Contents lists available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

Counting the cost of type 2 diabetes in Vanuatu☆

Douglas George Falconer, Alexandra Buckley, Ruth Colagiuri **

The Diabetes Unit, Menzies Centre for Health Policy, The University of Sydney, NSW, 2006, Australia

ARTICLE INFO

Article history:
Received 12 December 2008
Received in revised form
20 August 2009
Accepted 28 September 2009
Published on line 28 October 2009

Keywords:
Vanuatu
Type 2 diabetes
Cost

ABSTRACT

Aim: To determine the health system costs, cost to people with diabetes and their carers, and impact on quality of life associated with type 2 diabetes in Vanuatu.
Methods: A cross-sectional paper based survey was administered to 199 people with type 2 diabetes as part of a larger diabetes project.
Results: There were 172 respondents (86% response rate) with a mean age of 56 years (mean duration of diabetes 8 years, 106 females; 67 unemployed). Over the preceding year there were 2352 outpatient visits for health care totalling 442,400 vatu ($4020 USD); 140 overnight hospital stays totalling 1,383,620 vatu ($12,580 USD); and prescription medications costing 3220 vatu/person ($29.20 USD). Major out-of-pocket costs for individuals were the over-the-counter medications totalling 6600 vatu/person/year ($60 USD) for 31 people (18%); transport at 1980 vatu/person/year ($18.00 USD) for 110 people (64%) and special diets for 38 people (22%) costing 36,480 vatu/person ($332 USD). Quality of life was 91/100 on the EQ-5D visual analogue scale.
Conclusions: Given that diabetes in Vanuatu is likely to be significantly under-diagnosed and under-treated the current costs, while substantial are artificially low but are set to rise sharply with increased awareness of diabetes and growing rates of obesity.

1. Introduction

In Pacific Island countries (PICs) such as Vanuatu, three out of four deaths are attributable to non-communicable diseases (NCDs) [1]. The impact of this is felt by individuals who experience personal suffering; families who suffer socio-economic disadvantage and even poverty as a result of these diseases; and national economies which bear the brunt of the lost productivity as well as direct health care costs. Further, it is the poorest people who have the highest risk of developing chronic disease and they are the least able to cope with the resulting financial consequences [2].

Globally, over 60% of the world's mortality is attributable to four major chronic diseases i.e. cardiovascular disease, chronic respiratory disease, diabetes and cancers [3]. Diabetes is a significant contributor to these deaths. Some 246 million people worldwide had diabetes in 2007 [4] and its prevalence is expected to increase from 2.8% in 2000 to 4.4% by 2030 [5]. In developing countries the majority of people with diabetes are in the 35–64 years age range i.e. the productive years of the life cycle [4,5]. Diabetes is already the fifth leading cause of death worldwide [6] and one in ten deaths in economically productive individuals aged between 35 and 64 years can be attributed to diabetes [6]. With 70% of the global increase in diabetes expected to occur in the Asia Pacific region, PICs, with their rapid urbanisation and concomitant lifestyle changes and increases in weight and obesity, are predicted to experience among the greatest increases in diabetes prevalence worldwide [5].

Most PICs have severely limited resources and consequently a severely limited capacity to address the ever increasing burden of diabetes and its consequences. The precise prevalence of diabetes in Vanuatu is not known, but a 2005 survey [7] conducted by the Vanuatu Ministry of Health

☆ Grant funding: Conducted under a 3-year capacity building grant from the World Diabetes Foundation.
* *Corresponding author*. Tel.: +61 2 9036 6357; fax: +61 2 9351 5204.
E-mail address: rcolagiuri@med.usyd.edu.au (R. Colagiuri).
0168-8227/$ – see front matter
doi:10.1016/j.diabres.2009.09.022

indicated high rates of diabetes risk factors and diabetes prevalence is estimated to be similar to other PICs. Prevalence estimates of impaired glucose tolerance (IGT) in similar Melanesian nations such as Fiji, Papua New Guinea and the Solomon Islands were 10.2%, 9.1% and 9.0%, respectively with Vanuatu being estimated at 9.4% [4].

There are a limited number of studies on the cost of NCDs in PICs with even fewer reporting on diabetes. On a global scale, in 2002 the United States spent $92 billion (USD) on direct health costs specific to type 2 diabetes. This is expected to increase to $130 billion by 2020 [8]. The Diabco$t Australia study [9] estimated the burden of diagnosed type 2 diabetes at $3 billion (AUD) per year with an average cost per person at $10,900 including government benefits. A WHO analysis of health care expenditure in the Western Pacific Region found that 16% of hospital expenditure was due to diabetes with overall direct health costs of diabetes ranged from 2.5% to 15% of annual health care budgets depending on local diabetes prevalence and the sophistication of treatment available [10].

The cost of diabetes in Vanuatu was previously unknown. However, national health expenditure in terms of health as a percentage of the government budget was 19.6% in 2005 [11] which represented 4.1% of GDP. Only 1.2% of health expenditure was allocated to prevention. A 2003 economic assessment of the impact of non-communicable diseases on hospital resources in Tonga, Vanuatu and Kiribati estimated that 5.8% of admissions to public hospitals were due to NCDs and that these patients had a longer hospital stay. The average length of stay for people with diabetes in Vanuatu in this study was 13.3 days compared with the average overall length of stay for all causes of admission of 4.9 days [12].

In countries such as Vanuatu, where resources are already stretched, it is vitally important to identify current costs relating to type 2 diabetes and prioritise the allocation of funding to reduce costs through risk reduction, early diagnosis and effective treatments in order to mitigate the full weight of the personal, societal and economic repercussions of diabetes.

The aim of this study was to determine the individual and societal cost of type 2 diabetes in Vanuatu i.e. cost of treatment (health system cost), cost to people with diabetes and their carers (out-of-pocket expenses), and intangible costs (impact on quality of life).

2. Subjects, materials and methods

This cross-sectional cost of illness survey was conducted as a component of a number of baseline assessments for a larger diabetes capacity building project in Vanuatu, which aimed to reduce diabetes complications by improving the quality, accessibility and effectiveness of care [13]. A convenience sample of 199 people with known diabetes (83 males, 116 females) drawn from the Port Vila Central Hospital catchment area, who had been screened for complications under the capacity building project, were selected to participate in the cost of illness survey.

A paper based survey instrument, ''Questionnaire for persons with diabetes in Vanuatu'' was adapted from the Australian Diabco$t questionnaire [9] in collaboration with local diabetes staff to optimise its cultural relevance to Vanuatu. The questionnaire was administered by in-country project staff who were trained to administer the questionnaire which sought self-reported information for the preceding 3 months about the direct and indirect health care and non-health care costs for people with type 2 diabetes, costs to carers, and the impact of type 2 diabetes on quality of life.

Total health costs for the study respondents were assessed as it was not possible to separate health care costs attributable to diabetes from total health care costs.

Direct costs were assessed by asking respondents to record all health care encounters and their use of prescription and non-prescription medications in the preceding 3 months. Direct non-health care costs associated with diabetes, including the use of transport, home support and the purchase of special diabetic food, were also assessed.

Medication costs were sourced by the in-country project staff in Vanuatu from local Ministry of Health (MOH) pharmacy and financial records under the guidance of one of the authors (AB) who was advised by a health economist from the University of Sydney. The Vanuatu Ministry of Health also provided costing estimates for outpatient visits. Inpatient hospital costs were based on data from the Pacific Action for Health Project [12] and were estimated at 9883 vatu ($90 USD) per night. The cost of transport was calculated on advice of in-country project staff from their knowledge of local taxi and public transport costs. Private transport was calculated by fuel costs in relation to distance travelled.

Quality of life was assessed by administration of the EQ-5D, a two-part validated questionnaire which assesses generic health-related quality of life in chronic disease states [14], within the main questionnaire. The EQ-5D has five dimensions i.e. mobility, self-care, usual activity, pain/discomfort and anxiety/depression. Within each dimension there are three possible responses: no problem, some problem and extreme problem. Each dimension can be presented as a profile or converted into a single weighted index score. In addition, the EQ-5D asks respondents to rate their overall health on a visual analogue scale (VAS) ranging from 100 (best imaginable health state) to 0 (worst imaginable health state).

If respondents had nominated a non-professional carer, the carer was asked to complete a second section of the questionnaire about direct and indirect costs associated with caring for the person with diabetes.

The survey was conducted in late 2006 and it was assumed that the costs incurred for the 3 months preceding the survey were representative. The approach taken in the analysis was to assume that the costs incurred for the 3 months preceding the survey would be representative of the costs incurred on an annual basis. All costs for the 3 months period where then multiplied to represent a 12 months period of care. This represented a multiplication factor of four. The data was analysed for frequencies, averages and ranges using Microsoft Excel. The EQ-5D was analysed using the EuroQol EQ-5D user guide [14]. The currency conversion rate at the time of analysis was 110 vatu = $1 USD [15].

The survey was carried out according to the requirements of, and with the prior approval of the University of Sydney Human Research Ethics Committee and a Memorandum of Understanding between the researchers and the Ministry of Health, Vanuatu.

3. Results

3.1. Demographics

There were 172 survey respondents (86% response rate). Of the original cohort of 199 people with known diabetes who were screened for diabetes complications under the Vanuatu capacity building project, 13 had died and six could not be located at the time of the cost of illness survey. A total of 180 completed questionnaires were sent back to Australia for analysis, but eight of these were found to be duplicates.

There were 66 males (average age 56.5 years; range 27–72 years) and 106 females (average age 56.2; range 30–73 years). The average age of diagnosis was 48.6 years and the average duration of diabetes was 8 years; 67 (39%) were unemployed and 10 (6%) were smokers. The majority of respondents reported having readily available family support with 74 (43%) responding that a child would look after them if they needed help and 104 (81%) people reporting their spouse as the immediate carer. Some respondents reported they had several carers when unwell and eight (5%) reported having no one to look after them if they became acutely unwell.

3.2. Government/health system costs

As shown in Fig. 1, for the 12 months period, hospital outpatient visits totalled 896 occasions of service, there were 24 visits to the Emergency Department, 1032 outpatient reviews by hospital-based specialists (diabetes doctor, podiatrist, nephrologists, etc.), 184 visits to a community health centre or first aid post and 76 visits by those specialising in diabetic care outside of the hospital. This totalled 2212 occasions of service. The cost of each of these hospital visits was estimated at 200 vatu, thus outpatient costs were estimated at a total of 442,400 vatu ($4020 USD). Thirty-five overnight hospital stays were reported. With hospital cost per inpatient night estimated at 9883 vatu this amounted to a total cost of 1,383,620 vatu ($12,580 USD).

The government supports the cost of prescription medications. As shown in Fig. 2, 15 patients were treated with diet alone (9%), 146 with prescription medications (84%), 6 were treated with insulin (4%) and 5 with a combination of insulin injections and prescription medications (3%). Analysis of oral

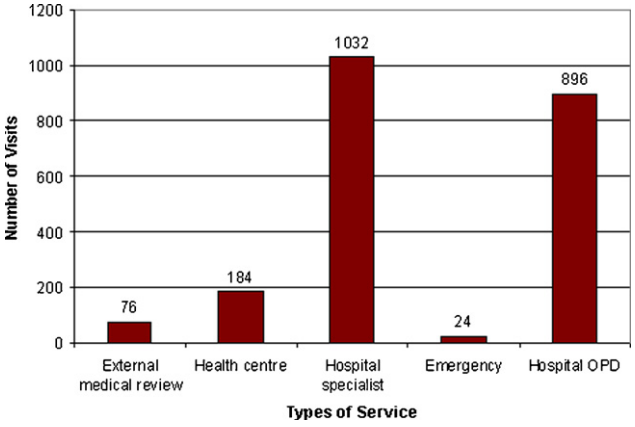

Fig. 1 – Occasions of service.

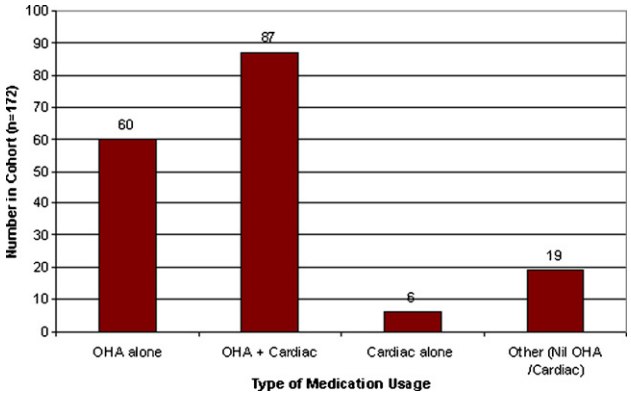

Fig. 2 – Types of prescription medications.

medications found 87 respondents (51%) in the cohort were concurrently treated with both OHA and cardiac drugs, 60 (35%) were treated with an oral anti-diabetic agent alone and only 19 (11%) of people took oral prescription drugs other than anti-diabetic or cardiac medications with the majority of this cost accounted for by antibiotics.

Based on the costing data supplied by the MOH, the cost of oral medications for the study period was 99,600 vatu ($904 USD). Divided among the study participants this amounted to a government cost of 3220 vatu ($28 USD) per patient per year. The cost of insulin therapy to the government for the 11 insulin requiring patients totalled 303,200 vatu ($2760 USD) for the year study period.

3.3. Individual cost

The main costs incurred by individuals were accounted for by over-the-counter (OTC) medications and transport to and from health care facilities. Of the respondents, 57 (33%) reported taking OTC medications but only 31 (18%) of these were able to place a value on this. Over the year period costs for OTC medications totalled 211,120 vatu ($1920 USD) for the 31 respondents who could quantify their expenditure (range: 80–120,000 vatu). Paracetamol and aspirin usage per day was equal to 6904 vatu ($63 USD) which totalled an estimated 642,000 vatu ($5840 USD) over the year.

Costs reported by 38 individuals for the purchase of special foods totalled 1,387,200 vatu ($12,612 USD) and averaged 34,400 vatu ($312 USD) per year per person (range 400–240,000 vatu).

The most common form of transport was public transport (64%) as opposed to other available options such as taxi or boat, although 23% reported no cost associated with transport. The overall cost of transport in the study period totalled 217,720 vatu ($1980 USD) making the average individual cost 1640 vatu ($14.80 USD) per year.

3.4. Quality of life

Quality of life (QOL) was assessed using the EQ-5D. As shown in Fig. 3, the self-reported EQ-5D scores indicated that over 90% of the respondents reported no problems for the first 3 questions (mobility 154 (90%), self-care 165 (96%) and usual

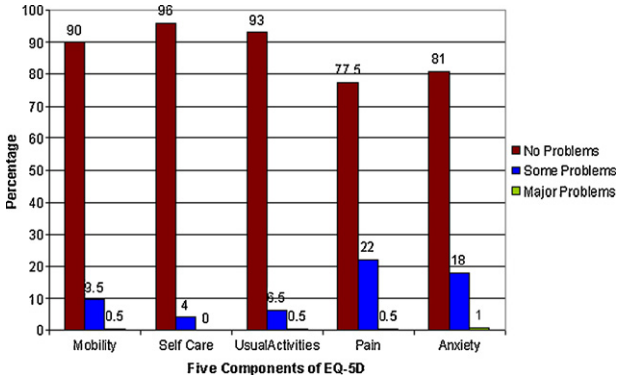

Fig. 3 – EQ-5D percentage of respondents reporting problems.

activities 160 (93%)). In relation to questions 4 and 5, 39 people (23%) reported that pain did cause them some problems and 33 people (18%) reported that diabetes had affected them in terms of their anxiety or depression. A visual analogue scale (VAS) was used to rank each respondent's health score out of 100. The average VAS score reported was 91 (range 37–100).

3.5. *Complications*

Of 172 respondents, 104 (60%) reported no complications as a result of type 2 diabetes. Fifty-nine people (34%) reported eye problems and 23 (13%) reported some kind of renal impairment. 10 (6%) reported ulcers (foot and leg) and 7 (4%) reported some form of amputation.

3.6. *Full-time carers*

Eight respondents reported having full-time carers. These carers had an average age of 43 years, six had other employment and two were unemployed. Average expenses incurred during the year period included: travel costing 17,600 vatu ($160 USD) for three carers; self-paid medications costing 2760 vatu ($25 USD) for two carers; and special food, costing 128,640 vatu ($1168 USD) on average for eight carers. The sum of all the expenses faced by the eight carers over the year period was 1,138,560 vatu ($10,360 USD).

4. Discussion

This study indicates that the major costs of diabetes to the Vanuatu government are related to overnight hospital stays, prescription medications and insulin therapy. The cost to the individual appears low by developed country standards, with only a small number of the cohort having to pay for over-the-counter medications and transport costs. However, these costs are difficult to interpret due to low average wages and high unemployment, and although the actual cost seems low the financial burden to the individual, and or, their carer's is likely to be onerous.

Compared to their Australian counterparts in the Diabco$t study [9] whose average quality of life on the EQ-5D VAS was 77.7 in people without complications and 65.1 in people with both microvascular and macrovascular complications, respondents in the Vanuatu study reported surprisingly little impact of diabetes on quality of life (VAS score of 91) even in the presence of complications. It was not within the scope of the study to explore the reasons for this but it is reasonable to speculate that this may be a function of the strong family and community support that is an integral component of Pacific Island culture. Transport costs may also be underestimated with 23% of respondents reporting no cost but it is not clear if this is related to walking or to lack of recognition of costs if transported to health care appointments by people outside the family. Another possible driver of underestimation of costs may relate to self-report which has been cited as a major concern for this method of data collection due to reduced recall and accuracy of reporting over time [17].

The in-country project staff who administered the survey underwent extensive training under the guidance of one of the authors (AB) who sat in on a selection of survey interviews in Vanuatu and was available for immediate telephone consultation throughout the survey. We attempted to minimise any potential for cultural, translation or administration errors and biases by collaborating with local staff who were adept at local languages and English to ensure cultural appropriateness of the survey without diminishing the integrity of the survey questions.

One of the most salient features of the results of this study was the cost attributable due to overnight hospital stays. Over year 140 overnight stays were recorded as a result of diabetes with costs for overnight hospital stays totalling 1,383,620 vatu ($12,580 USD). Given that the complications rates in this study may under estimate the true rate of complications, coupled with the rapidly rising prevalence of diabetes, this signals alarmingly high potential future direct costs to the Vanuatu health sector.

Health care in Vanuatu is primarily subsidised by the government including both inpatient and outpatient hospital visits and prescription medications. While it was not possible to separate health care costs attributable to diabetes from other health care costs in this study, the cost of prescription medications was substantial at 3220 vatu ($29.20 USD) per person, and a total cost 99,600 vatu ($904 USD) for the year period which constitutes a significant cost to the government.

The main forms of prescription medications in this study were oral anti-diabetic agents and cardiac medications. Only 9% were taking other prescription medications which may reflect the low rate of reported complications. Diabetes in PICs has been shown to be significantly under-diagnosed [18]. This coupled with resource limitations resulting in suboptimal quality of care makes it is inevitable that the demand for medications to treat hypertension and renal disease alone will increase dramatically in the foreseeable future. This also applies to the cost of insulin. It has been suggested that currently many people with diabetes in Vanuatu are started on insulin late and are under-insulinised [13]. Further, lack of resources precludes people with diabetes from daily access to blood glucose meters to obtain routine feedback on the status of their diabetes control. The cost of treating only 11 insulin requiring patients was 303,200 vatu ($2760 USD) for the year. As the drive to improve the management of type 2 diabetes

with insulin grows, so too will the cost faced by the government.

4.1. *Individual out-of-pocket expenses*

The minimum average wage in Vanuatu is approx 240,000 vatu per year ($2160 USD) as estimated by the WHO and corroborated by the Ministry of Health and the National Health Accounts [11]. For the 31 of the 57 respondents who could quantify how much they spent on OTC medications, an average of 6800 vatu per quarter ($62.00 USD) was calculated. Further, it should be noted that nearly 40% of the cohort were unemployed. Consequently, any additional cost of self-paid medications or transport incurs a significant financial burden for individuals and families. The main out-of-pocket costs faced by individuals were over-the-counter (OTC) medications and transport. Transport costs for 132 of the respondents were also estimated at 1640 vatu ($14.80 USD). Combining these and expressing them as a percentage of the average wage (240,000 vatu per year) the individual cost faced by a person requiring medications and transport represented 3.5% of their wage. These figures do not factor in the use of paracetamol or aspirin, which contributed another 12,600 vatu ($116 USD) to the respondents' quarterly costs.

For people who used special dietary products, the average additional cost was 34,400 vatu ($312 USD) per quarter and, again, this represents a significant portion of the average wage. However, these costs ranged from 400 to 240,000 vatu ($3.60–2180 USD) per person making it difficult to comment on what the average household would pay for a special diabetic diet.

4.2. *Impact on quality of life*

There appeared to be a relatively low impact of type 2 diabetes on quality of life. The only significant impact reported on the EQ-5D scores was related to pain levels where 23% reported some pain and this may account for the relatively heavy use of paracetamol. In relation to question five of the EQ-5D, 18% reported that diabetes had affected them in terms of anxiety or depression. The use of antidepressants was not reflected in the self-reports of medication taking but this may be because these drugs are not available in Vanuatu. Independent activities of daily living did not appear to be significantly affected.

The apparent lack of effect on the individual quality of life may be a result of the strong family and community support, which is such a prominent feature of Pacific Island culture. This is clearly evidenced in this study in which only eight respondents reported having no one to look after them when they became acutely unwell.

Despite the small sample size of only eight carer's the costs involved in looking after a person with diabetes were significantly higher than the cost faced by individuals with diabetes. Presumably, this effect relates to an advanced stage of disease process that necessitated the assistance of a carer, however, we were not able to verify this.

If diabetes trends in PICs continue to rise as predicted, the impact on individuals, families and communities could be dramatic. The role and position of men as providers and women as family carers can be severely affected by diabetes complications. Public provision of social security, home help and palliative care is virtually non-existent in PICs, causing additional financial, physical and emotional strain on families.

Diabetes complications impact significantly on diabetes related cost of illness [9] and Williams et al. point out that the prevention of diabetes complications will not only benefit patients, but also potentially reduce overall health care expenditure [19]. Participants in this survey were drawn from the outpatient clinic of Vanuatu's main referral hospital which, unlike the provincial hospitals, has staff with specific training in diabetes and better access to medications and equipment. Consequently they may enjoy better access to and quality of care and have fewer or less severe complications than the national average. This, in turn may mean that it is possible that our study underestimates the actual cost of diabetes Vanuatu. Further, in Vanuatu, items such as the cost of transport are difficult to identify. Costs such as lost productivity due to absenteeism, premature retirement and premature death are difficult to estimate but, arguably, may have an even greater impact on economic growth and development than direct health care costs.

Concern about the burden of type 2 diabetes in PICs is warranted, not only because of the human suffering attributable to its complications but because of its impact on poverty and the increasingly insupportable costs of health care and lost productivity.

Given that diabetes in Vanuatu is likely to be significantly under-diagnosed and under-treated, the current costs of diabetes, while substantial, may be artificially low and are set to rise sharply with increased awareness of diabetes and growing rates of obesity. The health system funding traditions and mechanisms in Pacific Island countries pose barriers to achieving a detailed understanding of cost of illness drivers and impacts. Further research into the cost of diabetes and its implications in this setting is imperative to underpin planning for future health service demand and to make the case for governments to invest in reducing modifiable risk factors for chronic diseases such as diabetes.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

Conducted in partnership with the Vanuatu Ministry of Health with assistance from Dr. Christopher Tarianga and Mr. John Tasserei, MOH Vanuatu; and the project collaborator's—the Australian and New Zealand Society of Nephrologists and the International Centre for Eyecare Education.

REFERENCES

[1] C. Tukuitonga, Meeting of Health Ministers for the Pacific Island Countries, Vanuatu, 2007.
[2] D.O. Abegunde, C.D. Mathers, T. Adam, M. Ortegon, K. Strong, The burden and costs of chronic diseases in

low-income and middle-income countries, Lancet 370 (2007) 1929–1938.
[3] Preventing Chronic Diseases: A Vital Investment, WHO 2005. www.who.int/chp/chronic_disease_report/contents/en/index.html.
[4] International Diabetes Federation, Diabetes Atlas 2007, Brussels, 2007.
[5] S. Wild, G. Roglic, A. Green, R. Sicree, H. King, Global prevalence of diabetes, Diabetes Care 27 (2004) 1047–1053.
[6] G. Roglic, N. Unwin, P.H. Bennett, C. Mathers, J. Tuomilehto, S. Nag, et al., The burden of mortality attributable to diabetes, Diabetes Care 28 (2005) 2130–2135.
[7] Vanuatu Ministry of Health, Non-Communicable Diseases (NCD) STEPS Survey 2005.
[8] P. Zing, M.M. Enelgau, S.L. Norris, E.W. Gregg, K.M. Venkat Narayan, Application of economic analysis to diabetes and diabetes care, Ann. Intern. Med. 140 (2004) 972–977.
[9] S. Colagiuri, R. Colagiuri, B. Conway, D. Grainger, P. Davey, DiabCo$t Australia: Assessing the burden of type 2 diabetes in Australia, Diabetes Australia, Canberra, 2003.
[10] WHO's Western Pacific regional analysis of health care expenditure. The World Health Report 2002. World Health Organization, Geneva, 2003.
[11] The Vanuatu NHA Team, Vanuatu National Health Accounts 2005. West Pacific Regional Office, 2007. Retrieved March 20, 2008, from www.who.int/nha/country/vut/Vanuatu%20NHA05%20draft.pdf.
[12] C. Doran, Pacific action for health project: Economic impact of assessment of non-communicable diseases on hospital resources in Tonga, Vanuatu and Kiribati, Final report September 2003.
[13] R. Colagiuri, Building capacity to reduce diabetes complications in the pacific: The Vanuatu experience so far, Pract. Diabetes Int. 23 (2006).
[14] EuroQol EQ-5D user guide, Version A (6/96), Publication Department, Centre for Health Economics, University of York, York.
[15] Reserve Bank of Vanuatu financial and economic news summary, Issue 104 (August, 2006), Retrieved April 22, 2008, from www.rbv.gov.vu/Publications/Monthly/2006/AUG06.pdf.
[17] A. Bhandari, T. Wagner, Self-reported utilization of health care services: improving measurement and accuracy, Med. Care Res. Rev. 63 (No. 2) (2006) 217–235.
[18] S. Colagiuri, R. Colagiuri, S. Na'ati, S. Muimuiheata, Z. Hussain, T. Paul, Prevalence of Diabetes in the Kingdom of Tonga, Diabetes Care 25 (8) (2002) 1378–1383.
[19] R. Williams, L. Van Gaal, C. Lucioni, Assessing the impact of complications on the costs of Type II diabetes, Diabetologia 45 (2002) S13–S17.