

Pacific Action for Health Project

Economic impact assessment of non-communicable diseases on hospital resources in Tonga, Vanuatu and Kiribati

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Table of contents

EXECUTIVE SUMMARY.....	V
1 OVERVIEW OF PROJECT AND DEFINITION OF NON-COMMUNICABLE DISEASES	1
1.1 INTRODUCTION	1
1.2 INTERNATIONAL CLASSIFICATION OF DISEASES	2
1.3 WHAT IS A NON-COMMUNICABLE DISEASE?	3
1.4 KEY NCDs CONSIDERED IN THIS REPORT	3
1.5 KEY RISK FACTORS FOR NCDs IN THIS REPORT (AS PER PROJECT BRIEF)	8
2 MOST RELIABLE SOURCES OF HOSPITAL DATA	11
2.1 INTRODUCTION	11
2.2 HEALTH CARE PROVISION AND DATA COLLECTION METHODS USED IN TONGA...	11
2.3 HEALTH CARE PROVISION AND DATA COLLECTION METHODS USED IN VANUATU ..	14
2.4 HEALTH CARE PROVISION AND DATA COLLECTION METHODS USED IN KIRIBATI ..	17
3 RESOURCE USE AND COST ASSOCIATED WITH NCD TREATMENT.....	19
3.1 INTRODUCTION	19
3.2 RESOURCE USE AND COST ASSOCIATED WITH TREATMENT OF DISEASE IN TONGA ..	19
3.3 RESOURCE USE AND COST ASSOCIATED WITH TREATMENT OF DISEASE IN VANUATU.....	22
3.4 RESOURCE USE AND COST ASSOCIATED WITH TREATMENT OF DISEASE IN KIRIBATI	25
4 IMPACT OF TOBACCO AND ALCOHOL ON HOSPITAL RESOURCES.....	35
4.1 INTRODUCTION	35
4.2 IMPACT OF TOBACCO AND ALCOHOL ON DISEASE	35
4.3 PREVALENCE OF ALCOHOL AND TOBACCO IN EACH COUNTRY	37
4.4 QUANTIFYING HARM CAUSED BY ALCOHOL AND TOBACCO IN EACH COUNTRY ...	43
5 ECONOMIC PROJECTIONS OF THE NCD BURDEN.....	48
5.1 INTRODUCTION	48

5.2	FUTURE RISE IN NCDs.....	48
5.3	CONSIDERATION OF DEMOGRAPHIC TRANSITION	50
5.4	CONSIDERATION OF EPIDEMIOLOGICAL TRANSITION	51
5.5	WHAT CAN BE DONE TO REDUCE POTENTIAL IMPACT OF NCDs?	53
6	CONCLUSIONS AND RECOMMENDATIONS.....	55
6.1	INTRODUCTION	55
6.2	LIMITATIONS.....	55
6.3	KEY FINDINGS	57
6.4	CONCLUSIONS.....	58
6.5	RECOMMENDATIONS.....	60
7	ACKNOWLEDGMENTS	63
8	REFERENCES.....	64

Abbreviations

ALOS	Average length of stay
AR-DRGs	Australian Refined Diagnosis Related Groups
AusAID	Australian Agency For International Development
CNS	Central nervous system
COPD	Chronic obstructive pulmonary disease
CRP	Comprehensive Reform Program
CVD	Cardiovascular disease
DM	Diabetes mellitus
ICD	International Classification of Diseases
IDDM	insulin dependent diabetes mellitus
MCH	Maternal and child health
MOH	Ministry of Health
NCD	Non-communicable disease
NIDDM	Non insulin dependent diabetes mellitus
NRH	Northern Region Hospital
PAHP	Pacific Action for Health Program
PIC	Pacific Island Countries
SPC	Secretariat of the Pacific Community
TB	Tuberculosis
VCH	Vila Central Hospital
WHO	World Health Organisation

EXECUTIVE SUMMARY

The aim of this report is to conduct an assessment of existing hospital inpatient data to estimate the economic burden of NCDs in the countries of Tonga, Vanuatu and Kiribati. The term NCD refers to heart disease, cancer, diabetes, high blood pressure and chronic respiratory diseases, among others. Data were collected from MOH representatives during site visits between March 2003 and May 2003. Data sought included information on hospital morbidity, budget reports and prevalence reports on lifestyle diseases. These data have been used in the current project, together with reasonable assumptions in lieu of missing or incomplete data, to consider the impact, both current and future, of NCDs on the burden of disease in these countries. As part of this assessment, estimates of treatment costs are derived and applied to hospital admissions to calculate total and average costs of treatment by NCD and non-NCD. Further, an attempt has been made to consider the extent to which tobacco and alcohol use contributes to the total current, and future, NCD burden in Tonga, Vanuatu and Kiribati.

The results indicate that in each of the countries included, Tonga, Vanuatu and Kiribati, NCDs currently account for 10.4%, 5.8% and 8.1% of all admissions, respectively. Patients being admitted for a NCD are much older than those presenting for a non-NCD, 16 years older in Tonga and 10 years older in Kiribati. Patients admitted for a NCD also stay in hospital longer with ALOS for a NCD admission being 9.2 days, 7.5 days and 13.5 days in Tonga, Vanuatu and Kiribati, respectively. This compares with an ALOS for a non-NCD admission of 4.9 days in both Tonga and Vanuatu and 9.3 days in Kiribati. Consistent with this finding, average treatment costs of NCDs are considerably higher than non-NCD admissions. Although NCDs account for a relatively low proportion of all admissions, they account for a disproportionately larger share of all treatment expenditures. In Tonga, Vanuatu and Kiribati NCDs account for 19.6%, 9% and 8.1%, respectively, of all treatment expenditures. To put this in context, in Tonga for example, one out of every 10 (10.4%) patients admitted to hospital are admitted for a NCD, however, for every 5 dollars spent on treating all patients, one of these dollars (20%), is required to treat the patient with a NCD.

The future impact of NCDs on hospital morbidity and treatment cost is likely to be substantial. The transition towards an older population in these three countries, coupled with greater harm from current risk behaviours (tobacco and alcohol use, physical inactivity etc), suggests that the burden of disease from NCDs will increase. For example, it is conservatively projected that the costs related to tobacco and alcohol use alone, will increase from approximately 9% of the NCD treatment budget to 21% by the year 2020. These financial burdens (which do not include any hospital outpatient or social costs to the community e.g. time off work etc), will have major impacts on the national economies of these countries. Additionally, as many of the strategic and evidence-based preventive approaches are outside of the MOH mandate e.g. financial, agricultural and educational policies, it is important for all Government ministries to work together to address these issues. The following recommendations provide a means by which Governments can begin to make a concerted effort and reduce the future costs associated with NCD in their country as well as improve efficiency in budget allocations.

Recommendations

Recommendation 1

- Improve the reliability of hospital data

Actions

- Commit additional resources to MOH to improve entry and monitoring of hospital data

How best achieved

- Maintain adequate staff levels in Statistics Office
- Ensure staff are well qualified and undergo ongoing training
- Ensure computer hardware and software is state of the art and well-maintained.

Example

- Vanuatu Comprehensive Reform Program

Recommendation 2

- Develop a clinical costing system

Actions

- Commit resources to MOH to link current hospital data collection with current cost of treatment

How best achieved

- Purchase expertise to develop system
- Train staff to contribute to dynamic system

Example

- Australian Diagnostic Related Groupings (adds value to data collected at patient level by costing treatment received)

Recommendation 3

- Improve the monitoring of risk factors for disease

Actions

- Commit additional resources to MOH to conduct regular surveys to better understand the prevalence and behaviours of key risk factors for disease

How best achieved

- Add additional questions to Census
- Regular population surveys to capture prevalence of risk factors

Example

- Vanuatu non-communicable disease survey report of key risk factors for NCD
- Diabetes survey in Kingdom of Tonga
- [STEPS surveillance \(WHO\)](#)

Recommendation 4

- Improve the efficiency of MOH funding

Actions

- To assess current spending, identify room for improvement and shift resources accordingly

How best achieved

- Commit additional resources to MOH to engage in Program Budgeting and Marginal Analysis
- Purchase expertise to review current MOH funding

Example

- None present but scope exists to conduct for all Ministries

Recommendation 5

- Develop a strategic NCD plan for each country

Actions

- Based on the STEPS framework, develop an evidence-based strategic plan to guide implementation on NCDs

How best achieved

- Ensure multi-sectoral participation and commitment across all government ministries to the development of the NCD plan and its implementation.

Example

- Tonga NCD Control Strategy

1 OVERVIEW OF PROJECT AND DEFINITION OF NON-COMMUNICABLE DISEASES

1.1 Introduction

The rapid rise of non-communicable diseases (NCDs) represents one of the major health challenges to global development. It is estimated that by 2020 over 70% of the global burden of disease will be related to NCDs (especially cancer, diabetes, cardiovascular diseases and chronic respiratory diseases), mental health disorders and injuries. This burden of disease is disproportionately high in poor and marginalised populations and is contributing to widening health gaps between and within countries, resulting in enormous human suffering and increased burden on many countries[1].

The Pacific Action for Health Program (PAHP) is an AusAID funded initiative with the goal of contributing to the reduction of NCDs within the populations of the Pacific Islands. Specifically, the purpose of the program is to enhance the capacity of the Ministries of Health and communities of the Pacific Islands, initially Kiribati, Tonga and Vanuatu, to address NCD priority risk factors and provide health-promoting environments for young people (10-19 years). An important component of the program is an initial assessment of existing hospital inpatient data to estimate the current and projected economic burden of NCDs treatment in these countries. As the three participating countries are at varying stages of both demographic and epidemiological transition, such evidence will provide an opportunistic assessment of the current (and likely future) impact of NCDs on the health system. It will also provide a reliable basis from which to develop and initiate relevant public health measures to address NCDs, both in these three countries specifically, and other Pacific Island Countries (PIC).

The report is structured according to the specific aims of the project. These aims are:

- i. In conjunction with Ministry of Health (MOH) representatives in each country, identify the most reliable sources of hospital data for use in the assessment of NCD.

- ii. To assess bed-day and direct treatment data relating to the most commonly occurring NCDs in the Pacific - cardiovascular diseases, neoplasms, chronic obstructive pulmonary disease, diabetes and hypertension.
- iii. Define, where practical, the impact of tobacco and alcohol usage on subsequent bed day utilisation and treatment (aetiological fractions).
- iv. Where practical, provide economic projections on the NCD burden through to 2020.

As a prelude to specifically addressing these aims, the remainder of this chapter is devoted to outlining the method of disease classification used in this report, including the International Statistical Classification of Diseases and Related Health Problems (ICD-10); the main types of NCDs considered in this report, by ICD code; and key risk factors for these NCDs.

1.2 International classification of diseases

A classification of diseases may be defined as a system of categories to which morbid entities are assigned according to established criteria. There are many possible axes of classification and the one selected will depend upon the use to be made of the statistics to be compiled. A statistical classification of diseases must encompass the entire range of morbid conditions within a manageable number of categories.

The Tenth Revision of the *International Statistical Classification of Diseases and Related Health Problems* is the latest in a series that was formulated in 1893 as the Bertillon Classification or International List of Causes of Death. The major difference between the 9th and 10th versions is the coding structure. Although the traditional ICD structure has been retained in the 10th version, an alphanumerical coding scheme replaces the previous numeric one. This provides a larger coding frame and leaves room for future revision without disruption of the numbering system[2].

The main categories reported in ICD-10 are as follows: certain infectious and parasitic diseases (A00-B99); neoplasms (C00-D48); diseases of blood and blood forming organs and certain disorders involving the immune mechanisms (D50-D89); endocrine, nutritional and metabolic diseases (E00-E90); mental, behavioural

disorders (F00-F99); diseases of the nervous system (G00-G99); diseases of the eye and adnexa (H00-H59); diseases of the ear and mastoid process (H60-H95); diseases of the circulatory system (I00-I99); diseases of the respiratory system (J00-J99); diseases of the digestive system (K00-K93); diseases of the skin and subcutaneous tissue (L00-L99); disease of the musculoskeletal system and connective tissue (M00-M25); diseases of the genitourinary system (N00-N99); pregnancy, childbirth and the puerperium (O00-O99); certain conditions originating in perinatal period (P00-P96); congenital malformations, deformations, and chromosomal abnormalities (Q00-Q99); symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99); injury, poisoning and certain other consequences of external causes (S00-T98); external causes of morbidity and mortality (V01-Y98); and, factors influencing health status and contact with health services (Z00-Z99).

1.3 What is a non-communicable disease?

The term NCD refers to a category of diseases that excludes communicable, maternal and perinatal diseases, injuries and under-nutrition. Examples include heart disease, cancer, diabetes, high blood pressure and chronic respiratory diseases, among others. In the parlance of ICD-10, NCDs predominantly comprise Group II conditions, as distinct from Group I (maternal and perinatal diseases and diseases related to under-nutrition), and Group III (injuries).

1.4 Key NCDs considered in this report

Diseases of the circulatory system (cardiovascular diseases)

Cardiovascular disease

The term cardiovascular disease (CVD) is used to cover all diseases and conditions involving the heart and blood vessels. The main underlying problem in CVD is atherosclerosis, a process that clogs blood vessels with deposits of fat, cholesterol and other substances that have built up in the inner lining of the vessels. It is most serious when it effects the blood supply to the heart (potentially causing angina or heart attack) or to the brain (which can lead to stroke)[3]. A common set of key risk factors for CVD include obesity, high blood pressure, diabetes, tobacco consumption, high fat consumption and physical inactivity.

ICD-10 codes for diseases of the circulatory system encompass: acute rheumatic fever (I00-I02); chronic rheumatic heart diseases (I05-I09); hypertensive diseases (I10-I15); ischaemic heart disease (coronary heart disease) (I20-I25); pulmonary heart disease and diseases of pulmonary circulation (I26-I28); other forms of heart disease (I30-I52); cerebrovascular diseases (stroke) (I60-I69); diseases of the arteries, arterioles and capillaries (I70-I79); diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified (I80-I89); and, other and unspecified disorders of the circulatory system (I95-I99). The most common types of cardiovascular disease are as follows.

Hypertensive diseases

Hypertension is a condition in which an individual has a higher blood pressure than is considered normal. The elevated blood pressure is caused by an increase in peripheral resistance resulting from constriction or narrowing of peripheral blood vessels. In the majority of patients, the aetiology of the condition is unknown and develops without apparent cause. Hypertension can be benign (slow progression), or malignant (rapid progression, a form accompanied by severe vascular damage)[4]. Hypertension is a clinically silent condition and often goes undiagnosed until after it becomes manifested in an acute clinical condition including heart attack, stroke, kidney failure or blindness. Risk factors for hypertension include behavioral/lifestyle aspects such as high dietary salt and alcohol consumption, stress, physical inactivity and obesity. There is also a hereditary component.

Ischaemic heart disease (coronary heart disease)

Coronary heart disease often results in sudden death. It consists mainly of acute myocardial infarction (heart attack) and angina. A heart attack is a life-threatening emergency that occurs when a vessel supplying blood to the heart muscle suddenly becomes blocked by a blood clot. Angina is temporary chest pain or discomfort when the heart's own blood supply is inadequate to meet extra needs[3].

Cerebrovascular diseases (stroke)

Stroke occurs when an artery supplying blood to the brain suddenly becomes blocked or bleeds, often causing paralysis of parts of the body or speech problems. It includes ischaemic stroke (blockage), haemorrhagic stroke (bleeding), transient

ischaemic stroke and other cerebrovascular diseases. Evidence from Australia suggests that 75% of stroke victims suffered a disability that required assistance with self-care, mobility or communication[5].

Diseases of the respiratory system

Acute respiratory infections, which include influenza and pneumonia and other upper and lower respiratory tract infections, are commonly related to communicable diseases. The specific ICD-10 codes for diseases of the respiratory system encompass: acute upper respiratory infections (J00-J06); influenza and pneumonia (J10-J18); other acute lower respiratory infections (J20-J22); other diseases of upper respiratory tract (J30-J39); chronic lower respiratory diseases (J40-J47); lung diseases due to external causes (J60-J70); other respiratory diseases principally affecting the interstitium (J80-J84); suppurative and necrotic conditions of lower respiratory tract (J85-J86); other diseases of pleura (J90-J94); and other diseases of the respiratory system (J95-J99).

Chronic obstructive pulmonary disease

The NCD related respiratory diseases can be classified under the umbrella of chronic obstructive pulmonary disease (COPD). Chronic obstructive pulmonary disease (COPD) is a permanent and typically progressive disease, where damage to the lungs obstructs oxygen intake and causes breathlessness with exertion and limitation of exercise capacity. In severe cases, breathlessness may occur with little or no exertion[3]. Symptoms of COPD include shortness of breath, wheezing, coughing and mucus production, all of which tend to become progressively worse over time. Disease progression is marked by a steady decline in lung function, punctuated with periodic exacerbations, either through infection (for which COPD is a predisposing factor) or inflammation alone.

Chronic bronchitis (J42) and emphysema (J43) are the two main components of COPD. Another category, other COPD (J44), is included in ICD-10 coding. It is important to note that asthma (J45) is not considered as a COPD due to the fact that lung function tends not to decline over time. As such it is not included in subsequent analyses. Consequently, only disease categories J42-J44 inclusive will be included in subsequent analysis.

Neoplasms (Cancer)

Cancer is a diverse group of diseases in which some of the body's cells become defective, begin to multiply out of control, can invade and damage the area around them, and can also spread (metastasize) to other parts of the body to cause further damage. Cancer impacts on almost all sites of the body with lung, breast, bowel and prostate among the most commonly diagnosed cancers in the western world[3].

The specific ICD-10 codes for neoplasms encompass: malignant neoplasms of lip, oral cavity and pharynx (C00-C14); malignant neoplasms of digestive organs (C15-C26); malignant neoplasms of respiratory and intrathoracic organs (C30-C39); malignant neoplasms of bone and articular cartilage (C40-C41); malignant neoplasms of skin (C43-C44); malignant neoplasms of mesothelial and soft tissue (C45-C49); malignant neoplasms of breast (C50); malignant neoplasms of female genital organs (C51-C58); malignant neoplasms of male genital organs (C60-C63); malignant neoplasms of urinary tract (C64-C68); malignant neoplasms of eye, brain and other parts of central nervous system (CNS) (C69-C72); malignant neoplasms of thyroid and other endocrine glands (C73-C75); malignant neoplasms of ill defined, secondary and unspecified sites (C76-C80); malignant neoplasms of lymphoid, haematopoietic and related tissue (C81-C96); malignant neoplasms of independent primary multiple sites (C97); in situ neoplasms (D00-D09); benign neoplasms (D10-D36); and, neoplasms of uncertain or unknown behaviour (D37-D48). All these disease categories will be included in subsequent analysis.

Endocrine, nutritional and metabolic disorders

ICD-10 codes for endocrine, nutritional and metabolic disorders encompass: disorders of the thyroid gland (E00-E07); diabetes mellitus (E10-E14); other disorders of glucose regulation and pancreatic internal secretion (E15-E16); disorders of the endocrine glands (E20-E25); malnutrition (E40-E46); other nutritional deficiencies (E50-E64); obesity and other hyper alimentation (E65-E68) and metabolic disorders (E70-E90). In accordance with the project brief, only diabetes mellitus (E10-E14) will be included in subsequent analysis.

Diabetes mellitus

DM is a long term (chronic) condition in which blood glucose levels become too high because the body produces little or no insulin or cannot use insulin properly. Insulin is a hormone produced by the pancreas that helps the body use glucose. Over the course of the disease, diabetes can lead to long term damage to various parts of the body, especially the heart and blood vessels, eyes, kidneys and nerves. Diabetes can also contribute to many pregnancy-related complications for the mother and baby, both before and after birth. It is largely irreversible once established, and is a key risk factor for CVD, including heart attack and stroke. Because the common feature of diabetes is high blood glucose, it is often mistakenly thought to be a single disease.

There are two main types of diabetes, Type 1 and Type 2, each with different casual mechanisms[3]. Type 1 diabetes (insulin-dependent diabetes mellitus or IDDM) is marked by a total or near lack of insulin. It results from the body destroying its insulin-producing cells in the pancreas. People with this form of diabetes require daily insulin therapy to survive. It is the most common cause of childhood diabetes and accounts for around 10-15% of all people with diabetes. Type 2 diabetes (non-insulin dependent diabetes mellitus or NIDDM) is marked by reduced levels of insulin, or the inability of the body to use insulin properly (insulin resistance).

This disease is most common among people aged 40 years and over and accounts for 85-90% of all people with diabetes. Many people with this form of diabetes eventually need insulin therapy to control their blood glucose levels. Risk factors for type 2 diabetes include obesity, poor diet and lack of exercise. NIDDM also has a strong genetic component in some Pacific communities, with some ethnic groups being affected more than others. In contrast to IDDM, the decline in insulin production and effectiveness in NIDDM is progressive rather than absolute, and in some cases this decline can be prevented or reversed with appropriate changes in diet, weight and physical activity[4].

1.5 Key risk factors for NCDs in this report (as per project brief)

Tobacco and alcohol

Tobacco consumption

Cigarette smoking and other forms of tobacco consumption are important risk factors for CVD, COPD, cervical cancer and lung cancer (of which it is the most important single cause). Smoking prevalence is high in many PICs and has been increasing over the past 10 to 20 years. In many PICs, smoking prevalence is now greater than in Australia, New Zealand and the United States. Of particular concern is the uptake of smoking by young people. More data on smoking prevalence are discussed in Chapter 4. Due to the fact that the risk of smoking-related diseases increases with how long an individual has smoked, and since smoking is an addictive habit, these data point to the likelihood of a substantial increase in smoking-related diseases as these cohorts age[6].

Alcohol consumption

In general, higher overall levels of consumption in a population are associated with higher levels of alcohol-related problems. Alcohol consumption has health and social consequences via intoxication (drunkenness), high dependence (habitual, compulsive, long-term heavy drinking) and other biochemical effects. Intoxication is a powerful mediator for acute outcomes, such as motor vehicle accidents and domestic violence, and is associated with many chronic health and social problems. There are casual relationships between average volume of alcohol consumption and more than 60 types of disease and injury. Most of these relationships are detrimental, but there is some evidence of beneficial relationships with coronary heart disease, stroke and diabetes, provided low average volume of consumption is combined with non-binge patterns of drinking.

Other lifestyle risk factors not factored into subsequent analysis

Obesity

Obesity is a risk factor for CVD, diabetes and hypertension, as well as cancers of the breast, and colon. It is defined on the basis of the body mass index (BMI), a figure obtained by dividing an individual's weight in kilograms by the square of his or her height in meters. Evidence suggests the prevalence of overweight and obesity

combined is greater than 50 percent in at least 10 PICs, and rates as high as 75 percent - among the highest in the world - have been reported in Nauru, Samoa, Tonga, Cook Islands and French Polynesia[4]. These figures have been used to justify the description of obesity as an “epidemic” in PICs. Underlying risk factors for obesity include poor diets and physical inactivity, both of which are discussed separately below. Also relevant is the issue of “body image”. In many PICs, cultural norms support the pursuit of increased weight, and obesity is considered a sign of wealth or social status. Obesity tends to be more prevalent in urban than rural populations and is more common among women than men; although these trends are changing due to increases in rural and male obesity in many PICs. Obesity typically peaks in the 20 to 45 year age group, though wealthier PICs have been experiencing an increase in childhood obesity in recent years. A lower mean BMI is noted in older age groups, probably reflecting the better chances of survival with a lower BMI than any trend to lose weight with age[6].

Poor diet

Dietary factors are implicated in the origin of obesity, diabetes, hypertension, CVD and certain cancers—including bowel, breast and prostate cancers. For a large percentage of people, the modern Pacific Island diet has changed from one consisting primarily of root vegetables, coconut, fresh fish and green leaves, to one with a lower vegetable content and a higher intake of rice, bread, tinned fish and meat, sugar, salt and alcohol. As a result, the consumption of energy (calories), salt, animal fats, sugar and alcohol has increased, leading to a greater prevalence of obesity (due to excess energy from fats, sugar and alcohol), diabetes (same factors), hypertension (salt, alcohol) and CVD (all). At the same time, the consumption of fiber, antioxidants and trace minerals has generally decreased, leading to an increase in bowel (low fiber, high fat) and other cancers (low antioxidants, high fat, high alcohol). These changes have been most evident in urban settings but are occurring in many rural communities as well[6].

Physical inactivity

Physical inactivity is a risk factor for obesity, hypertension and CVD. In the case of obesity, a lack of physical activity, especially when combined with a high calorie diet, leads to a surplus of calories that are subsequently converted into fat as an energy

storing mechanism. Physical inactivity can contribute to high blood pressure either directly or through its effect on BMI (since obesity increases blood pressure). Its effects on CVD are mediated through a similar set of pathways. In comparison with other NCD risk factors, relatively little is known about the extent to which patterns of physical activity have changed in PICs, although there is considerable anecdotal evidence that the level of physical activity in PICs has declined with the advent of westernisation.

2 MOST RELIABLE SOURCES OF HOSPITAL DATA

2.1 Introduction

The specific aim of this chapter is to identify the most reliable sources of hospital data for assessing the impact of NCDs on health systems. Since the reliability of the data depends, in part, on existing health care delivery infrastructure, this chapter will also consider separately for Tonga, Vanuatu and Kiribati: the health care services available; current expenditure on health care; data collection methods used to track an inpatient's episode of care from admission to discharge; the clinical costing systems used to track resource use for inpatients; and finally, an assessment of the most suitable data on which to base subsequent economic impact analyses.

2.2 Health care provision and data collection methods used in Tonga

Health care provision

The Kingdom of Tonga has a population of approximately 100,000 spread over 36 inhabited islands[7]. The country is divided into three main islands (Tongatapu, Vava'u and Ha'apai) and the health districts of the MOH are aligned with the national structure. The largest and most populous district is Tongatapu, in which the capital, Nuku'alofa, is situated. This district also dominates the co-ordination and provision of health care. It comprises the island of Tongatapu and the small adjacent island of 'Eua[8].

The national referral hospital, Vaiola, is situated on the outskirts of Nuku'alofa and the MOH is in the grounds of Vaiola hospital. All specialist services are provided through Vaiola hospital, including outpatient and dental services. Diagnostic, pharmaceutical and other clinical support services are also provided at Vaiola hospital. Environmental health, health promotion and community health services are co-ordinated from the MOH through the Public Health Division. Villages on Tongatapu are serviced by 7 community health centres staffed by a health officer and public health nurses. In addition, there are 19 Maternal and Child Health (MCH) clinics run by public health nurses alone. Health services in 'Eua comprise one 16 bed hospital (Niu'eiki) and three MCH clinics. While 'Eua is officially linked with Tongatapu, it is managed as a separate health district with the Chief Medical Officer reporting directly to the Director of Health.

The health districts of Vava'u and Ha'apai are each serviced by a community hospital, Prince Wellington Ngu (61 beds) and Niu'ui (28 beds) respectively. These hospitals are supported by small pathology, radiology, pharmacy and dental services, and both include an outpatient department. MCH, environmental health and community health services for these districts are co-ordinated from the hospital. Prince Ngu hospital is supported by 3 health centres and 5 MCH clinics on Vava'u itself and is also responsible for the two health centres on Niuafu'ou and Niuatoputapu. Niu'ui hospital is supported by 2 health centres and 3 MCH clinics and is responsible for some isolated island communities[8].

Health care expenditure

Government expenditure on health has increased by 14% from \$7.372m in 1997/98 to \$8.414m in 2001/2002. The 2001/02 health budget was equivalent to around 10% of the total government expenditure (\$87.2m) for that year and included an additional \$2.5m made available from overseas aid funding to supplement the health budget. In the year 2001/02, expenditure on salaries accounted for around 68% of the budget (\$5.7m), goods and services consumed a further 26% (\$2.2m) and the remaining 6% was spent on maintenance and other items[8].

Estimates from the WHO indicate that Tonga has the lowest per capita expenditure on health (US\$73) compared with other Pacific Nations[9]. In spite of this, Tonga does spend a greater proportion (%) of its gross domestic product (GDP) on health than other countries across the region, with the exception of the Marshall Islands and Kiribati.

Data collection methods

Hospital patient records usually contain information about a patient's diagnosis and procedures performed during the hospital stay. This is no exception in the Kingdom of Tonga, with admission and discharge data forms collecting data on patient admissions, ward occupancy, average length of stay, diagnostic tests performed and medications provided. Tonga uses ICD-10 coding. At Vaiola hospital, diagnosis is coded by the Medical Records staff and then submitted to the Statistics Unit. All other facilities outside Vaiola send admission and discharge information to the Statistics Unit at the MOH where staff code individual patient data. The Health

Statistics Unit is responsible for entering the data from all notifications provided by outlying areas and the Public Health Division, as well as data analyses and feedback of statistical reports to all sections of the Ministry.

Clinical costing systems

In general, clinical costing systems provide a bottom up assessment of resource use which is measured and valued accordingly[10]. Ideally, resource use should monitor the spectrum of care provided, diagnostic tests performed and medications provided. In most developed countries, data from admission / discharge forms are matched with the value of the resources utilized in provision of care to a particular patient, to provide an estimate of the cost of care. In Australia, this classification system is referred to as Australian Refined Diagnostic Related Groups (AR-DRGs). This classification provides a means to determine the number and type of patients admitted and treated in a hospital (i.e. its case mix) and relating this information to the resources required by the hospital. The AR-DRGs, therefore, provide a standardized method for assessing the performance of hospitals and facilitates future planning and funding in the provision of hospital services.

Data of this nature are not currently available in Tonga. While data are collected on disease classification and treatment procedures, only limited patient data are entered into the database which impedes the ability to track and compare resources used by patients, both between and within disease classifications. Further, no medical benefits schedule is currently in place to reliably ascertain the relative values of particular health care procedures.

In the absence of a complete clinical costing system, a general indication of the costs associated with treatment provision can be obtained by combining available data (such as the number of hospital admissions per disease) with estimates based on reasonable assumptions, in lieu of missing data. This approach is adopted in this project with details provided in Chapter 4.

An alternate approach was adopted in an earlier study of the Economic costs of NCDs in the Pacific[11] and reported in Khaleghian (2001)[6]. The authors used a WHO estimate of the average cost per inpatient bed-day (for all diseases, not just

NCDs) at WST 235 (USD 77.50)[12]. This approach, while reasonable, does not utilize available local data, and, hence, may not provide an accurate assessment of local conditions.

Most reliable data

At the time of site visit, in May 2003, the most accurate and reliable hospital morbidity data available were for the year 2001. Budget estimates and MOH staff lists were provided for the year 2002/03. These data sets are used in subsequent analyses.

2.3 Health care provision and data collection methods used in Vanuatu

Health care provision

The majority of health care provided in Vanuatu is through the MOH. The MOH has been restructured under the Comprehensive Reform Program (CRP) and now comprises four divisions: the Southern Health Care group including Shefa and Tafea, the Northern Health Care group including Torba, Sanma, Malampa and Penama; Public Health; and, Planning and Administration.

The Vanuatu health system comprises a four tier structure:

- i. *Aid posts (180 in the year 2001)*. Staffed by community volunteers provided with six weeks of training, aid posts treat minor ailments and promote family planning and health education. Aid post workers are trained to detect serious complaints and to refer patients as early as possible to dispensaries.
- ii. *Dispensaries (79 in the year 2001)* Each service a population of around 3,000 with basic facilities. Some have 1-2 beds. Services include maternal and child health, family planning, immunizations, health education, and detection and referral of serious diseases.
- iii. *Health centers (23 in the year 2001)*. With about ten beds, the centres are intended to be run by a nurse practitioner, with 1-2 nurses. They service a population of 3,000-8,000, supplementing the dispensaries and providing beds for inpatients and birthing.
- iv. *Hospitals (5 in the year 2001)*. A hospital is located in each province, except Torba. Three of the five hospitals are designated as provincial hospitals, Lenakel hospital in Tafea province, Norsup Hospital in Malampa province, and Lolowai hospital in Penam province. Two other hospitals, Vila Central Hospital

(VCH) in Shefa province and Northern Region Hospital (NRH) located in Sanma province, provide referral services for the provincial hospitals and are designated as referral hospitals[13].

Each hospital provides the following services:

- Lenakel provides both outpatient and inpatient facilities including maternity and delivery, female, male, pediatric, tuberculosis (TB); laboratory, pharmacy, theatre, radiology, dental; and, general administrative support services which include office administration, maintenance, kitchen, laundry and cleaning;
- Norsup provides the same services as Lenakel, with the addition of providing a surgical ward.
- Lolowai provides similar outpatient and administration services but inpatient services comprise only a general and maternity ward.
- Vila Central Hospital (VCH) is the main referral hospital, providing all major health care facilities: outpatient, maternity, pediatric, surgical, medical, psychiatry, theatre, laboratory, radiology, pharmacy, ear/nose/throat, physiotherapy, orthotics, dental and general administration. The central medical store is also located within the hospital compound.
- Northern Region Hospital (NRH) provides similar services to VCH with the exception of physiotherapy and orthotics[14].

In addition to government run health services, private health delivery is expanding. A number of doctors practice western medicine, predominantly in Port Villa and Luganville. There are also numerous traditional practitioners and birth assistants in rural and urban areas. Private doctors typically provide services for tourists, expatriates and an increasing number of ni-Vanuatu. Consultation fees are of the order of Vt1,500 while traditional pharmacies can charge more. The growth of these suggests that many people are prepared to pay for what they perceive to be a more efficient or effective service.

Health care expenditure

The MOH budget for 2002/03 was Vt916.3m[15]. The proportion of the national budget spent on health has not changed greatly since 1990, though the trend over the past four years has been downwards from a peak of 12.4% in 1997 to 10.3% in

2001[13]. Expenditure per capita (Vt4909 per person) can be calculated by dividing expenditure on health (Vt916.3m) with population estimates (186,680)[16].

Data collection methods

Admission forms capture data pertaining to patient characteristics, clinical diagnosis and discharge status. Three of the five hospitals complete all admission forms and send them to a National Statistics Officer for coding and data entry. Two of the hospitals, VCH and NRH, enter the data themselves and forward complete data sets to a National Statistics Officer for data checking. All data is then entered into the Vanuatu's Health Information System. It has been documented, however, that the coding and entry of hospital statistics has, in the past, been very poor. For example, in the Second National Health Development Plan report, it was noted that for the NRH, the officer appointed to be responsible for hospital statistics was not well qualified, necessitating immediate replacement of the officer with a more qualified person[14]. This implies that the admission forms processed are likely to represent an underestimate of the true healthcare services utilization rate, due to possible leakages in data collection, coding and entry. However, the CRP appears to have improved the efficiency and reliability of data collection such that the database will provide an adequate overall picture of NCD admittances in Vanuatu.

Clinical costing systems

The situation of clinical costing in Vanuatu is similar to that in Tonga. That is, although each hospital separation is tracked using a detailed admission form that captures, among other things, patient length of stay, diagnosis and procedures performed, not all of this information is stored electronically for each patient. Data were consistently available on length of stay and diagnosis by ICD-10, but not for resource use by particular disease classifications.

As for Tonga, in the absence of a complete clinical costing system, a general indication of the costs associated with treatment provision can be obtained by the use of available data (such as the number of hospital admissions per disease), complemented by estimates for missing data, based on reasonable assumptions. Details of this method are provided in Chapter 4.

Most reliable data

At the time of the site visit in April 2003, the most accurate and reliable hospital morbidity data available were for the year 2002. Budget estimates and MOH staff lists were provided for the year 2002/03. These data sets are used in subsequent analyses.

2.4 Health care provision and data collection methods used in Kiribati

Health care provision

The Republic of Kiribati comprises 33 small and scattered atolls in the central South Pacific Ocean. The total land area of 811 square kilometers is spread over 3.5 million square kilometers of ocean. The economy is primarily based on copra, fish and workers' remittances. On the Human Development Index, Kiribati ranks 11th out of the 14 countries in the Pacific region and 129th in the world. In terms of infant mortality and child morbidity, per capita GDP and living conditions, particularly in regard to water and sanitation, Kiribati's development indicators are among the lowest in the Pacific region.

The population of Kiribati numbers around 84,000. The eastern islands are very sparsely populated, making delivery of services difficult and costly because of communication and transport difficulties. Most people live on the western islands of Kiribati, with over one third of the national population living on the capital atoll of South Tarawa[17].

The MOH is responsible for the health care system in Kiribati. The overall outcome of the MOH is to achieve the improvement of health to all I-Kiribati. This will be approached through: a focus on primary health care as the lead mechanism for delivering health services; rationalization of curative services through greater reliance on cost recovery, manpower planning and maintenance of facilities; involvement of churches, local government and community organizations in health care delivery; and encouraging development of a private health care market.

Health care expenditure

According to the Republic of Kiribati 2002/03 budget report, operating expenditure for the financial year 2002/03 was **AUD\$77,911,230** of which expenditure to the MOH

accounted for 11.6% or \$9,043,867[18]. With an estimated population in 2000 of 84,494[17], this represents per capita expenditure on health of \$107.

Data collection methods

Information from inpatient admission forms is transferred to hospital discharge forms, where relevant ICD coding occurs. Hospital discharge forms collect data on, among other things, patient characteristics, ward admitted, date of admission and discharge, principle diagnosis and procedures performed. A medical record officer enters the relevant ICD code and forwards completed discharge forms to the Statistics Office for electronic entry.

Clinical costing systems

The situation of clinical costing in Kiribati is similar to that in Vanuatu and Tonga. That is, although each hospital separation is tracked using a detailed admission form that captures relevant information, not all of this information is stored electronically for each patient. Available data includes length of hospital stay and diagnosis by ICD-10, but excludes resource use by particular disease classification. The approach taken to cost clinical activity for Kiribati is detailed in Chapter 4.

Most reliable data

At the time of the site visit in March 2003, although staff were using the ICD-10 coding system, the most accurate and reliable hospital morbidity data available were for the year 1997, which was coded using ICD-9. In terms of MOH expenditure, a copy of the proposed 2002/2003 budget was sighted and used in these analyses, but was not made available in hard copy. Although this budget had not been ratified by the Government, it provides a good approximation of likely MOH expenditure, as the estimates do not vary substantially from previous years.

3 RESOURCE USE AND COST ASSOCIATED WITH NCD TREATMENT

3.1 Introduction

The purpose of this chapter is to address the second aim of this project: to assess bed day and direct treatment data relating to the most commonly occurring NCDs in the Pacific - cardiovascular diseases, neoplasms, chronic obstructive pulmonary disease, diabetes and hypertension. In order to achieve this aim it is useful, in the first instance, to consider hospital morbidity and cost data by disease classification and secondly, to elaborate on specific NCD categories. The quantification of resource use and cost associated with the treatment of disease will be presented individually for each country. All costs presented are expressed in local currency.

3.2 Resource use and cost associated with treatment of disease in Tonga

Hospital morbidity and cost by disease and NCD classification

Data obtained from the Kingdom of Tonga Hospital inpatient database for the year 2001 was sorted by ICD-10 code. Table 1 provides an overview of these data and presents results for each disease category in terms of: the total number of separations (or episodes of care); the proportion of all separations; average age; separation by gender; ALOS; and, average cost. Table 2 follows a similar presentation style to Table 1 in considering hospital morbidity and cost data by NCD. The derivation, and discussion, of average cost is outlined in the following section “quantifying the cost of treatment”.

As shown in Table 1, a total of 8,776 admissions were registered on the provided database for Tonga. The results suggest that for the year 2001, the main diagnoses for hospital admission were: pregnancy, childbirth and the puerperium (34.4% of total); diseases of the respiratory system (11.7% of total); diseases of the digestive system (8.2% of total); and injury, poisoning and external causes (8.0% of total). Diseases of the circulatory system and neoplasms accounted for 4.6% and 1.8%, respectively, of total admissions. The average age of all patients was 30 years of age while the ALOS across all separations was 4.9 days. Patients diagnosed with endocrine, nutritional and metabolic disorders had the longest ALOS (12.7 days), followed by mental, behavioural disorders (10.1 days) and neoplasms (9.6 days).

Table 2 shows a total of 911 NCD-related admissions, accounting for 10.4% (911 / 8776) of all admissions in 2001. Diabetes was the most prevalent NCD with 273 admissions representing 30% (273 / 911) of all NCD admissions. Diseases of the circulatory system accounted for 44% (403 / 911) of NCD admissions. The two most common circulatory conditions, other forms of heart disease (140 admissions) and hypertensive disease (105 admissions), together comprised 61% (245 / 403) of all circulatory diseases. Neoplasms were the next most common NCD representing 17.3% of all NCD admissions. The most common neoplasms were malignant neoplasms of digestive organs (34 admissions - 11 for stomach cancer, 11 for liver cancer and 7 for colon cancer) and benign neoplasms (27 admissions - 11 for benign lipomatous neoplasm). Less common neoplasms were breast cancer (19 admissions), lung cancer (8 admissions), and prostate cancer (8 admissions). There were a total of 75 admissions for unspecified COPD comprising 8.2% of all NCD admissions. The average age of all patients diagnosed with an NCD was 46 years of age with an ALOS of 9.2 days, almost twice that for all disease categories (4.9 days). Within the NCD group, patients with diabetes had the longest ALOS at 14.7 days followed by neoplasms (9.6 days) and unspecified COPD (8 days).

Quantifying the cost of treatment

As alluded to earlier, in the absence of a sophisticated clinical costing system, a decision was made to estimate the cost of a hospital separation using available information, predominantly budget and staff records. The process for deriving this estimate involved three main steps.

First, budget estimates had to be separated for inpatient and outpatient stay; as well as hospital and non-hospital care. In addition, although management and support staff (such as cleaners, maintenance and drivers) may be paid from separate program accounts, a certain portion of their budget needs to be apportioned to hospital care. Management and support staff provide services that ensure the hospital, as well as the MOH in general, is a well-functioning, well-supervised and well-maintained service to the community. The 2002/03 budget was used as a starting point and augmented or reduced with apportioned costs from, or to, budgets currently attributable to other divisions. For example, medical records are currently part of the MOH budget. As the function of medical records would be required in a

hospital, a proportion of the budget has been attributed to Vaiola hospital. Rates of apportionment are, generally, consistent with those used in the recent Kingdom of Tonga Health Sector Reform Project[19]. The Health Sector Reform project focused on Vaiola hospital as a whole, therefore, further apportioning was required to exclude outpatient activity from budget estimates, as well as include inpatient focused activity from other hospitals.

Second, using the MOH employment staff list for the year 2002/03, the total number of staff working in the medical services division (444) excluding emergency and outpatient activity (21), leaving predominantly inpatient activities (423), was divided by the total number of staff currently employed by the MOH (695), to estimate the proportion of MOH staff engaged, predominantly, in inpatient activity (61%). This rate was then applied to budget estimates that were not apportioned in the Health Sector Reform project, notably, general medical, laboratory, X-Ray and radiology, pharmacy, maintenance, medical administration, other islands with hospitals and the development fund.

As a consequence of these two steps, the budget estimate for inpatient activity for all hospitals is estimated at \$6,740,788 or 52% of the total MOH budget (\$12,898,852) for the year 2002/03. Given that the medical division employs approximately 63% of all MOH staff and accounted for close to 44% of the total MOH budget for the same year, the estimate of 52% of the total budget for inpatient activity (including administrated support) appears reasonable.

Finally, in order to cost an inpatient stay it is necessary to calculate an inpatient cost per day. Dividing total inpatient cost (\$6,740,788) with total inpatient length of stay of 42,885 days, results in a cost per inpatient day of \$157. This compares favourably with WHO estimates of average cost per inpatient bed-day (for all diseases, not just NCDs) at WST 235 (USD 77.50). The value of \$157 is applied in this study to estimate the resource implications associated with NCD admissions compared with admissions for other illnesses/diseases.

Cost associated with treatment

The last column in Table 1 and Table 2 provide the average cost of treatment by disease and NCD category respectively. The average total cost of a hospital admission for any disease is estimated at \$768 (Table 1) compared to \$1,447 for a NCD admission (Table 2). The average cost of the most prevalent diagnoses for admission: pregnancy, childbirth and the puerperium (\$481); diseases of the respiratory system (\$687); and, diseases of the digestive system (\$640) are all substantially lower than the average cost of the most prevalent NCDs: diseases of the circulatory system (\$884), diabetes (\$2,306), unspecified COPD (\$1,262) and neoplasms (\$1,501). This suggests that the average hospital admission costs associated with NCDs are approximately two to six times higher than those attributable to the most prevalent non-NCDs.

Total cost of treatment by disease or NCD may be estimated by multiplying the number of admissions for a specific disease by the respective average cost. For example, the total cost of neoplasms can be estimated at \$237,189 (158 admissions x \$1,501.2). The application of this method to NCD and all admissions suggest that total treatment costs for all NCDs was \$1,318,136 while, treatment costs for all conditions was \$6,740,788. Numbers presented in the Tables have been rounded so estimates derived by the reader may differ slightly from these totals.

These data suggest that NCDs accounted for 10.4% (911 / 8776) of all hospital admissions while the treatment of these diseases represented 19.6% (\$1,318,136 / \$6,740,788) of all inpatient hospital-based expenditures.

-----Tables 1 and 2 about here-----

3.3 Resource use and cost associated with treatment of disease in Vanuatu

Hospital morbidity and cost by disease and NCD classification

Data obtained from the National Statistics Officer for the year 2002 were analysed in an identical way to data from Tonga. Table 3 provides an overview of these data and presents, for each disease category, results in terms of: total number of separations; proportion of all separations; proportion of patients over the age of 15 years; separation by gender; ALOS; and, average cost. Table 4 follows a similar

presentation style to Table 3 in considering hospital morbidity and cost data by NCD. The derivation, and discussion, of average cost is outlined in the next section “quantifying the cost of treatment”.

Table 3 shows a total of 10,216 admissions were registered on the provided database for Vanuatu for the year 2002. The main diagnoses for hospital admission were: pregnancy, childbirth and the puerperium (28.8% of total); certain infections and parasitic diseases (17.6% of total); diseases of the respiratory system (13.9% of total); and, injury, poisoning and external causes (9.8% of total). Diseases of the circulatory system and neoplasms accounted for 3% (308 / 10216) and 1.1% (115 / 10216), respectively, of total admissions. Seventy-four percent of all patients were over 15 years while the ALOS was 4.9 days. Patients diagnosed with endocrine, nutritional and metabolic disorders had the longest ALOS (11.7 days), followed by certain conditions originating in the perinatal period (11.1 days).

Table 4, shows a total of 595 NCD-related hospital admissions accounting for 5.8% (595 / 10216) of all admissions in 2002. Diseases of the circulatory system accounted for 52% (308 / 595) of all NCD admissions (Table 4). The most two most common diseases of the circulatory system, hypertensive disease (163 admissions) and other forms of heart disease (60 admissions), were together responsible for 72.4% (223 / 308) of all admissions for circulatory system disease. Neoplasms were the next most prevalent NCD category with 115 admissions representing 19.3% of all NCD admissions. The most common neoplasms were: benign neoplasms (27 admissions); neoplasms of an uncertain or unknown behaviour (27 admissions); and malignant neoplasms of female genital organs (15 admissions). Less common cancers were malignant neoplasms of digestive organs (11 admissions of which 7 were related to liver cancer), breast cancer (5 admissions) and lung cancer (1 admission). There were 50 admissions for unspecified COPD representing 8.4% (50 / 595) of all NCD admissions. Ninety-six percent of all patients admitted for an NCD were over 15 years while the ALOS was 7.5 days. This compares with the ALOS of all separations of 4.9 days. For the key NCD groups, patients with diabetes had the longest ALOS at 13.3 days followed by neoplasms at 8.1 days.

Quantifying the cost of treatment

A three-step procedure similar to that used to estimate hospital cost per day for Tonga was applied for Vanuatu. The 2002/03 budget was used in conjunction with the chart of accounts in an attempt to net out the cost of providing inpatient care. The chart of accounts provided detail on each health-related program, activity and account range. The programs included: Southern Health Care (SHC); Northern Health Care (NHC); Public Health; and, Planning and Administration. Within each program a number of activities had been costed. For example, the SHC program contained cost breakdowns for the Director, Vila Central Hospital (VCH), Lenakel Provincial Hospital, Shafea province and Tafea province. As a consequence, expenditure data were available on all referral and provincial hospitals in Vanuatu. Using details of staff employed at MOH contained in the 2002/2003 budget estimates, the number of staff working in either a referral or provincial hospital (N=289) was divided by the total number of MOH salaried staff (N=540), to estimate the proportion of MOH staff engaged, predominantly, in hospital activity (54%). This rate was then applied uniformly across all programs and their respective activities to provide a proxy for the cost of inpatient hospital care. As a consequence of this method, the budget estimate for inpatient activity for all hospitals is estimated at Vt490,400,889, or 54% of the total MOH budget (Vt490,400,889) for the year 2002/2003. Although there are obvious limitations to this method (discussed in Chapter 6), this estimate (54% of total budget attributable to inpatient care) is similar to the estimate derived for Tonga, which was developed using a more rigorous procedure.

A cost per inpatient stay was calculated by dividing total inpatient cost (Vt490,400,889) with total inpatient length of stay of 49,620 days, resulting in a cost per inpatient day of Vt9,883. The value Vt9,883 is applied in this study to estimate the resource implications associated with NCD admissions compared with admissions for other illnesses/diseases.

Cost associated with treatment

The last column in Table 3 and Table 4 provide the average cost of treatment by disease and NCD category, respectively. The average cost of a hospital admission for all diseases is estimated at Vt48,003 compared to Vt73,799 for a NCD admission. The average costs for the majority of the most prevalent diagnoses for admission:

pregnancy, childbirth and the puerperium (Vt34,124); diseases of the respiratory system (Vt41,922); and, injury, poisoning and external causes (Vt38,579), are all substantially lower than the average cost of the most prevalent NCDs: diseases of the circulatory system (Vt57,951) and neoplasms (Vt80,252) with the exception of infectious and parasitic diseases (Vt63,928).

The total treatment cost for all NCD admissions is estimated at Vt43,909,845 (Vt73798.06 x 595) while treatment expenditure for all conditions was Vt490,400,889. Numbers presented in the Tables have been rounded so estimates derived by the reader may differ slightly from these totals.

These data suggest that NCDs accounted for 5.8% (595 / 10216) of all hospital admissions while the treatment of these diseases amounted to the equivalent of 9% (Vt43,909,845 / Vt490,400,889) of all inpatient hospital based expenditures.

-----Tables 3 and 4 about here-----

3.4 Resource use and cost associated with treatment of disease in Kiribati

Hospital morbidity and cost by disease and NCD classification

Data obtained from the Health Information Officer for the year 1997 were analysed in a similar way to the data for Tonga and Vanuatu. Given these data were coded according to ICD-9 coding, the numerical coding of disease categories differed marginally. Nevertheless, the divergence between ICD-9 and ICD-10 is not significant and similar result tables were able to be generated. Table 5 provides a summary of the findings in terms of main disease category (as per ICD-9 code), total number of separations, proportion of all separations, average age, separation by gender, ALOS and average cost. Table 5 follows a similar presentation style to Table 4 in considering hospital morbidity and cost data by NCD. The derivation, and discussion, of average cost is outlined in the following section “quantifying the cost of treatment”.

Table 5 shows a total of 3,872 admissions were registered on the provided database for Kiribati. The results suggest that for the year 1997, the main diagnoses for hospital admission were: pregnancy, childbirth and the puerperium (30.1% of total);

certain infections and parasitic diseases (13.1% of total); diseases of the respiratory system (13.1% of total); and diseases of the digestive system (9.2% of total). Diseases of the circulatory system and neoplasms accounted for 3.9% (151 / 3872) and 2% (79 / 3872), respectively, of total admissions. The average age of all patients was 29 years, while the ALOS was 9.3 days. Excluding mental and behavioural disorders, the diseases with the longest ALOS were certain infections and parasitic diseases (15.9 days), diseases of the skin and subcutaneous tissue (13.5 days) and diseases of the circulatory system (13.4 days).

Table 6 shows a total of 313 NCD-related hospital admissions accounting for 8.1% (313 / 3872) of all admissions in 1997. Diseases of the circulatory system accounted for 48.2% (151 / 313) of all NCD admissions (Table 6). The three most prevalent diseases of the circulatory system other forms of heart disease (46 admissions), hypertensive disease (38 admissions) and stroke (21 admissions) were together responsible for 70% (105 / 151) of all diseases of the circulatory system. Neoplasms were the next most prevalent NCD category with 79 admissions representing 25% of all NCD admissions. The most common cancers were: malignant neoplasms of genitourinary organs (22 admissions); malignant neoplasms of bone, connective tissue, skin and breast (11 admissions); neoplasms of unspecified nature (11 admissions), and malignant neoplasms of digestive organs (9 admissions). There were 60 admissions for diabetes and 23 admissions for bronchial COPD. The average age of all patients diagnosed with a NCD was 39 years of age with an ALOS of 13.5 days. This compares with the ALOS of all diseases of 9.3 days.

Quantifying the cost of treatment

Detailed data on budget estimates and MOH staff were not available at the time of the site visit. Subsequent effort to procure this information was not successful. In light of a complete lack of reliable data from which to derive estimates of the cost of inpatient hospital care, a decision was made to use the average proportion of inpatient to MOH expenditure derived for Tonga and Vanuatu. For Tonga, the budget estimate for inpatient activity for all hospitals is estimated at \$6,740,788 or 52% of the total MOH budget (\$12,898,852) for the year 2002/03. For Vanuatu, the budget estimate for inpatient activity for all hospitals is estimated at Vt490,400,889, or 54% of the total MOH budget (Vt490,400,889) for the year 2002/2003. Therefore,

the midpoint of these two estimates, 53%, is used as a proxy for expenditure on hospital inpatient care in Kiribati. As a consequence of this method, the budget estimate for inpatient activity for all hospitals is estimated at \$4,793,250 of the total MOH budget (\$9,043,867) for the year 2002/2003.

A cost per inpatient stay was calculated by dividing total inpatient cost (\$4,793,250) with total inpatient length of stay of 35,939 days, resulting in a cost per inpatient day of \$134. The value \$134 is applied in this study to estimate the resource implications associated with NCD admissions compared with admissions for other illnesses/diseases.

Although not included in this report, it is important to note that in the period between admission as an inpatient following initial treatment and any subsequent admissions/treatments, patients referred from the outer islands and their caregiver(s) that normally accompany them, are provided with food, shelter and personal hygiene items at the hospital Maneaba. Currently the hospital Maneaba will accommodate about 60 families and an additional Maneaba is being constructed due to lack of space at the existing site. While these are not technically a direct inpatient cost, they are strongly related, as these funds are derived from the MOH budget. Hence the financial imposts presented represent a conservative estimate of costs.

Cost associated with treatment

The last column in Table 5 and Table 6 provide the average cost of treatment by disease and NCD category, respectively. The average cost of a hospital admission for any disease is estimated at \$1,238 compared to \$1,806 for a NCD admission. The average costs for the majority of diseases were relatively close to the averages. The three exceptions were: pregnancy, childbirth and the puerperium (\$560); congenital anomalies (\$785); and, mental, behavioural disorders (\$10,170). The most expensive NCDs to treat were: malignant neoplasms of lip, oral cavity and pharynx (average cost of \$3,501); benign neoplasms average cost of \$3,152) and malignant neoplasms of digestive organs (average cost of \$3,097).

Given the extreme ALOS (76.3 days) and average costs (\$10,170) of mental and behavioural disorders (Table 5), this category was deleted from the database. This

resulted in reduction of 0.1 ALOS days and a \$9 decrease in average cost. Since this category impacts relatively little on total ALOS and average cost (due to the small number of patients, N=4), it was retained in the analysis.

The total treatment cost for all NCD admissions is estimated at \$565,363 ($\1806.27×313) while treatment expenditure for all conditions was \$4,793,250. Numbers presented in the Tables have been rounded so estimates derived by the reader may differ slightly from these totals. These data suggest that NCDs accounted for 8.1% ($313 / 3872$) of all hospital admissions while the treatment of these diseases amounted to the equivalent of 11.8% ($\$565,363 / 4,793,250$) of all inpatient hospital based expenditures.

-----Tables 5 and 6 about here-----

Table 1: Hospital morbidity and cost data by disease category, Tonga 2001

Category	Total	% of total	Av. age	M	F	ALOS	Av. cost*
Pregnancy, childbirth and the puerperium	3016	34.4%	29	15	3001	3.1	481
Diseases of the respiratory system	1029	11.7%	23	582	447	4.4	687
Diseases of the digestive system	720	8.2%	27	412	308	4.1	640
Injury, poisoning and external causes	702	8.0%	23	505	197	5.8	909
Certain infections and parasitic diseases	535	6.1%	24	268	267	4.4	693
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	524	6.0%	27	262	262	4.1	644
Diseases of the circulatory system	403	4.6%	57	209	194	5.6	884
Diseases of the genitourinary system	352	4.0%	38	103	249	5.9	927
Endocrine, nutritional and metabolic disorders	348	4.0%	57	107	241	12.7	1993
Certain conditions originating in perinatal period	236	2.7%	0	110	126	7.9	1237
Diseases of the skin and subcutaneous tissue	225	2.6%	28	138	87	7.5	1182
Disease of the musculoskeletal system and connective tissue	178	2.0%	36	116	62	8.8	1377
Neoplasms	158	1.8%	54	64	94	9.6	1501
Diseases of the nervous system	105	1.2%	29	61	44	8.0	1265
Congenital malformations, deformations, and chromosomal abnormalities	56	0.6%	6	38	18	6.1	954
Diseases of blood and blood forming organs and certain disorders involving the immune mechanisms	48	0.5%	53	13	35	6.3	989
Factors influencing health status and contact with health services	32	0.4%	27	6	26	3.3	526
Mental, behavioural disorders	29	0.3%	29	17	12	10.1	1594
Diseases of the ear and mastoid process	26	0.3%	16	13	13	4.1	641
Miscellaneous	23	0.3%	28	6	17	7.3	1148
External causes of morbidity and mortality	20	0.2%	23	11	9	2.4	369
Diseases of the eye and adnexa	11	0.1%	41	6	5	7.5	1186
TOTAL	8776	100.0%	30	3062	5714	4.9	768

*Expressed in local currency

Table 2: Hospital morbidity and cost data by NCD, Tonga 2001

NCDs	Total	Av. age	M	F	ALOS	Av. cost*
Neoplasms	158	54	64	94	9.6	1501
Malignant neoplasms of digestive organs	34	64	17	17	12.1	1900
Benign neoplasms	27	35	9	18	5.6	879
Neoplasms of uncertain or unknown behaviour	23	56	7	16	11.4	1797
Malignant neoplasms of breast	19	46	0	19	11.6	1820
Malignant neoplasms of lymphoid, haematopoietic and related tissue	11	51	5	6	9.0	1415
Malignant neoplasms of ill defined, secondary and unspecified sites	10	64	5	5	6.7	1053
Malignant neoplasms of respiratory and intrathoracic organs	9	64	8	1	11.4	1799
Malignant neoplasms of male genital organs	8	72	8	0	12.8	2004
Malignant neoplasms of female genital organs	7	55	1	6	6.1	966
Malignant neoplasms of thyroid and other endocrine glands	3	48	0	3	7.0	1100
In situ neoplasms	2	67	0	2	9.5	1493
Malignant neoplasms of lip, oral cavity and pharynx	1	69	1	0	3.0	472
Malignant neoplasms of skin	1	64	0	1	3.0	472
Diabetes mellitus	273	59	83	190	14.7	2306
Diseases of the circulatory system	403	57	209	194	5.6	884
Other forms of heart disease	140	56	79	61	7.4	1155
Hypertensive diseases	105	62	37	68	5.0	793
Ischaemic heart disease (coronary heart disease)	66	58	44	22	5.4	848
Cerebrovascular disease (stroke)	52	66	26	26	8.5	1333
Acute rheumatic fever	14	15	7	7	8.7	1370
Chronic rheumatic heart diseases	11	31	7	4	8.9	1400
Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified	9	46	5	4	7.1	1118
Other and unspecified disorders of the circulatory system	3	49	2	1	4.0	629
Diseases of the arteries, arterioles and capillaries	2	64	2	0	5.5	865
Other COPD	75	69	60	15	8.0	1262
Bronchitis (COPD)	2	37	1	1	1.5	236
TOTAL OF NCDs	911	46	417	494	9.2	1447

*Expressed in local currency

Table 3: Hospital morbidity and cost data by disease category, Vanuatu 2002

Category	Total	% total	% age >15	M	F	ALOS	Av. cost*
Pregnancy, childbirth and the puerperium	2943	28.8%	99%	0	2943	3.5	34124
Certain infections and parasitic diseases	1796	17.6%	55%	936	860	6.5	63938
Diseases of the respiratory system	1418	13.9%	44%	819	599	4.2	41922
Injury, poisoning and external causes	1000	9.8%	74%	610	390	3.9	38579
Diseases of the genitourinary system	457	4.5%	93%	151	306	4.8	47290
Diseases of the digestive system	420	4.1%	71%	241	179	4.7	46025
Diseases of the skin and subcutaneous tissue	403	3.9%	59%	230	173	5.5	54404
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	361	3.5%	78%	177	184	3.6	35111
Diseases of the circulatory system	308	3.0%	94%	155	153	5.9	57951
Disease of the musculoskeletal system and connective tissue	183	1.8%	81%	101	82	6.1	60309
Endocrine, nutritional and metabolic disorders	180	1.8%	79%	82	98	11.7	115792
Factors influencing health status and contact with health services	152	1.5%	88%	63	89	8.0	79410
Neoplasms	115	1.1%	97%	42	73	8.1	80251
Certain conditions originating in perinatal period	104	1.0%	0%	56	48	11.1	109788
Diseases of the nervous system	94	0.9%	70%	59	35	6.2	61633
Mental, behavioural disorders	78	0.8%	97%	36	42	2.8	28015
Diseases of the eye and adnexa	68	0.7%	81%	40	28	3.8	37498
Diseases of the ear and mastoid process	53	0.5%	47%	29	24	5.1	50385
Diseases of blood and blood forming organs and certain disorders involving the immune mechanisms	50	0.5%	56%	16	34	8.2	80884
Congenital malformations, deformations, and chromosomal abnormalities	33	0.3%	15%	14	19	5.8	57202
TOTAL	10216	100.0%	74%	3857	6359	4.9	48003

*Expressed in local currency

Table 4: Hospital morbidity and cost data by NCD, Vanuatu 2002

NCDs	Total	% age > 15	M	F	ALOS	Av. cost*
Neoplasms	115	97%	42	73	8.1	80252
Benign neoplasms	27	96%	8	19	5.3	52784
Neoplasms of uncertain or unknown behaviour	27	96%	9	18	7.7	76028
Malignant neoplasms of female genital organs	15	100%	1	14	11.4	112669
Malignant neoplasms of digestive organs	11	100%	9	2	4.9	48518
Malignant neoplasms of lymphoid, haematopoietic and related tissue	9	100%	6	3	4.5	44914
Malignant neoplasms of ill defined, secondary and unspecified sites	8	100%	1	7	19.8	195193
Malignant neoplasms of breast	5	100%	0	5	6.8	67206
Malignant neoplasms of thyroid and other endocrine glands	4	100%	1	3	6.8	66712
Malignant neoplasms of lip, oral cavity and pharynx	2	100%	2	0	9.0	88949
Malignant neoplasms of male genital organs	2	50%	2	0	6.5	64241
Malignant neoplasms of respiratory and intrathoracic organs	1	100%	1	0	10.0	98832
Malignant neoplasms of bone and articular cartilage	1	100%	0	1	22.0	217430
Malignant neoplasms of skin	1	100%	1	0	9.0	88949
Malignant neoplasms of mesothelial and soft tissue	1	100%	0	1	7.0	69183
Malignant neoplasms of urinary tract	1	100%	1	0	18.0	177898
Diabetes mellitus	103	99%	55	48	13.3	131677
Diseases of the circulatory system	308	94%	155	153	5.9	57952
Hypertensive diseases	163	99%	69	94	5.2	51557
Other forms of heart disease	60	93%	32	28	7.3	71851
Ischaemic heart disease (coronary heart disease)	23	100%	17	6	3.5	34936
Cerebrovascular disease (stroke)	21	100%	13	8	9.3	91726
Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified	21	67%	13	8	6.4	63159
Acute rheumatic fever	17	65%	10	7	4.9	48894
Chronic rheumatic heart diseases	2	100%	1	1	4.5	44475
Diseases of the arteries, arterioles and capillaries	1	100%	0	1	16.0	158131
Other COPD	50	100%	30	20	4.9	48428
Bronchitis (COPD)	18	100%	5	13	4.0	39973
Emphysema	1	100%	1	0	13.0	128482
TOTAL OF NCDs	595	96%	288	307	7.5	73798

*Expressed in local currency

Table 5: Hospital morbidity and cost data by disease category, Kiribati 1997

Category	Total	% total	Av age	M	F	ALOS	Av. cost*
Pregnancy, childbirth and the puerperium	1164	30.1%	28	18	1146	4.2	560
Certain infections and parasitic diseases	509	13.1%	22	279	230	15.9	2122
Diseases of the respiratory system	503	13.0%	18	264	239	9.4	1252
Diseases of the digestive system	358	9.2%	35	202	156	10.3	1376
Injury and poisoning	200	5.2%	28	152	48	11.1	1477
Diseases of the genitourinary system	182	4.7%	35	57	125	9.0	1205
Diseases of the nervous system and sense organs	156	4.0%	31	91	65	8.7	1160
Diseases of the circulatory system	151	3.9%	44	93	59	13.4	1786
Diseases of the skin and subcutaneous tissue	144	3.7%	32	91	53	13.5	1806
Symptoms, signs and ill-defined conditions	143	3.7%	31	58	85	8.3	1109
Endocrine, nutritional and metabolic disorders, and immunity disorders	93	2.4%	41	39	54	12.3	1635
Disease of the musculoskeletal system and connective tissue	86	2.2%	32	51	35	11.5	1528
Neoplasms	79	2.0%	46	29	50	12.6	1675
Diseases of blood and blood forming organs and certain disorders involving the immune mechanisms	42	1.1%	22	21	21	7.6	1016
Congenital anomalies	35	0.9%	14	23	12	5.9	785
Certain conditions originating in perinatal period	23	0.6%	8	13	10	9.3	1241
Mental, behavioural disorders	4	0.1%	21	4	0	76.3	10170
TOTAL	3872	100%	29	1485	2388	9.3	1238

*Expressed in local currency

Table 6: Hospital morbidity and cost data by NCD, Kiribati 1997

NCD	Total	Av age	M	F	ALOS	Av. cost*
Neoplasms	79	46	29	50	12.6	1675
Malignant neoplasms of genitourinary organs	22	47	1	21	11.0	1467
Malignant neoplasms of bone, connective tissue, skin and breast	11	40	3	8	6.1	812
Neoplasms of unspecified nature	11	45	3	8	17.9	2389
Malignant neoplasms of digestive organs	9	53	6	3	23.2	3097
Malignant neoplasms of lip, oral cavity and pharynx	4	44	2	2	26.3	3501
Malignant neoplasms of other and unspecified sites	4	53	4	0	9.8	1300
Malignant neoplasms of lymphoid, haematopoietic and related tissue	3	17	1	2	14.7	1956
Benign neoplasms	3	45	7	6	23.3	3112
Malignant neoplasms of respiratory and intrathoracic organs	2	67	2	0	12.5	1667
Diabetes mellitus	60	52	24	36	14.3	1907
Diseases of the circulatory system	151	44	93	59	13.4	1786
Other forms of heart disease	46	43	31	15	15.4	2053
Hypertensive diseases	38	48	21	17	11.9	1593
Cerebrovascular disease (stroke)	21	56	14	7	9.0	1207
Ischaemic heart disease (coronary heart disease)	14	50	12	2	4.2	562
Chronic rheumatic heart diseases	13	26	5	8	7.1	944
Diseases of the arteries, arterioles and capillaries	7	47	4	3	16.3	2172
Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified	7	26	5	2	18.9	2515
Bronchitis (COPD)	23	15	15	8	16.0	2128
TOTAL OF NCDs	313	39	161	153	13.5	1806

*Expressed in local currency

4 IMPACT OF TOBACCO AND ALCOHOL ON HOSPITAL RESOURCES

4.1 Introduction

The purpose of this chapter is to address the third aim of this project: to define, where practical, the impact of tobacco and alcohol usage on subsequent bed day utilisation and treatment (aetiological fractions). In order to achieve this aim it is necessary to: first, consider the available evidence regarding the impact of tobacco and alcohol use on burden of disease / hospital admissions; second, consider the prevalence of tobacco and alcohol use in the community; and third, apply these rates OR develop aetiological fractions for each country.

4.2 Impact of tobacco and alcohol on disease

An aetiological fraction, also known as an attributable proportion or attributable risk, is a form of indirect quantification of morbidity and mortality due to a specified risk factor. Indirect methods involve the estimation of a probability measure of the likelihood of causation by the risk factor which is then applied to the total number of deaths, illnesses or injuries resulting from a specific cause[20]. In this particular case, the risk factor is the consumption of alcohol or tobacco.

There are two main sources of aetiological fractions for alcohol/tobacco related illnesses and injuries. First, the fractions can be estimated directly from a series of cases where each case can be identified as caused or not caused by the drug in question. For example, from a representative series of fire deaths subjected to review, an estimated 17% were caused by cigarette smoking. Thus an aetiological fraction of 17% can be applied to all fire deaths in the population to estimate the number attributable to cigarette smoking. The second, and more common, source of aetiological fractions is from studies of the comparative rates of death, illness or injury in groups of people exposed and not exposed, or exposed at varying levels, to the drug in question. These types of studies are more common in developed countries and provide a reasonable understanding of the type of illnesses usually attributable (in whole or in part) to the consumption of alcohol and tobacco. The following example illustrates this method. Table 7 provides Australian derived aetiological fractions of cigarette smoking for stroke and pneumonia[20]. The table indicates that 41.6% of all stroke deaths in Australian males in the age group 35-39

are casually associated with tobacco. Among females in the same age group the percentage (37.8%) is slightly lower. Much lower proportions of pneumonia deaths are attributable to smoking (18% for males aged 35-39 and 15.9% for females).

An aetiological fraction which is positive but less than one indicates that the particular medical condition has more than one cause. Table 7, for example, indicates that smoking is not the only cause of strokes or pneumonia. Occasionally these fractions can be negative, indicating that the drug in question has a protective effect against the medical condition under study.

Table 7: Selected aetiological fractions for tobacco

Condition	Male 35-39 years	Female 35-39 years
Stroke	0.416	0.378
Pneumonia	0.180	0.159

Calculating an aetiological fraction using the second method requires two fundamental pieces of information: i) the relative risk (measuring the casual relationship between exposure to the risky drug and the condition being studied); and, ii) prevalence (measuring the proportion of the relevant population engaging in risky activity). In Australia, researchers and clinicians have conducted many clinical trials examining the impact of tobacco and alcohol on various diseases in order to collect data on relative risks and prevalence estimates. The culmination of this research is presented in Table 8 which lists all the conditions which Australian researchers and their predecessors have concluded are casually linked to the use of tobacco and alcohol[20]. It is important to note that the impact that either tobacco or alcohol has on a particular condition will undoubtedly vary according to demographic and epidemiological transitions (discussed in Chapter 5). Further, for many NCDs the presence of multiple risk factors (in addition to tobacco and alcohol) has a synergistic effect in causing disease, in other words, the risk of disease may actually multiply when more than one risk factor is present. This is important in estimating the epidemiological impact of risk factors and diseases, and in planning interventions against them.

Table 8: Conditions attributable to tobacco and alcohol

Alcohol	Tobacco
Oropharyngeal cancer	Oropharyngeal cancer
Oesophageal cancer	Oesophageal cancer
Liver cancer	Stomach cancer
Laryngeal cancer	Anal cancer
Female breast cancer	Pancreatic cancer
Alcoholic psychosis	Laryngeal cancer
Alcohol dependence/abuse	Lung cancer (active and passive)
Alcoholic liver cirrhosis	Endometrial cancer
Road injuries	Cervical cancer
Epilepsy	Vulvar cancer
Alcoholic poly-neuropathy	Penile cancer
Hypertension	Bladder cancer
Ischaemic heart disease	Renal parenchymal cancer
Alcoholic cardiomyopathy	Renal pelvic cancer
Supraventricular cardiac dysrhythmias	Respiratory carcinoma in situ
Heart failure	Ischaemic heart disease (active and passive)
Stroke – haemorrhagic	COPD
Stroke – ischaemic	Tobacco abuse
Oesophageal varices	Parkinson's disease
Gastro-oesophageal haemorrhage	Pulmonary circulation disease
Alcoholic gastritis	Cardiac dysrhythmias
Unspecified liver cirrhosis	Heart failure
Cholelithiasis	Stroke
Pancreatitis - acute	Artheroscleroris
Pancreatitis – chronic	Pneumonia
Low birthweight	Peptic ulcer
Psoriasis	Chron's disease
Alcoholic beverage and other ethanol poisoning	Ulcerative colitus
Other ethanol and methanol poisoning	Ectopic pregnancy
Fall / fire injuries	Spontaneous abortion
Drowning	Antepartum haemorrhage
Aspiration	Hypertension in pregnancy
Occupational and machine injuries	Low birthweight
Suicide and self-inflicted injuries	Premature membrane rupture
Assault	SIDS
Child abuse	Fire injuries
	Asthma (under 15 years)
	Lower respiratory illness (under 18 months)

4.3 Prevalence of alcohol and tobacco in each country

The WHO estimates that about 50% of men and 8% of women in developing countries are smokers. About 800 million of the world's estimated 1.1 billion smokers (73% of the total) are in developing countries. Further, the Western Pacific Region has shown the highest rise in tobacco use of any WHO region. The prevalence rates are 62.3% for males and 5.8% for females, equivalent to 422 million smokers, or 34.4% of the total number of smokers in the world[21].

Given the well-known harms associated with smoking, the current, and rising, rates of smoking will be associated with significant future morbidity and mortality unless current smoking trends can be reversed. While data on the prevalence of smoking appears reasonably reliable for developed, and to a lesser extent, developing countries (particularly more so since the introduction of guidelines by WHO for conducting smoking surveys[22]), data on the prevalence of alcohol use is somewhat limited, particularly for Kiribati, Tonga and Vanuatu. The purpose of this section is to provide an overview of research that has examined the prevalence of alcohol and tobacco use in these countries. To this extent, the review is not meant to be comprehensive but rather informative of the general magnitude of use.

Tonga

Woodward et al., (1994) measured the prevalence of smoking in Tonga in 1991[23]. The questionnaire was based on the WHO guidelines for tobacco smoking surveys [22]. As indicated in Table 9, current smoking, defined as smoking in the three months prior to the survey, was reported by 62% of males and 14% of females. The highest proportions of smokers were found amongst young and middle-aged men, but the prevalence of smoking tended to increase with age amongst women.

Table 9: Prevalence of current smokers, by sex and age group, Tonga 1991

Age group	Current smokers	
	Males	Females
20-24	60.4%	9.8%
25-29	60.7%	9.9%
30-34	64.4%	16.5%
35-39	74.8%	14.9%
40-44	58.9%	12.9%
45-49	63.8%	11.5%
50-54	68.0%	17.1%
55-59	64.1%	14.8%
60-64	66.4%	16.3%
65-69	54.5%	26.1%
70-74	60.9%	15.5%
75-79	43.4%	14.6%
80 and over	43.9%	25.9%
All ages	62.4%	14.2%

A recent study by UNICEF called, State of Health Behaviour and Lifestyle of Pacific Youth Survey[24], found that substantial percentages of young people, both school pupils and school leavers, had tried alcohol, tobacco and illegal drugs. Table 10

summarises the findings from this study. This survey was carried out in all parts of Tonga, but the report does not show differences between island groups. Moreover, although substance use was reported by both males and females, the overall percentages by gender were shown only for frequency of use by Out-of-School Youth. The table indicates, however, that both male school pupils and male Out-of-School Youth were more likely to have ever used or regularly used substances than were their female counterparts. There was also the expected pattern of increasing ever use of substances with increasing age. A striking feature of these data is that almost half of the At-School Youth had tried smoking, and around one in five had tried alcohol. Among Out-of-School Youth, almost 70% had tried smoking, and more than 75% of boys and almost 20% of girls were regular smokers. More than 55% of Out-of-School Youth had tried alcohol, with almost 70% of boys and almost 30% of girls using it regularly. Although only a few Out-of-School girls had tried other substances, substantial percentages of boys were regular users of solvents, marijuana and methylated spirits.

Table 10: Summary of UNICEF findings on substance use

Substance	At School Youth		Out of School Youth		
	Ever Used	Use Weekly or More Often	Ever Used	Use Weekly or More Often	
				Boys	Girls
Tobacco	47.6%	17.1%	68.0%	75.9%	19.9%
Kava	29.9%	8.4%	56.9%	75.1%	54.1%
Alcohol	21.3%	No data	55.5%	69.6%	28.3%
Solvents	13.6%	4.3%	20.0%	28.9%	2.9%
Marijuana	5.6%	2.7%	27.2%	38.1%	5.9%
Methylated spirits	4.0%	2.0%	23.8%	34.7%	2.4%
Mushrooms	3.7%	2.1%	12.2%	16.5%	3.2%
Fafangu (Datura)	1.6%	1.2%	5.4%	7.1%	2.1%

A recent study undertaken on behalf of the Pacific Action for Health Project of SPC, working in conjunction with the Tonga Family Health Association, investigated the nature and patterns of substance use among young people in Tonga using focus groups[25]. The study found that smoking and alcohol consumption among Tongan youth was widespread. The most common ages to start smoking were 11 to 13 years, while 16 and 17 were the most common ages to start drinking. Smoking is often a daily activity, but alcohol is most often consumed at weekends, especially on Friday nights. Younger children smoke in secret but older youths smoke in public. The usual places for alcohol consumption are night clubs, 'huts' and secret locations.

Binge drinking seems to be the norm. Narcotics are usually taken in secret locations. Some reported episodes of alcohol and narcotic consumption were life-threatening. Cigarettes are widely used, the majority of respondents having tried commercial brands such as Winfield. Spirits ('hot stuff') such as Bounty Rum were the most popular beverage while local and imported beer were less common than spirits. There was considerable variation in the number of cigarettes smoked and the quantities of alcohol consumed. The majority of smokers smoked less than 10 cigarettes a day, with the youngest smokers likely to smoke only 1-3 a day. Those who smoked least tended to smoke irregularly. While smokers were likely to smoke everyday, drinking tended to be related to paydays or the acquisition of money in other ways. Most drinkers reported drinking mainly on Fridays, and sometimes Saturdays as well, or opportunistically if one of their peers had obtained some alcohol[25].

Vanuatu

One of the first NCD surveys conducted in Vanuatu occurred in 1984[26]. This survey was limited, however, to examining the prevalence of obesity, diabetes and hypertension. In 1985, a joint effort by the MOH, SPC and WHO, was undertaken to determine the prevalence of NCDs and their risk factors amongst adults in Vanuatu, as well as to assess the impact of increasing urbanization on those diseases[27]. A cross-sectional prevalence survey of adult ni-Vanuatu aged 20 years and over was conducted, drawn from three populations presumed to be at different levels of modernisation: Vila (urban), Nguna (intermediate) and Middle Bush Tanna (rural). Among other things, measurements were made of tobacco, alcohol and kava use. Summary findings for tobacco, alcohol and kava use are presented in Table 11. Use of tobacco, kava and alcohol was much higher in men than in women. Tobacco use was lower in male urban civil servants than in the rural population. The use of alcohol and kava was about the same in males for all locations (although volume consumed may have been different), but alcohol and kava use was very infrequent amongst women in Tanna[27].

Table 11: Summary statistics, Vanuatu NCD survey 1985

Substance	Urban	Intermediate	Rural
Use of tobacco			
Males	54%	80%	77%
Females	5%	3%	6%
Use of Kava			
Males	68%	78%	73%
Females	6%	9%	1%
Use of alcohol			
Males	74%	82%	70%
Females	19%	16%	3%

In 1986 a food and nutrition policy was developed in Vanuatu with one of its objectives being to prevent an increase in the prevalence of NCDs[28]. Since that time there have been ad hoc NCD surveys conducted in 1990 (using the same three sites as the 1985 survey) and in 1993 amongst civil servants in Vanuatu[29]. Although these reports remain incomplete and unpublished, they suggest that NCDs had increased further in urban areas but the evidence in the reports was not strong enough to provide the basis for national policy and programmes. Additionally, as there had been no national data collected on the prevalence of NCDs since the 1985 survey, the real picture of NCDs in Vanuatu remained unknown.

In 1993, the Vanuatu National Nutrition Surveillance system was established. The system identified the need to assess the extent of obesity, hypertension and diabetes in selected sites and to monitor the change in these conditions over time[29]. The main NCDs reported by the HIS in Vanuatu were diabetes, hypertension, heart disease, cancer, stroke and overweight/obesity. One recommendation of the HIS was to ensure efficient monitoring of the NCD situation by conducting sentinel site surveys every five years to measure the trends[29]. As a consequence of this recommendation, in 1998, the Department of Public Health undertook an assessment of the prevalence of non-communicable diseases and their risk factors in Vanuatu[30]. The survey was administered in five of the six provinces of Vanuatu, based on the presence of provincial hospitals. Participants were selected using a cluster sampling methodology and only household members aged 20 years and over were interviewed. Questions on alcohol and smoking consumption patterns were collected. Table 12 reports the findings for questions relating to alcohol, smoking and kava use. The findings showed that over 50% of males and 11% of the females surveyed reported consuming alcohol. Reported frequency of alcohol consumption (not shown in Table

12) was low, with nearly 70% total male and 78% females reporting consuming alcohol yearly. Around 50% of males and 5% of females reported smoking with the highest prevalence of smoking (61%) found among the 20-29 year old age cohort. The majority of male (49.1%) and female (56.4%) of smokers consumed between 1 and 5 cigarettes per day. Kava use was reported by 67% of all males and 15% of females surveyed. Overall 86% of males and 45% females consumed Kava at least weekly.

Table 12: Distribution of respondents by alcohol consumption, smoking and kava use, gender and age group

Gender/age group	Alcohol	Smoking	Kava
Males			
20-29	72.2%	60.9%	71.4%
30-39	52.3%	46.2%	64.1%
40-49	42.9%	41.7%	67.3%
50-59	30.9%	44.2%	68.4%
>60	16.3%	42.0%	61.7%
All	50.4%	49.1%	67.2%
Females			
20-29	13.2%	4.7%	11.3%
30-39	10.9%	2.3%	13.6%
40-49	11.9%	5.7%	15.7%
50-59	7.5%	2.5%	16.3%
>60	5.7%	15.7%	30.0%
All	11.1%	5.0%	14.9%
All respondents	30.8%	27.2%	41.3%

Kiribati

In a report by Collins and Lapsley (1997)[31], data on the prevalence of smoking in Kiribati were reported. Table 13 presents the key findings of this survey. As indicated in the table, that prevalence of smoking was high across all groups with prevalence highest among urban males aged 25-34. In general, the prevalence of smoking was highest amongst males than females, and among urban settings than rural settings.

Table 13: Smoking prevalence in Kiribati, by age, gender, urban/rural, 1981

Age	Urban male	Urban female	Rural male	Rural female
20-24	95%	63%	85%	57%
25-34	90%	75%	83%	68%
35-44	91%	78%	84%	73%
45-54	84%	71%	87%	66%
55+	83%	82%	79%	71%

Using data collected for a 1999 WHO report, Khaleghian (2001) reports that 82% of all males and 65% of females in Kiribati are current smokers[6]. Similar patterns were reported by Stanton (2001), who, using data collected for the 1997 WHO “Tobacco or Health: a global status report”, concluded that Kiribati had the highest rate of women smokers in the world with 74% of females regularly using tobacco[32].

The most recent data on the prevalence of smoking and alcohol use in Kiribati comes from the report of the 2000 census of population[17]. Respondents were asked whether any member of the household smoked or drunk alcohol. Eighty one percent of households indicated a member smoked while 38% had consumed alcohol.

4.4 Quantifying harm caused by alcohol and tobacco in each country

As discussed previously, in order to calculate aetiological fractions two fundamental pieces of information are required: the relative risk (measuring the causal relationship between exposure to the risky drug and the condition being studied); and, prevalence (measuring the proportion of the relevant population engaging in the risky activity). Although the data bank on the prevalence of alcohol and tobacco use in Tonga, Vanuatu and Kiribati is growing, the lack of detailed epidemiological data on relative risks suggests that, at this stage, it is not possible to develop specific tobacco and alcohol aetiological fractions for the three countries of interest.

Although Australian aetiological fractions have been developed and comprehensively list all the conditions causally linked to the use of tobacco and alcohol (Table 8), these fractions are very country specific. For instance, in relation to tobacco, given the long delay between the onset of smoking and development of tobacco-related illnesses, the patterns of tobacco-related harm experienced in Australia today are a reflection of smoking practices many years ago. Further, many of the health effects of smoking depend on the exposure history, including the age at which smoking began, the number of cigarettes smoked per day, the degree of inhalation and

cigarette characteristics such as tar and nicotine content or presence of a filter. Therefore, the conditions identified in Australia as being attributable to tobacco and alcohol may not (currently) apply to Tonga, Vanuatu or Kiribati. However, a caveat of this argument is that it is plausible to assume that these conditions are likely to be applicable in the near future, as these populations undergo epidemiological transition, resulting in more tobacco and alcohol-related harm.

In the World Health Report 2002, region specific population attributable fractions have been developed by age and gender for particular risk factors[1]. These fractions for tobacco and alcohol use are outlined in Table 14. Included in the table are estimates for low mortality developing and developed countries. The low mortality developing category includes the Western Pacific Region (Group B) of which Kiribati, Tonga and Vanuatu are members. The developed country category includes Australia and is included for comparative purposes, to illustrate variations in the magnitude of attributable fractions between countries.

Given that these estimates are the most reliable to date, they are used in this document to consider the impact of tobacco and alcohol usage on subsequent bed - day utilization and treatment costs in each country. Using data reported in Tables 1-6, the attributable fractions are applied to the particular disease of interest (or injury in the case of alcohol) to estimate the number of admissions and associated cost attributable to smoking and alcohol. These estimates are then expressed as a proportion of NCDs and all diseases.

Table 14: Population attributable fractions by risk factor, age and gender, 2000

Risk factor and condition	Low mortality developing		Developed countries	
	Males	Females	Males	Females
Tobacco				
COPD	35%	14%	79%	57%
Mouth and oropharynx cancers	0%	0%	0%	0%
Trachea/bronchus/lung cancers	57%	20%	90%	69%
Other cancers	12%	1%	19%	2%
Other medical conditions	7%	1%	16%	6%
CVD	12%	2%	32%	10%
Alcohol				
Cirrhosis of the liver	45%	13%	63%	49%
Drowning	10%	6%	43%	25%
Epilepsy	27%	13%	45%	36%
Falls	8%	3%	21%	8%
Haemorrhagic stroke	21%	2%	26%	0%
Homicide	28%	16%	41%	32%
Ischaemic heart disease	5%	0%	2%	-3%
Ischaemic stroke	3%	0%	5%	-16%
Unipolar depressive disorders	3%	0%	7%	2%
Liver cancer	32%	11%	36%	28%
Mouth and oropharynx cancers	28%	10%	41%	28%
Oesophagus cancer	42%	16%	46%	36%
Other cancers	5%	2%	11%	8%
Self-inflicted injuries	10%	5%	27%	12%
Poisoning	11%	7%	43%	26%
Other intentional injuries	20%	11%	32%	19%
MVA	25%	8%	45%	18%
Other unintentional injuries	15%	6%	32%	16%

Tonga

The number of hospital admissions and treatment costs attributable to tobacco and alcohol for Tonga 2001 are presented in Table 15. The table presents the impact of tobacco and alcohol according to NCDs, other treatment and all diseases. Although the attributable risk of tobacco is generally confined to NCD, the attributable risk of alcohol is associated with both NCD and other diseases (predominantly injury). The proportion of total risk is estimated by dividing tobacco and alcohol risk by totals derived from Tables 1 and 2. The data suggests that for the year 2001, tobacco and alcohol were responsible for an estimated 9.9% (90 / 911) of all NCD admissions and 2.1% (186 / 8776) of total admissions. The cost of treating patients with a tobacco- or alcohol-related disease or injury is estimated to account for 9.1% (\$120,563) of the total cost of treating all NCDs and 3.1% (\$208,090) of the cost of treating all diseases.

Table 15: Number of hospital admissions and treatment costs attributable to tobacco and alcohol, Tonga 2001

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 1&2)	% Total
Hospital admissions					
NCD	72	18	90	911	9.9%
Other diseases	0	96	96	7865	1.2%
All diseases	72	114	186	8776	2.1%
Cost of treatment*					
NCD	\$92358	\$28204	\$120563	\$1318136	9.1%
Other diseases	\$0	\$87528	\$87528	\$5422652	1.6%
All diseases	\$92358	\$115732	\$208090	\$6740788	3.1%

*Expressed in local currency

Vanuatu

The number of hospital admissions and treatment costs attributable to tobacco and alcohol for Vanuatu 2002 are presented in Table 16. The table presents the impact of tobacco and alcohol according to NCDs, other treatment and all diseases.

Although the attributable risk of tobacco is generally confined to NCD, the attributable risk of alcohol is associated with both NCD and other diseases (predominantly injury).

The proportion of total risk is estimated by dividing tobacco and alcohol risk by totals derived from Tables 3 and 4. The data suggests that for the year 2002, tobacco and alcohol were responsible for an estimated 9.9% (59 / 595) of all NCD admissions and 1.8% (187 / 10216) of total admissions. The cost of treating patients with a tobacco or alcohol related disease or injury is estimated to account for 8.5% (Vt3,746,959) of the total cost of treating all NCDs and 1.8% (Vt8,679,144) of the cost of treating all diseases.

Table 16: Number of hospital admissions and treatment costs attributable to tobacco and alcohol, Vanuatu 2002

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 3&4)	% Total
Hospital admissions					
NCD	49	10	59	595	9.9%
Other diseases	0	128	128	9621	1.3%
All diseases	49	138	187	10216	1.8%
Cost of treatment*					
NCD	3087118	659841	3746959	43909845	8.5%
Other diseases	0	4932184	4932184	446491044	1.1%
All diseases	3087118	5592026	8679144	490400889	1.8%

*Expressed in local currency

Kiribati

The number of hospital admissions and treatment costs attributable to tobacco and alcohol for Kiribati 1997 are presented in Table 17. The table presents the impact of tobacco and alcohol according to NCDs, other treatment and all diseases. Although the attributable risk of tobacco is generally confined to NCD, the attributable risk of alcohol is associated with both NCD and other diseases (predominantly injury). The proportion of total risk is estimated by dividing tobacco and alcohol risk by totals derived from Tables 5 and 6. The data suggests that for the year 1997, tobacco and alcohol were responsible for an estimated 9.8% (31 / 313) of all NCD admissions and 1.5% (59 / 3872) of total admissions. The cost of treating patients with a tobacco or alcohol related disease or injury is estimated to account for 11% (\$62,183) of the total cost of treating all NCDs and 1.6% (\$104,540) of the cost of treating all diseases.

Table 17: Number of hospital admissions and treatment costs attributable to tobacco and alcohol, Kiribati 1997

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 5&6)	% Total
Hospital admissions					
NCD	23	8	31	313	9.8%
Other diseases	0	28	28	3559	0.8%
All diseases	23	36	59	3872	1.5%
Cost of treatment*					
NCD	\$44356	\$17827	\$62183	\$565363	11.0%
Other diseases	\$0	\$42357	\$42357	\$6175425	0.7%
All diseases	\$44356	\$60184	\$104540	\$6740788	1.6%

*Expressed in local currency

5 ECONOMIC PROJECTIONS OF THE NCD BURDEN

5.1 Introduction

The purpose of this chapter is to address the fourth aim of this project: to provide, where practical, economic projections on the NCD burden through to 2020. While a full appraisal of the social economic cost of NCDs is beyond the brief of this report, it is useful to consider the spectrum of resources usually involved in such an appraisal. The economic costs of NCDs (and for that matter any disease) can be described as having two components: direct and indirect costs. Direct costs are those specifically incurred for the diagnosis, treatment and palliation of a disease. Examples include the cost of a diagnostic test, a home visit from a nurse or a course of medication and include the cost of labour, materials and facilities involved in the production of each. Indirect costs are those caused by the loss of productive life. These include the cost of lost productivity due to illness, disability or premature death on the part of disease sufferers, as well as the cost of forgone economic opportunities for family members and informal caregivers, who spend time caring for an affected individual.

Given this report has focused entirely on the treatment of NCDs within hospitals, it is appropriate to limit discussion of future economic costs of NCDs to this setting. Specifically, attention will be directed to examining the direct resource implications of NCDs, with a focus on tobacco and alcohol as risk factors for disease. As such, no consideration will be given to the indirect economic implications of tobacco or alcohol related morbidity or mortality.

5.2 Future rise in NCDs

As discussed in the introductory chapter, the rapid rise of NCDs represents one of the major health challenges to global development. It is estimated that by 2020 over 70% of the global burden of disease will be caused by NCDs (especially cancer, diabetes, cardiovascular diseases and chronic respiratory diseases), mental health disorders and injuries[1]. Table 18 provides an overview of attributable mortality by selected risk factor, by gender, for developing countries (such as Tonga, Vanuatu and Kiribati) and developed countries, 2000[1]. The risk factors listed in this table indicate the current divergence in mortality between developing and developed countries. The largest divergence in risk factor attributable death is seen for tobacco.

Tobacco-related disease causes 26.3% and 9.3% of all male and female deaths, respectively, in developed countries, compared to 12.2% and 2.9% of male and female deaths, respectively, in developing countries. The key message from this table is that, given the current prevalence of risk factors for NCDs in developing countries, it is just a matter of time until developing countries see similar patterns of mortality.

Table 18: Attributable mortality by selected risk factor, level of country development and sex, 2000

Risk factor	Developing countries		Developed countries	
	Males % of total deaths	Females % of total deaths	Males % of total deaths	Females % of total deaths
Diet-related risks and physical activity				
Blood pressure	12.7%	15.1%	20.1%	23.9%
Cholesterol	5.1%	5.6%	14.5%	17.6%
Overweight	4.2%	5.6%	9.6%	11.5%
Low fruit and vegetable intake	5.0%	4.8%	7.6%	7.4%
Physical inactivity	2.8%	3.2%	6.0%	6.7%
Addictive substances				
Tobacco	12.2%	2.9%	26.3%	9.3%
Alcohol	8.5%	1.6%	8.0%	-0.3%
Illicit drugs	0.6%	0.1%	0.6%	0.3%

The escalation of NCDs in all countries of the world, and in particular developing countries, can be attributed, predominantly, to what is known as the health transition. There are two components to the health transition: a demographic component, also known as the *demographic transition* and an epidemiological component, the *epidemiological transition*. As countries develop, the age structure of their population changes (due mainly to improvements in infant and adult survival) and the proportion of elderly individuals tends to increase. This is the demographic component of the health transition. At the same time, changes in lifestyle factors, such as diet and levels of physical activity, along with improvements in health care and environmental sanitation, lead to an increase in the prevalence of NCDs and a corresponding decline in communicable, perinatal and maternal conditions. As a result, NCDs begin to displace communicable diseases as the primary cause of ill-health and death. This change represents the epidemiological component of the health transition. The combined effect of these demographic and epidemiological transitions is a shift from a young population characterized by a high level of communicable, maternal and

perinatal diseases, to an older population characterized by a greater prevalence of NCDs[1].

This health transition has been under way in PIC for the past 30 years, as indeed in most developing countries around the world. In most countries, the health transition is not characterized by sharp changes in epidemiological and demographic profiles. Instead, the process unfolds gradually, and the overall disease profile is, for an extended period, characterized by the coexistence of communicable and NCDs, the balance between them being determined by a number of factors including levels of environmental sanitation, the availability of health services and the age structure of the population. Different countries, therefore, are at varying points in the health transition, from those who have just entered the transition to those who have nearly completed it.

5.3 Consideration of demographic transition

World Health Report (2002) population indicators for Tonga, Kiribati and Vanuatu are presented in Table 19[1]. Although each country has undertaken a demographic census, the World Health Report standardizes these results for the year 2001. Table 19 presents results in terms of the demographic shift in population for each country. Although annual population growth rates have remained positive, fertility rates have fallen (with the exception of a 0.2% rise in Kiribati) which imply a relatively neutral population growth. The table also presents life expectancy at birth, with Tonga having the longest life expectancy at 69.4 years and Kiribati the shortest at 63.6 years. Although not presented in Table 19, life expectancy is increasing in all three countries and is likely to continue to increase[1]. In summary, then, with relatively neutral population growth and increased life expectancy, it appears that the demographic transition for Tonga, Vanuatu and Kiribati is changing from a more traditional societal pattern of relatively young populations, to those with increasing numbers of middle-aged and elderly.

Table 19: Basic indicators of population for Tonga, Vanuatu and Kiribati, 2001

Country	Population	Annual growth	% pop aged		Total fertility		LE at birth
	('000) 2001	rate 1991-2001	60+ years 1991	60+ years 2001	rate 1991	rate 2001	(years) 2001
Tonga	99	0.3%	5.8%	6.9%	4.7%	3.8%	69.4
Vanuatu	201	2.8%	5.2%	4.8%	4.9%	4.4%	65.6
Kiribati	84	1.4%	6.0%	6.9%	4.4%	4.6%	63.6

The exploration of the potential economic impact of this demographic transition on the NCD burden requires an understanding of both population changes and economic indicators. Using the data obtained in Table 19, crude population projections are able to be made. However, as suggested above, population changes are likely to be minimal given current indicators of population change. Further, in the absence of future economic indicator data, any attempt to quantify the potential impact of the demographic transition is likely to be contentious with estimates subject to considerable uncertainty.

However, before moving on to consider the epidemiological transition, it is useful to reflect on the current age profile of disease morbidity in each of the countries and how an ageing population will see a natural increase in the proportion of the population with a NCD. The average age of patients admitted for any disease in Tonga is 30 years of age (Table 1), while the average age of patients admitted with an NCD is 46 years. In Kiribati, a similar picture unfolds: average age for all diseases is 29 years (Table 5) while for NCDs it is 39 years of age (Table 6). Average ages of patients admitted to hospital were not available for Vanuatu. With an ageing population comes a demographic shift toward the middle-aged and elderly, where the prevalence of NCDs is much higher. This suggests that even in the absence of population growth, the proportion of patients with an NCD will inevitably increase and, as it does, so too will the cost of treating these diseases. The next section elaborates on this point in more detail.

5.4 Consideration of epidemiological transition

Chapter 4.4 used WHO attributable fractions (Table 14) for the Western Pacific Region to consider the impact of tobacco and alcohol usage on hospital admissions and treatment costs for Tonga, Vanuatu and Kiribati. Also reported in Table 14 were attributable fractions for developed countries, including Australia, where the epidemiological transition is advanced. The fractions derived for developed countries

are used in the present analysis to examine the potential impact tobacco and alcohol use may have on disease burden.

Tonga

Using the same hospital morbidity and cost data as discussed in earlier chapters, Table 20 presents the results of the number of hospital admissions and treatment costs attributable to tobacco and alcohol using developed country aetiological fractions. The data in Table 20 suggest that, after applying revised aetiological fractions, tobacco and alcohol related NCD admissions have increased from 9.9% (Table 15) to 24.2%. This implies that nearly 1 in 4 admissions for NCDs are attributable to tobacco or alcohol. The cost of treating patients with a tobacco or alcohol related disease or injury has increased from 9.1% (Table 15) of the total cost of treating all NCDs to 22%. The costs of these admissions represent 7.3% of all hospital related expenditures, up from 3.1% as reported in Table 15.

Table 20: Projected impact of tobacco and alcohol on hospital resources, Tonga 2001

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 1&2)	% Total
Hospital admissions					
NCD	192	28	220	911	24.2%
Other diseases	0	15	15	7865	0.2%
All diseases	192	43	235	8776	2.7%
Cost of treatment*					
NCD	\$241889	\$47062	\$288951	\$1318136	21.9%
Other diseases	\$0	\$200075	\$200075	\$5422652	3.7%
All diseases	\$241889	\$247137	\$489026	\$6740788	7.3%

*Expressed in local currency

Vanuatu

The data in Table 21 suggests that, after applying revised aetiological fractions, tobacco and alcohol related NCD admissions have increased from 9.9% (Table 16) to 25.3%. Similar to Tonga, this implies that over 1 in 4 admissions for NCDs are attributable to tobacco or alcohol. The cost of treating patients with a tobacco or alcohol related disease or injury has increased from 8.5% (Table 16) of the total cost of treating all NCDs to 21.6%. The costs of these admissions represent 4.3% of all hospital related expenditures, up from 1.8% as reported in Table 16.

Table 21: Number of hospital admissions and treatment costs attributable to tobacco and alcohol, Vanuatu 2002

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 3&4)	% Total
Hospital admissions					
NCD	134	17	150	595	25.3%
Other diseases	0	296	296	9621	3.1%
All diseases	134	313	446	10216	4.4%
Cost of treatment					
NCD	8261551	1211342	9472892	43909845	21.6%
Other diseases	0	11382309	11382309	446491044	2.5%
All diseases	8261551	12593650	20855201	490400889	4.3%

*Expressed in local currency

Kiribati

The data in Table 22 suggests that, after applying revised aetiological fractions, tobacco and alcohol related NCD admissions have increased from 9.8% (Table 17) to 17.9%. The cost of treating patients with a tobacco or alcohol related disease or injury has increased from 11% (Table 17) of the total cost of treating all NCDs to 20.5%. The costs of these admissions represent 3.1% of all hospital related expenditures, up from 1.6% as reported in Table 17.

Table 22: Number of hospital admissions and treatment costs attributable to tobacco and alcohol, Kiribati 1997

Attributable to tobacco and alcohol conditions	Tobacco	Alcohol	Tobacco and alcohol	Total (from Tables 5&6)	% Total
Hospital admissions					
NCD	43	13	56	313	17.9%
Other diseases	0	64	64	3559	1.8%
All diseases	43	77	120	3872	3.1%
Cost of treatment*					
NCD	\$84488	31194	115682	565363	20.5%
Other diseases	\$0	96377	96377	6175425	1.6%
All diseases	84488	127571	212059	6740788	3.1%

*Expressed in local currency

5.5 What can be done to reduce potential impact of NCDs?

The future impact of NCDs on hospital morbidity and associated treatment is likely to be significant. The demographic transition implies that as the age profile of a population changes, so to does the pattern of disease. Consistent with the WHO predictions, countries of Tonga, Vanuatu and Kiribati are all likely to see a reduction in the more prevalent communicable diseases that impact predominantly on younger people and an increase in NCDs that impact predominantly on the middle-aged to

elderly. The epidemiological transition is also inevitable. The wealth of data from developed countries has established the link between the prevalence of certain risk factors and the delayed onset of NCDs. The magnitude of the transition which unfolds and the extent to which NCDs impact on disease burden is, however, something governments are able to influence. For example, governments have the ability to devote resources into health promoting programs that aim to reduce the prevalence of key risk factors for NCDs, of which tobacco smoking is arguably the best example. Governments of Tonga, Vanuatu and Kiribati can learn much from the tobacco control movement of developed countries, in terms of implementing cost-effective strategies aimed at reducing the prevalence of smoking. While the recommendations of specific interventions to alleviate (or more appropriately minimize) the future burden of NCDs is beyond the scope of this project, carefully planned and implemented interventions are likely to be cost-beneficial.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The primary aim of this report has been to conduct an assessment of existing hospital inpatient data to estimate the economic burden of NCDs in the countries of Tonga, Vanuatu and Kiribati. Site visits were conducted within each country during the period March – May 2003. During this time data were collected from MOH representatives relating to hospital morbidity, budget reports and prevalence reports on lifestyle diseases in these countries. These data have been used in the current project, together with reasonable assumptions in lieu of missing or incomplete data, to consider the impact, both current and future, of NCDs on the burden of disease in these countries. As part of this assessment, estimates of treatment costs were derived and applied to hospital admissions to calculate total and average costs of treatment by NCD and non-NCD. Further, an attempt has been made to consider the extent to which tobacco and alcohol use contributes to the total current, and future, NCD burden in Tonga, Vanuatu and Kiribati.

The key findings, conclusions and recommendations of this report need to be considered in the context of the limitations imposed by the quality of the data obtained, as well as the key assumptions made during data analyses.

6.2 Limitations

Data quality

At the time of hospital data collection a number of salient issues were made apparent. First, as for any data entry process, it is likely that a number of admissions /discharge forms may have been misplaced en-route to the statistics office and, hence, may not have been entered into the relevant database. Second, the relatively lack of expertise, and resources available for training staff in appropriate coding, may lead to incorrect codes being assigned to particular episodes of care. The process of coding is a difficult task compounded by the fact that certain diseases (for example, diabetes) do not fit neatly into specific ICD categories. Third, and a related point, is that resources for data entry and manual checking are simply not available in the countries of interest, which often results in delays in data entry and the use of unchecked databases. This point is particularly relevant for Kiribati. Fourth, no

comprehensive clinical costing system is currently available to provide detailed information of the type of care and cost associated with patients' admissions. The development of such a system would facilitate a more reliable assessment of hospital care by disease category. Finally, although the data bank on the prevalence of alcohol and tobacco use in Tonga, Vanuatu and Kiribati is growing, the lack of detailed epidemiological data on relative risks suggests that, at this stage, it is not possible to develop specific tobacco and alcohol aetiological fractions for the three countries of interest.

Data assumptions

Consistent with most projects of this nature, a number of assumptions have been necessary in deriving estimates of hospital cost per day as a proxy for the value of resource use associated with treatment. This estimate has been derived by dividing total inpatient cost with total inpatient length of stay to provide a cost per inpatient day. For Tonga and Vanuatu reasonable data were available to guide the separation of inpatient and outpatient components of the MOH budgets. For Kiribati, however, no such data were available. The estimates of total length of stay (derived from hospital databases) may also be conservative given the above issues surrounding data quality. Further, using an estimate of a hospital cost per day does not take into account the fact that some admissions may cost more per day than others, either because they involve more expensive technologies or because they consume more staff time. For example, an admission for simple pneumonia is less expensive on a per-day basis than an admission for surgery to remove bowel cancer, for which there may be an added cost of operating time, surgical instruments and staff time (e.g. nurses, anaesthetists and surgeons). These differences are not captured in an aggregated estimate of cost per day. If NCD admissions are, on average, more resource intensive than those for other conditions, then the overall estimate of inpatient cost will underestimate the true cost of NCD admissions using this method.

In considering the impact of tobacco and alcohol usage on hospital admissions and treatment costs, WHO estimates of attributable risk have been used. These estimates of risk are region specific and may not necessarily reflect the true burden of harm in particular countries. For example, the WHO estimates consider a fraction of the conditions identified by Australian researchers that are attributable to tobacco

and alcohol use. It may be possible that these conditions represent a true reflection of current harm attributable to tobacco and alcohol however, it is at least equally plausible to assume that there is a dearth of adequate data in these countries to facilitate a comprehensive assessment.

6.3 Key findings

Table 23 presents the key findings of this report. In each of the countries included, Tonga, Vanuatu and Kiribati, NCDs currently account for 10.4%, 5.8% and 8.1% of all admissions, respectively. Patients being admitted for a NCD are much older than those presenting for a non-NCD, 16 years older in Tonga and 10 years older in Kiribati. Patients admitted for a NCD also stay in hospital longer with ALOS for a NCD admission being 9.2 days, 7.5 days and 13.5 days in Tonga, Vanuatu and Kiribati, respectively. This compares with an ALOS for a non-NCD admission of 4.9 days in both Tonga and Vanuatu and 9.3 days in Kiribati. Consistent with this finding, average treatment costs of NCDs are considerably higher than non-NCD admissions. Although NCDs account for a relatively low proportion of all admissions, they account for a disproportionately larger share of all treatment expenditures. In Tonga, Vanuatu and Kiribati NCDs account for 19.6%, 9% and 8.1%, respectively, of all treatment expenditures. To put this in context, in Tonga for example, one out of every 10 (10.4%) patients admitted to hospital are admitted for a NCD, however, for every 5 dollars spent on treating all patients, one of these dollars (20%), is required to treat the patient with a NCD.

Tobacco and alcohol are two risk factors for NCDs, the use of which are prevalent in Tonga, Vanuatu and Kiribati. Indeed, like most PIC, the rates of smoking in the population are some of the highest in the world. Using data from a number of sources, it is estimated that approximately 10% of all current NCD admissions are the result of tobacco and alcohol attributable conditions in Tonga, Vanuatu and Kiribati. A similar proportion of money (10%) is devoted to treating these tobacco and alcohol related NCDs. The extent to which tobacco and alcohol will play in future disease is clear. The transition towards an older demography in these three countries, coupled with an epidemiological transition towards greater harm from current risk behaviour suggests that the burden of disease from NCDs will increase. Based on epidemiological transition towards the attributable fractions of more

developed countries, it is estimated that up to 25% of all NCD admissions, and 20% of all NCD treatment cost, may be attributable to tobacco and alcohol consumption use.

Table 23: Summary of key findings for each country

	Tonga	Vanuatu	Kiribati
Hospital data			
Number of admissions	8776	10216	3872
Number of NCD admissions	911	595	313
% of NCD to all admissions	10.4%	5.8%	8.1%
ALOS all admissions (days)	4.9	4.9	9.3
ALOS NCD admissions (days)	9.2	7.5	13.5
Average age of all admissions (years)	30	NA	29
Average age of NCD admissions (years)	46	NA	39
Cost data			
MOH budget (millions)	\$12.90	Vt916.32	\$9.04
Inpatient hospital (millions)	\$6.74	Vt490	\$4.79
% inpatient hospital to MOH	52%	54%	53%
Inpatient hospital cost per day	\$157	Vt9883	\$133
Average hospital cost per admission	\$768	Vt48003	\$1,238
Average hospital cost per NCD admission	\$1,447	Vt73799	\$1,806
% total cost NCD to total cost all admissions	19.6%	9%	8.1%
Tobacco and alcohol			
Current: % NCD admissions attributable to tobacco and alcohol	9.90%	9.90%	9.80%
Current: % NCD cost attributable to tobacco and alcohol	9.10%	8.50%	11.00%
Future: % NCD admissions attributable to tobacco and alcohol	24.20%	25.30%	17.90%
Future: % NCD cost attributable to tobacco and alcohol	21.90%	21.60%	20.50%

6.4 Conclusions

A major strength of this report is the use of a range of local data in estimating the extent to which NCDs currently impact, and will impact in the future, on hospital morbidity and treatment costs in Tonga, Vanuatu and Kiribati. Overall, the results indicate that:

- NCDs are a significant contributor to the burden of disease in each of these countries;
- Patients admitted for a NCD are older and are likely to require more care than patients admitted for other diseases;
- The cost of treating patients admitted for a NCD is considerably higher than the cost of treating the average patient;

- Tobacco and alcohol use are high and are both significant risk factors for NCD, accounting for approximately 10% of all NCD admissions;
- In the future, NCDs will account for a greater proportion of the disease burden, with tobacco and alcohol related attributable disease estimated to account for up to 25% of all NCD treatment costs.

While this project has focused on the impact of tobacco and alcohol as risk factors for NCD, there are other important risk factors including obesity, poor diet and physical inactivity that contribute to the current, and will contribute to the future, burden of NCD. Further, it is important to note that for many NCDs, the presence of multiple risk factors has a synergistic effect in causing disease. In other words, the risk of disease may actually disproportionately increase when more than one risk factor is present. This is important in estimating the epidemiological impact of risk factors and diseases, and in planning comprehensive interventions against them.

Given evidence of the increasing emergence of the NCD epidemic in these countries, what can be done about it?. The PAPH project is an excellent example of the need to make a concerted effort to clearly identify behavioural and health problems, collect local level data to define the magnitude and exact nature of health problems, and work with local people to design and implement intervention strategies that educate people about risk factors and promote a change towards healthy lifestyle behaviours. However, PAPH cannot work alone. There needs to be a concerted effort by Governments of PICs to alleviate the current and future burden of harm associated with NCDs. Such a commitment requires the allocation of resources to improve the capacity to understand burden of disease patterns and identify potential solutions to bring about change. The Government of Vanuatu have indicated a commitment to improve the health of its people through the development of the Comprehensive Reform Program. Among other things, this program seeks to improve data collection surveillance and monitoring which is essential in understanding where the harm lies and using this information to design interventions which will have the biggest impact on reducing the burden of disease, particularly in relation to NCDs. In learning from the experiences of the more developed countries in the South Pacific region, PICs have an opportunity to implement relatively easier (and cheaper) interventions aimed

at preventing the onset of disease, rather than focusing disproportionately on treatment.

The recommendations of this report provide a means by which Governments can begin to make a concerted effort and reduce the future costs associated with NCD in their countries as well as improve efficiency in budget allocations.

6.5 Recommendations

Recommendation 1

- Improve the reliability of hospital data

Actions

- Commit additional resources to MOH to improve entry and monitoring of hospital data

How best achieved

- Maintain adequate staff levels in Statistics Office
- Ensure staff are well qualified and undergo ongoing training
- Ensure computer hardware and software is state of the art and well-maintained.

Example

- Vanuatu Comprehensive Reform Program

Recommendation 2

- Develop a clinical costing system

Actions

- Commit resources to MOH to link current hospital data collection with current cost of treatment

How best achieved

- Purchase expertise to develop system
- Train staff to contribute to dynamic system

Example

- Australian Diagnostic Related Groupings (adds value to data collected at patient level by costing treatment received)

Recommendation 3

- Improve the monitoring of risk factors for disease

Actions

- Commit additional resources to MOH to conduct regular surveys to better understand the prevalence and behaviours of key risk factors for disease

How best achieved

- Add additional questions to Census
- Regular population surveys to capture prevalence of risk factors

Example

- Vanuatu non-communicable disease survey report of key risk factors for NCD
- Diabetes survey in Kingdom of Tonga
- [STEPS surveillance \(WHO\)](#)

Recommendation 4

- Improve the efficiency of MOH funding

Actions

- To assess current spending, identify room for improvement and shift resources accordingly

How best achieved

- Commit additional resources to MOH to engage in Program Budgeting and Marginal Analysis
- Purchase expertise to review current MOH funding

Example

- None present but scope exists to conduct for all Ministries

Recommendation 5

- Develop a strategic NCD plan for each country

Actions

- Based on the STEPS framework, develop an evidence-based strategic plan to guide implementation on NCDs

How best achieved

- Ensure multi-sectoral participation and commitment across all government ministries to the development of the NCD plan and its implementation.

Example

- Tonga NCD Control Strategy

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8 REFERENCES

1. World Health Organisation, *The World Health Report 2002: Reducing risks, promoting healthy life*, ed. C. Murray and A. Lopez. 2002, Geneva: WHO.
2. World Health Organisation, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10)*. 1992, Geneva: WHO.
3. Australian Institute of Health and Welfare, *Australia's Health 2002*. 2002, Canberra: AIHW.
4. Coyne, T, *Lifestyle diseases in Pacific communities*, ed. R. Hughes and S. Langi. 2000, Noumea, New Caledonia: SPC.
5. Australian Bureau of Statistics, *Disability, ageing and carers: summary of findings, Australia, 1998*. ABS Cat. No. 4430.0. 1999, ABS: Canberra.
6. Khaleghian, P., *Non-communicable diseases in Pacific Island Countries: disease burden, economic cost and policy options*. 2001, SPC and the World Bank: Noumea, New Caledonia.
7. Statistics Department, *Tonga population census 1996: demographic analysis*. 1999, Nuku'alofa: Statistics Department.
8. Ministry of Health, *Tonga's Health 2000*. 2000, Nuku'alofa, Tonga: MOH.
9. World Health Organisation, *World Health Report 2000*. 2001, Geneva: WHO.
10. Collins DJ, Lapsley. H., *Counting the cost: estimates of the social costs of drug abuse in Australia in 1998-99*. National Drug Strategy Monograph Series No. 49. 2002, Canberra: Commonwealth of Australia.
11. Dalton, A. and Crowley, S., *Economic costs of NCDs in the Pacific (Unpublished findings)*. 2001, Monash University: Melbourne.
12. Hu, S., *WHO Mission Report*. 1999, WHO: Geneva.

13. Asian Development Bank, *Vanuatu Economic Performance and Challenges Ahead*. 2002, Manilla: Asian Development Bank.
14. Health Planning Unit, *Republic of Vanuatu: Second National Health Development Plan 1997-2001*. 1997, Port Villa: Health Planning Unit, Ministry and Department of Health,.
15. Department of Planning, *2003-2004 Budget Report*. 2003, Port Villa: Department of Planning, Health and Administration,.
16. National Statistics Office, *Vanuatu National Population and Housing Census 1999 Main Report*. 2000, Port Villa: National Statistics Office.
17. Statistics Office Ministry of Finance, *Report of the 2000 census of population*. 2002, MOF: Bairiki, Tarawa, Republic of Kiribati.
18. National Economic Planning Office, *2002/03 budget*. 2003, MOF and Economic Planning: Bairiki.
19. World Bank, *Kingdom of Tonga health sector reform project: hospital recurrent costing*. 2002: Nuku'alofa, Tonga.
20. Ridolfo, B. and C. Stevenson, *The quantification of drug-caused mortality and morbidity in Australia, 1998*. 2001, Australian Institute of Health and Welfare (Drug Statistics Series No. 7). AIHW Cat. No. PHE 29.: Canberra.
21. Carrao, M., et al., *Building the evidence base for global tobacco control*. Bulletin of the World Health Organisation, 2000. 78(7): p. 884-90.
22. World Health Organisation, *Guidelines for the conduct of tobacco smoking surveys of the general population. Report of a WHO meeting held in Helsinki Finland 29 November to 4 December 1982*. 1983, WHO: Geneva.
23. Woodward , A., et. al, *Smoking in the Kingdom of Tonga: report from a national survey*. Tobacco Control, 1994. 3: p. 41-45.

24. UNICEF, *The State of Health Behaviour and Lifestyle of Pacific Youth: Kingdom of Tonga Report*. 2001, Suva: UNICEF Pacific.
25. McMurray, C., *Kingdom of Tonga Qualitative Study of Youth Substance Abuse*,. 2003, Pacific Action for Health Project, Secretariat of the Pacific Community: Noumea.
26. Finlayson, P., et al., *Diabetes, obesity and hypertension in Vanuatu*. PNG Medical Journal, 1988. 31: p. 9-18.
27. Montaville, B., et al., *Vanuatu/WHO/SPC non-communicable disease survey 1985*. 1987, Technical Paper No. 192: Noumea, New Caledonia.
28. Vanuatu Department of Health and FAO, *Vanuatu Food and Nutritional Policy*. 1986, MOH: Port Villa, Vanuatu.
29. Marks, G. and M. Lund-Adams, *Development of the Vanuatu National food and nutrition surveillance system*. 1993: Save the Children Fund, Australia.
30. Carlot-Tary, M., R. Hughes, and M.C. Hughes, *Vanuatu non-communicable disease survey report*. 2000, Noumea: Secretariat of the Pacific Community.
31. Collins, D. and H. Lapsley, *The economic impact of tobacco smoking in Pacific Islands*. 1997, Pacific Tobacco and Health Project, Adventist Development and Relief Agency: Sydney.
32. Stanton, H., *Smoking and development in the Pacific*. Development Bulletin, 2001. 54: p. 67-68.