Government's own resources of \$ 4 per person per year (Vt 360). Third, Government expenditure on pharmaceuticals has, along with salaries and allowances, been a source of budget over-runs, requiring supplementary budgets and requests for substantial emergency funding from development partners. Fourth, the

rise of diabetes and hypertension will put unsustainable pressure on a public health system that currently allocates around \$ 64 (Vt 5849) per person per year from government appropriations to health care. Despite its importance to policy makers and framers of budgets, however, little is known about the actual costs of treating diabetes and hypertensive patients in Vanuatu. Falconer's study is informative but is now becoming a little dated, drawing on surveys in 2006, and did not extend to costs of hypertension (29).

Against that background, we sought to estimate the pharmaceutical cost to Government of treating Type 2 diabetes, and hypertensive, patients in Vanuatu during late 2012. The objective of the study was to estimate how the financial cost to the Government's pharmaceutical budget increased as the disease progressed, and then place those estimates in the context of Government health expenditure and overall affordability. The unit of analysis was the direct pharmaceutical drug cost to Government as it is the substantial source of drug expenditure. Data limitations did not allow the analysis to extend to other direct medical costs, including doctors' and nurses' time, other medical equipment used including syringes or dressings, diagnostic tests including X rays, patient referrals, surgery or other related treatment arising from medical complications of diabetes or high blood pressure, or administrative overheads. Data and time limitations did not permit analysis of direct (out of pocket) or indirect (foregone income) costs to individuals or their carers.

The **method, data sources, approach and assumptions** were as follows. We used Vanuatu Government Standard Treatment Guidelines for treating a patient with Type 2 diabetes or hypertension including recommended generic brand and dosage of drug throughout the progression of the disease. We recognise that for many patients, diabetes and hypertension coexist as comorbidities or "bad companions" to each other¹⁵ (11). However for ease of exposition we first show how pharmaceutical cost rises for diabetes as the disease worsens, and then separately show

¹⁵ Ferrannini and Cushman estimate that, globally, high blood pressure is reported in over two thirds of patients with Type 2 diabetes and in patients with diabetes, hypertension produces and increased risk of cardiovascular disease

how costs increase for hypertension. We used current prices in October 2012 from the Government owned Central Medical Stores as the source of pricing and cost to Government for drugs.

Table 1 below summarises the actual unit costs of the main drugs used in treating diabetes and hypertension , the dosage used at various stages in the disease in Vanuatu, and the average annual cost at each stage of treatment.

Table 1

Pharmaceutical costs of treating diabetes and hypertension in Vanuatu in October 2012

Source: Government of Vanuatu

Disease stage	Pharmaceutical product used	Unit price in \$US (Vatu in brackets)	Dosage used in Vanuatu	Additional Cost to Government of treating one patient in one year	Cumulative cost to Government of treating one patient per annum.
DIABETES					
First line testing	Blood glucose testing strips	\$0.47 (Vt 42) per strip	One test per month	\$ 5.59 (Vt 504)	\$5.59 (Vt504)
Oral medication stage	Metformin 500 mg	\$0.01 (Vt 1.17) per tablet	4 tablets per day	\$ 18.96 (Vt 1708)	\$ 24.55 (Vt 2212)
Oral medication	Glibenclamide 5mg	(0.5Vt) per	4 tablets per	\$ 8.10	\$32.65

September 30, 2013

stage 2			tablet	day	(Vt 730)	(Vt 2942)
Insulin	stage	Biphasic Insulin	\$13.82	40 units per	\$ 262	\$ 305.78
with metformin			(Vt 1245)	day. ¹⁶	(Vt 23,655)	(Vt 27,548)
and weekly			per vial of	Metformin	for insulin	
blood glucose			1000 units.	dosage		
testing				remains the		
				same but		
				blood glucose		
				testing		
				increased to		
				once a week		
				but		
				glibenclamide		
				discontinued.		
Insulin	stage	150 mg Aspirin and	0.4 Vt /tab	One per day of	\$ 61.17	\$366.95
with additional		20 mg Simvastatin	aspirin.	aspirin and	(Vt 5511)	(Vt 33,059)
drugs		and 20mg Enalapril	10.7Vt/tab	simvastatin.		
			simvastatin	Four per day of		
			and	enalapril		
			1Vt/5mg			
			tab			
			enalapril			

¹⁶ We assume there would be some inevitable wastage and spillage as the insulin is withdrawn from the vial. We therefore assume 50 units are actually withdrawn (40 of which are delivered to the patient). The cost is therefore 50 units * 365 = Vt 18,250 units, or 18.2 vials. In practice, this would equate to 19 vials. 19 vials * Vt1245 per vial = Vt 23,655 or \$262.

September 30, 2013

HYPERTENSION

First line drug therapy	Hydrochlorothiazid e 12.5mg-25mg	\$0.38 for 100 tablets	One tablet per day	\$1.38 (Vt 124)	\$1.38 (Vt 124)
		(Vt 0.34 per tablet)			
Additional drug therapy	Enalapril	\$0.01 (Vt 1 per 5mg tablet)	Two tablets twice a day	\$16.21 (Vt 1460)	\$17.58 (Vt 1584)
Further drug therapy	Atenolol ¹⁷	(Vt 3.12 per tablet)	50 mg once daily	\$12.64 (Vt 1,139)	\$30.23 (Vt 2723)
Non-hypertensive drug therapy in addition	Aspirin for blood thinning and Simvastatin for cholesterol	Vt 0.4 per 150 mg tablet for aspirin and Vt 10.7 per 20 mg simvastatin	Daily	\$ 44.91 (Vt 4046)	\$75.14 (Vt 6769)
				comprising \$1.62 (Vt 146)	for aspirin and \$43.35 (Vt 3900)
				for	simvastatin

Results

¹⁷ The alternative treatment in Vanuatu is Nifedipine. The cost is \$13.04 per year (Vt 3.22 per 20 mg tablet), taken once a day, which is similar to the \$12.64 for Atenolol.

In the case of diabetes, pharmaceutical costs to Government are initially low, but then rise in a step wise fashion. As seen from Table 1, glucose testing strips cost the Government \$ 5.59 per patient per year at the initial testing stage. If advice on lifestyle and diet changes are not successful, oral medication in the form of metformin tablets are prescribed. The cost to Government of one 500 mg Metformin tablet to help control blood sugar levels is \$ 0.01 (Vt 1.17) per tablet. As blood glucose testing strips are still used on a monthly basis, total direct pharmaceutical costs rise to \$24.55 per patient per year. If the diet and metformin are insufficient to control the diabetes, a second oral medicine is added, Glibenclamide. Dosage commences at 5mg daily but can rise to a maximum of 10mg twice a day. Adding in the additional costs of \$ 8.10 (Vt 730) per patient per year for glibenclamide increases the total drug cost to the Government of \$32.65 (VT 2942) per patient per year. At this stage blood glucose testing may also increase with associated costs dependent on frequency of testing.

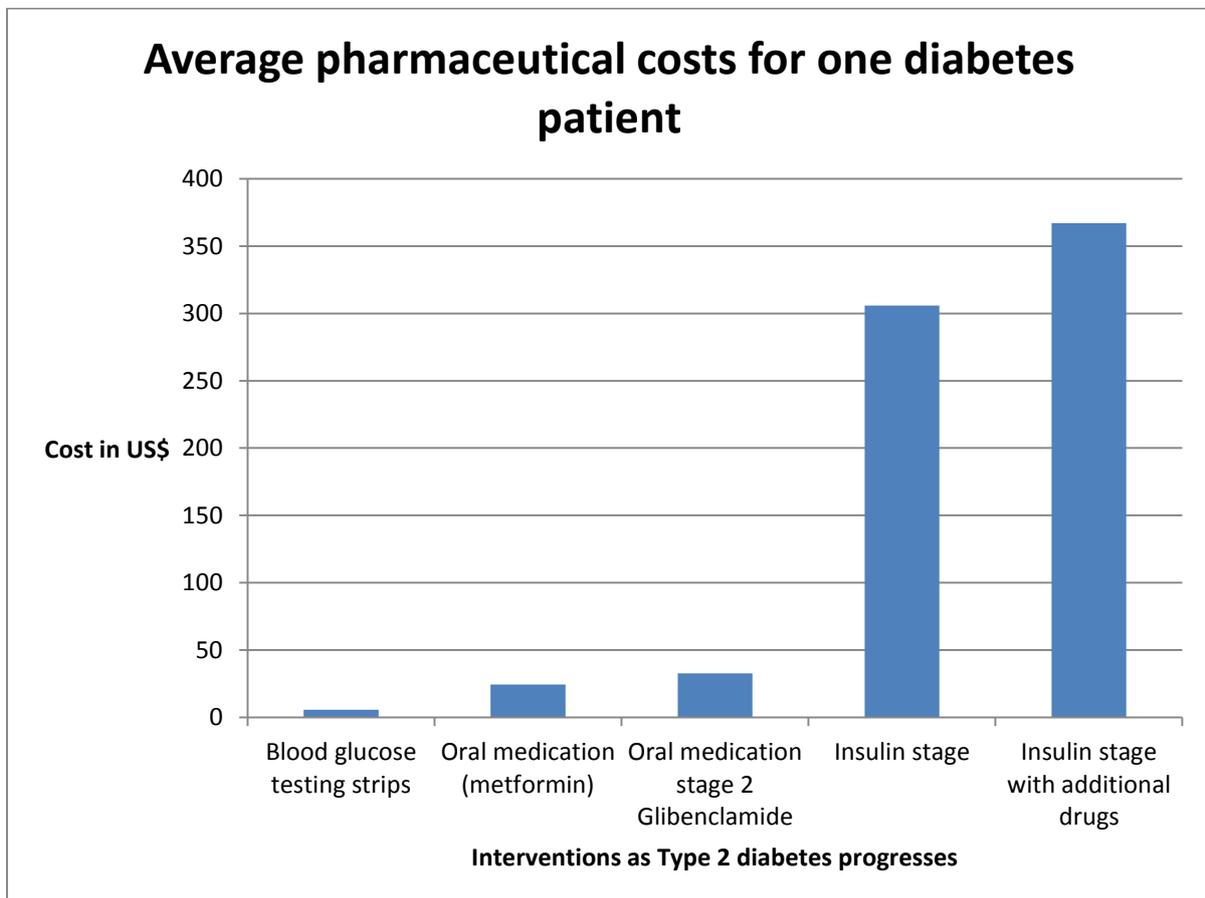
If the disease progresses further and insulin is required the costs rise dramatically. The drug cost of insulin alone adds a further \$ 262 (Vt 23,655) per patient per year at a conservative dose of 40 Units daily. Dosage of 1 g metformin twice daily would continue provided renal function remains adequate. Glibenclamide would be discontinued, but the frequency of testing for blood sugar levels would increase from monthly to weekly tests at a health facility. (Ideally, blood sugar levels would be tested daily, but the vast majority of patients in Vanuatu cannot afford a glucometer and the testing strips and so rely entirely on public health facilities). In total, this would bring the net cost of drugs to \$305.78 per patient per year: a more than twelve fold increase from the oral medication stage using metformin. Experience in Vanuatu and elsewhere suggests that when a patient's diabetes has progressed to the point of requiring insulin, there are usually other risk factors present, including high cholesterol and high blood pressure, or the diabetes has triggered medical complications affecting target organs which require additional drug treatment. Most commonly, aspirin,

simvastatin¹⁸ and enalapril are added, incurring an additional \$61.17 (Vt 5511) to treatment costs each year. This brings the total pharmaceutical drug cost to Government to \$366.95 (Vt 33,059) per patient per year: a 15 fold increase in costs from oral medication using metformin. The increase in direct pharmaceutical costs to Government as the disease progresses is displayed in Figure 3 below.

Figure 3

Progression of average pharmaceutical costs per patient per year for Type 2 diabetes in 2012

Source: Government of Vanuatu Ministry of Health



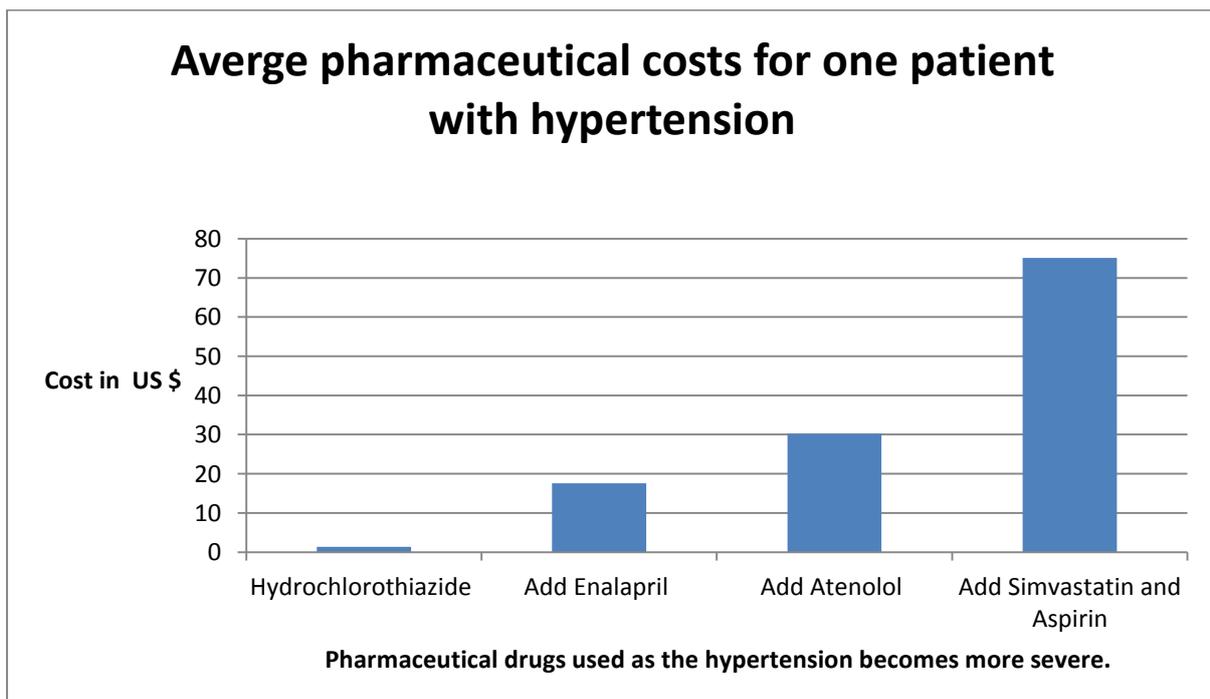
¹⁸ Statins have been approved for restricted use recently but the Government is still awaiting supplies.

A similar exercise was also done to estimate the pharmaceutical costs of treating hypertension in Vanuatu. The increase in cost of drugs to the Government as the hypertension progresses is displayed in Figure Four below.

Figure Four

Progression of average pharmaceutical costs per patient per year for hypertension in 2012

Source: Government of Vanuatu Ministry of Health



Discussion

The first point to note is that **drug costs to Government escalate significantly if diabetes and / or hypertension progress to more advanced stages.** Costs do not move gradually, or smoothly.

Instead, as Figures 3 and 4 shows, drug costs move in large, step wise, fashion as the disease progresses and more expensive / intensive pharmaceutical products are required. Costs increase more than four- fold as a patient moves from the stage of close monitoring, lifestyle changes and no-medication to initiating oral medication using metformin. Costs increase again if glibenclamide is added to the regime. Costs then increase if the disease further progresses and the patient moves to insulin: a more than twelve fold increase between the oral medication using metformin stage to insulin. There is a sixty five-fold increase in costs between first line testing (\$5.59) and insulin with additional drugs (\$366.95). Similarly for hypertension: costs increase more than twelve times as the patient's treatment moves from hydrochlorothiazide to addition of enalapril (\$1.38 per patient per year to \$17.58 per patient per year), almost doubling to \$ 30.23 with the addition of atenolol or nifedipine, and then more than doubling again to \$75.14 if simvastatin is added to the regime.

Second, the **steep increase in costs as the diseases progress has the potential to quickly exhaust the Government's pharmaceutical budget at relatively low levels of service coverage.** As noted above, the notional budget allocation for drugs from the Government's Central Medical Store is the equivalent of \$4 per person per year in Vanuatu. Provision of additional essential drugs for those with diabetes and hypertension is obviously important if the disease progresses. But it does come at a high "opportunity cost" in terms of the number of people that could be treated with drugs for other diseases in Vanuatu. As Table 2 shows, a diabetes patient who requires oral medication involving metformin tablets to stabilise blood sugar levels absorbs the equivalent of 6.14 other person's notional drug allocation for the year. If the diabetes then progresses to a more advanced stage and an insulin regime is required, this absorbs the equivalent of 76.4 other person's notional drug allocation rising to 91.7 person's notional drug allocation if simvastatin and other drugs are employed. There are similarly high opportunity costs arising from hypertension treatment: adding atenolol to the drug regime for one hypertensive patient is the equivalent of the notional drug allocation of another 7.5 persons.

The third point to note is that even relatively low costs of drugs can become unaffordable in a low resource setting such as Vanuatu. The right hand column of Table 2 shows that, with a notional drug allocation averaging \$4 per person per year, only 16% of the total population could be supplied with early stage oral medication using metformin for diabetes before the total budget for the Government's Central Medical Stores was fully spent. Only 1.31 % of the population could be treated with insulin before the total nation-wide pharmaceutical budget was fully spent, or 1.09 % if additional drugs such as simvastatin were added. Similarly for hypertension: only 13.26 % of the population could receive the combination of hydrochlorothiazide + enalapril + atenolol before the total pharmaceutical budget for the year was spent. This is not sufficient to cover all those in need, especially when the latest NCD STEPS survey found that prevalence of hypertension is high.

Table 2

Number and percentage that can be treated.

Source: Government of Vanuatu Ministry of Health

Stage of Disease	Drug costs per annum per patient	Number of other people's notional allocation of \$4 per person used	Number of people that could be treated at that level before Government's total pharmaceutical budget exhausted.	Per cent of the total population that could be treated at that level before Government's total pharmaceutical budget exhausted
Diabetes				
Glucose testing	\$5.59	1.4 persons	178,571	72%

September 30, 2013

strips

Oral medication	\$24.55	6.14 persons	40,717	16%
-----------------	---------	--------------	--------	-----

(metformin)

Oral medication	\$32.65	8.1 persons	30,618	12%
-----------------	---------	-------------	--------	-----

(metformin with
glibenclamide)

Insulin	\$305.78	76.4 persons	3,270	1.31%
---------	----------	--------------	-------	-------

Insulin with	\$366.95	91.73 persons	2,725	1.09%
--------------	----------	---------------	-------	-------

additional drugs

Hypertension

Hydrochlorothiazide	\$1.38	0.34 persons	724,638	290%
---------------------	--------	--------------	---------	------

Adding Enalapril	\$17.60	4.4 persons	56,818	22%
------------------	---------	-------------	--------	-----

Adding Atenolol	\$30.23	7.5 persons	33,079	13.26%
-----------------	---------	-------------	--------	--------

Adding simvastatin	\$75.14	18.78 persons	13,308	5.3%
--------------------	---------	---------------	--------	------

and aspirin

Conclusion

Vanuatu faces important health financing challenges. It has a health system heavily dependent on government financing and provision, but with low absolute levels of domestically generated health expenditure of around \$ 64 per person per year in 2012. This paper shows that just two NCDs – diabetes and hypertension – impose large and ultimately unsustainable pressures on the

Government's pharmaceutical budget. This is especially the case if the prevalence of those diseases increase over time and / or those diseases progress to more advanced stages and cause severe medical conditions requiring more expensive medications. The high level of current risk factors – 30% of the adult population in the recent NCD STEPS survey have raised blood pressure but 95% of those are not on medication – is a potentially ominous warning of future health and financing challenges. The chronic, long term nature of NCDs such as diabetes and hypertension carries implications for Vanuatu's health budget and, ultimately, the Government's longer term fiscal strategies.

While more funding is needed in the health sector, the prospects for substantial increases are limited in the immediate future. This is due to a combination of several factors including relatively modest economic growth in Vanuatu; a narrow tax base (and no income tax); vulnerability to economic and natural disaster shocks; competing Government priorities; and limits to already quite substantial aid funding from development partners. Focusing the country's limited resources on effective primary and secondary prevention through health promotion, lifestyle change, screening, early detection and treatment and effective clinical management are therefore strategic interventions. This would improve health outcomes for large segments of the population, whilst simultaneously averting - or at least postponing - additional expenditure pressures on an already tightly constrained public budget.

There are limitations to this study. The estimated costs are restricted solely to drug costs. Lack of robust data currently precluded estimates of total counselling, surgery, and other treatment and medical overhead costs that Government bears. Nor does the study estimate the extent of direct out of pocket expenses incurred by patients. (However these are thought to be quite low given that Government finances and provides pharmaceutical products usually without charge, or at nominal cost to the patient). Nor, given the absence of data, does the study seek to estimate indirect costs to patients (or their employers) that would be incurred through foregone income as a result of illness

and absence from work. Nor is there sufficiently robust data at this stage on the socio-economic profile of patients to estimate the equity implications and burden of hypertension and Type 2 diabetes. On the other hand, this study is the first to have estimated the pharmaceutical costs of treating various stages of Type 2 diabetes and hypertension in Vanuatu and examined this in the context of broader sustainability of health financing. The study has been particularly conservative in its estimating process, capturing the drug costs of treatment to the Government's Central Medical Store as this data was robust and reliable.

The research and analysis was undertaken as part of wider work on health financing options for Vanuatu undertaken by the Vanuatu Ministry of Health, and supported by the World Bank. Financial support from the Australian Agency for International Development (AusAID) enabled this broader work to be undertaken but AusAID had no role in the analysis or writing of this article. The authors declare no conflict of interest.

Contributions of authors

IA conceived the article and led the drafting and analysis. AS provided information on drug costs, treatment regimes at various stages of disease progression, and worked with IA on the analysis. HA and LT provided policy and programming perspectives from the point of the Ministry of Health in Vanuatu; SI provided policy and programming perspectives from her perspective as Task Team Leader with the World Bank leading a range of analytical work on health financing options for Vanuatu; RL and JK provided input in terms of clinical perspectives of the issues and links to public health policy. The authors confirm they have no conflict of interest in undertaking or presenting this article.

References

1. WHO. WHO Noncommunicable Diseases Fact Sheet. 2011.
2. Abegunde DO, Mathers CD, Adam T, Ortegón M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *The Lancet*. 2007;370(9603):1929-38.
3. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barrón V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *The Lancet*. 2010;376(9754):1775-84.
4. Beaglehole R et al. Priority Actions for the Non-Communicable Disease Crisis. *The Lancet*. 2011;377(9775).
5. Bloom D et al. The global economic burden of noncommunicable diseases. 2011.
6. WHO. Global Status Report on Non-Communicable Diseases. Geneva: 2010.
7. Beaglehole R, Bonita R, Alleyne G, Horton R, Li L, Lincoln P, et al. UN High-Level Meeting on Non-Communicable Diseases: addressing four questions. *The Lancet*. 2011;378(9789):449-55.
8. World Bank. *The Growing Danger of Non-Communicable Diseases: Acting Now to Reverse Course*. Washington DC: 2011.
9. Ibrahim MM, Damasceno A. Hypertension in developing countries. *The Lancet*. 2012;380(9841):611-9.
10. Schiffrin EL. Hypertension: treatments, diabetes, and developing regions. *The Lancet*. 2012;380(9841):539-41.
11. Ferrannini E, Cushman WC. Diabetes and hypertension: the bad companions. *The Lancet*. 2012;380(9841):601-10.
12. Robinson H HK. Non-communicable diseases and health systems reform in low and middle income countries. *Pacific Health Dialog*. 2012;18(1):179-90.
13. WHO. Diabetes: Fact Sheet Number 312 2011.
14. International Diabetes Federation. *IDF Diabetes Atlas Fifth Edition*. 2011.
15. Ramachandran A MR, and Snehalatha C,. Diabetes in Asia. *The Lancet Volume 375*. 2010.
16. Colagiuri S PT, Viali S, Hussain Z and Colagiuri R,. The epidemiology of diabetes in Pacific Island populations. In: Ekoe J RM, Williams R and Zimmet P,, editor. *The epidemiology of diabetes mellitus, second edition: John Wiley and Sons; 2008*.
17. T C. Lifestyle diseases in Pacific communities. 2000.
18. DiBello JR, McGarvey ST, Kraft P, Goldberg R, Campos H, Quesada C, et al. Dietary Patterns Are Associated with Metabolic Syndrome in Adult Samoans. *The Journal of Nutrition*. 2009 October 1, 2009;139(10):1933-43.
19. Lower T NB, Abel M, Ake M, Puloka V, Tiban K,. Curbing the tide: non-communicable disease in the Pacific. *Pacific Health Dialog*. 2005;12(2):61-4.
20. Aitaoto NT BK, Ichiho HM, Kuhau RL,. Diabetes today in the Pacific: reports from the field. *Pacific Health Dialog*. 2005;12(1):124-31.
21. World Bank. *The Economic Costs of Non-Communicable Diseases in the Pacific Islands: A Rapid Stocktake Of The Situation In Samoa, Tonga and Vanuatu*. 2012.
22. Tabák AG, Herder C, Rathmann W, Brunner EJ, Kivimäki M. Prediabetes: a high-risk state for diabetes development. *The Lancet*. 2012;379(9833):2279-90.
23. WHO. Noncommunicable Diseases Country Profiles. 2011.
24. Government of Tonga. *Second National Millennium Development Goals Report*. In: Ministry of Finance and National Planning, editor. 2010.
25. UNICEF. *Global study on child poverty and disparities: national report Vanuatu*. 2012.
26. Vanuatu Go. *Health Information System Annual Report 2011*.

September 30, 2013

27. WHO. Vanuatu STEPS Survey Fact Sheet.: WHO; 2012 [cited 2013 16 April 2013]. Available from: <http://www.who.int/chp/steps/vanuatu/en/>.
28. Government of Vanuatu. National Population and Housing Census 2009. In: Office VNS, editor. 2010.
29. Falconer G BA, Colagiuri R. Counting the cost of type 2 diabetes in Vanuatu. *Diabetes Research and Clinical Practice*. 2010;87:92-7.