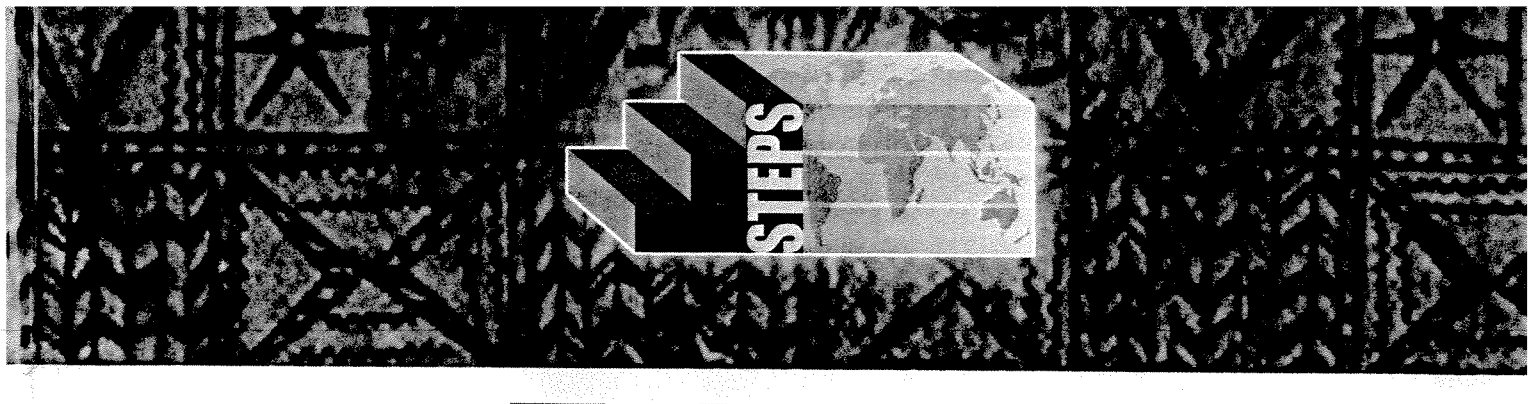
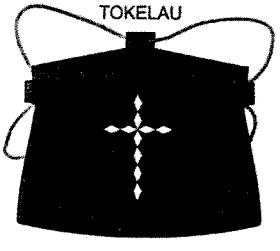
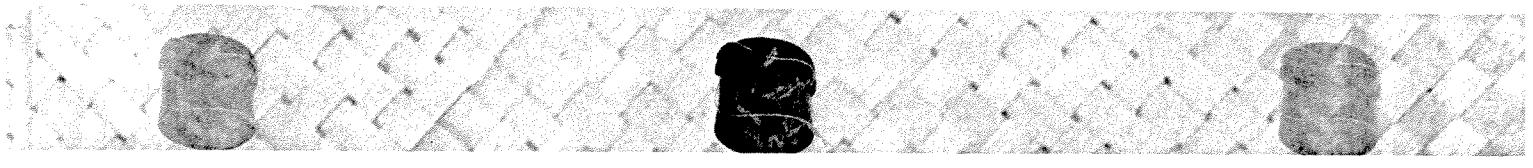


Tokelau NCD Risk Factors

STEPS REPORT



World Health Organization
Western Pacific Region



TOKELAU
NCD Risk Factors
STEPS Report

Printed in Suva, Fiji
December, 2007

Acknowledgements

The Tokelau NCD Risk Factors STEPS Report is a record of a combined effort of several organizations and individuals. We would like to acknowledge each organization and everyone's contributions, dedication and determination in completion of the survey and report.

It is a collaborative effort between the Tokelau Department of Health (DOH), World Health Organization (WHO) and the Fiji School of Medicine (FSM), supported by the Australian Agency for International Development (AusAID).

Report Compiled By: Dr Tekaai Nelesone (DOH), Dr Jan Pryor (FSM), Dr Li Dan (WHO, Suva), Dr Silivia Tavite (Nukunonu, Tokelau), Dr Tekie Iosefa (DOH), Ms Nancy Macdonald (Auckland, New Zealand), Mr Shalvindra Raj (WHO, Suva), Ms Leanne Riley (WHO, Geneva), Mr Robert Hughes (WHO, Manila), Dr Gauden Galea (WHO, Geneva), Mr Alapati Tavite (DOH), Dr Philayrath Phongsavan (CPAH), Ms Shakila Naidu (FSM), and Ms Tasha Shon-Maiai (WHO, Apia).

Great appreciation is to the Tokelau DOH, thanks to the Minister of Health, Hon. Pio Tuia and the Director of Health, Dr Tekaai Nelesone and the former Director of Health, Dr Tekie Iosefa for their support of the NCD STEPS survey in Tokelau. The list of STEPS field staff from Tokelau is in Appendix 2 on the Page 70. A special gratitude is made to all of them.

Grateful acknowledgement is made to the WHO and its staff, to Dr Chen Ken (WHO Representative in the South Pacific, Suva), Dr Kevin Palmer (WHO Representative for American Samoa, Cook Islands, Niue, Samoa and Tokelau, Apia), and to Dr Linda Milan and Dr Tommaso Cavalli-Sforza (WHO Office in Manila) for their management and support. Acknowledgement is also given to the WHO staff who contributed to the survey, including Dr Stephen Terras, Ms Perelini Fidow, and Ms Rosemary Ah Chong (WHO Office in Apia), and the statistical support and result generation provided by Ms Leanne Riley, Ms Jacklynn Lippe (CDC, USA), Ms Melanie Cowan and Ms Regina Guthold (WHO Office in Geneva), and Mr Shalvindra Raj who made substantial contribution to the timely completion of data analyses.

Thanks are due to the FSM for Dr Jan Pryor as the research consultant for the Tokelau STEPS survey and the valued assistance of Ms Vizo Halavatau and Ms Shakila Naidu.

The Tokelau STEPS survey was funded by AusAID and WHO, the Tokelau DOH provided funding-in-kind. The funds for the final review came from the New Zealand Ministry of Health. The funds for printing came from WHO.

Dr Silivia Tavite drafted the first version of the report, guided by the FSM and the WHO Office in Suva. Dr Li Dan, Ms Leanne Riley, Dr Ruth Bonita Beaglehole (University of Auckland, New Zealand), Mr Robert Hughes (WHO Office in Manila), Dr Colin Bell (Population Health, Hunter New England Area Health Service, Australia) and Dr Philayrath Phongsavan (Centre for Physical Activity and Health, University of Sydney) have conducted technical reviews for the report.

Dr Jan Pryor, Dr Philayrath Phongsavan and Dr Li Dan are the final technical and editorial reviewers of this STEPS Report, through country consultation with Dr Tekaai Nelesone, Mr Alapati Tavite and Ms Faimanifo Peseta.

WHO Office in Suva arranged the printing, on behalf of DOH, Tokelau.

CONTENTS

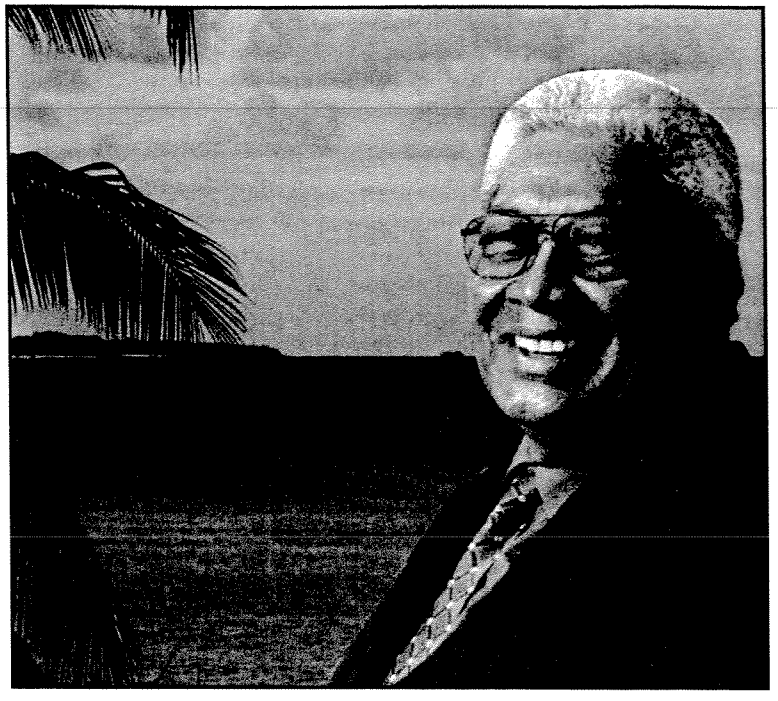
LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AusAID	Australian Agency for International Development
BMI	Body Mass Index
BP	Blood Pressure
CHD	Coronary Heart Disease
CI	Confidence Interval
cm	Centimetres (unit for height and waist measurements)
COGT	Council of the On-going Government of Tokelau
CVD	Cardiovascular Diseases
DABPM	The OMRON M4 Digital Automatic Blood Pressure Monitor
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DOH	Department of Health
EEZ	Exclusive Economic Zone
FBS	Fasting Blood Sugar
FSM	Fiji School of Medicine
kg	Kilograms (unit for weight measurement)
GTT	Glucose Tolerance Test
HTN	Hypertension
MET	Metabolic equivalent
mmHg	Millimetres of mercury (unit of blood pressure measurement)
mmol/L	Millimoles per litre (unit for blood chemistry values)
NCD	Noncommunicable diseases
NIDDM	Non-insulin Dependent Diabetes Mellitus
PA	Physical Activity
PICs	Pacific island countries and areas
SBP	Systolic Blood Pressure
TALO	Tokelau-Apia-Liaison Office
TeleTok	Tokelau Telecommunication
TIMS	Tokelau Island Migration Studies
TPRS	Tokelau Patient Referral Scheme
UNDP	United Nations Development Program
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

FOREWORD



The Tokelau NCD STEPS survey in 2005 was conducted to assess the prevalence of the common NCDs, mainly diabetes and hypertension, and their risk factors in our population. The information from this survey provides an important platform for the development and implementation of strategic plans and programs, like guidelines for diabetes prevention and control, to address the growing epidemic of NCDs in Tokelau.

If we want to effectively address the growing problem, we must have accurate and updated information regarding the risk factors that contribute to the development of NCDs. Risk factors refer to any characteristic or exposure that increases a person's likelihood of developing a NCD, and include smoking, alcohol use, physical inactivity, obesity, high blood pressure, a raised level of blood glucose or cholesterol, and an unbalanced diet.

The Department of Health is sincerely grateful to the World Health Organization (WHO), and the Fiji School of Medicine (FSM) for the technical assistance provided that helped guide the survey from inception to implementation, analysis and interpretation. We are also appreciative of the funding from AusAID and WHO that allowed us to undertake this important activity.

Conducting the Tokelau NCD STEPS survey required intensive work, long days, and persistence and dedication from the Tokelau team that undertook the survey. Indeed, it is the hard work of the STEPS team that allowed this vital activity to take place and we owe each of them our sincere appreciation. There has been no population-based information on the prevalence of the NCD risk factors that are common to many of the NCDs affecting our population. It is this risk approach to NCD surveillance and control that is one of the most notable features of the STEPwise surveillance process with a shift in emphasis from individual to community health.

The results showed that while the percentage who drank alcohol on 4 or more days in the last week was only 0.6%, the proportion of binge drinkers (5 or more drinks for males, 4 or more drinks for women on any day in the last week) was much higher with 37.5% in males and 20.0% in females.

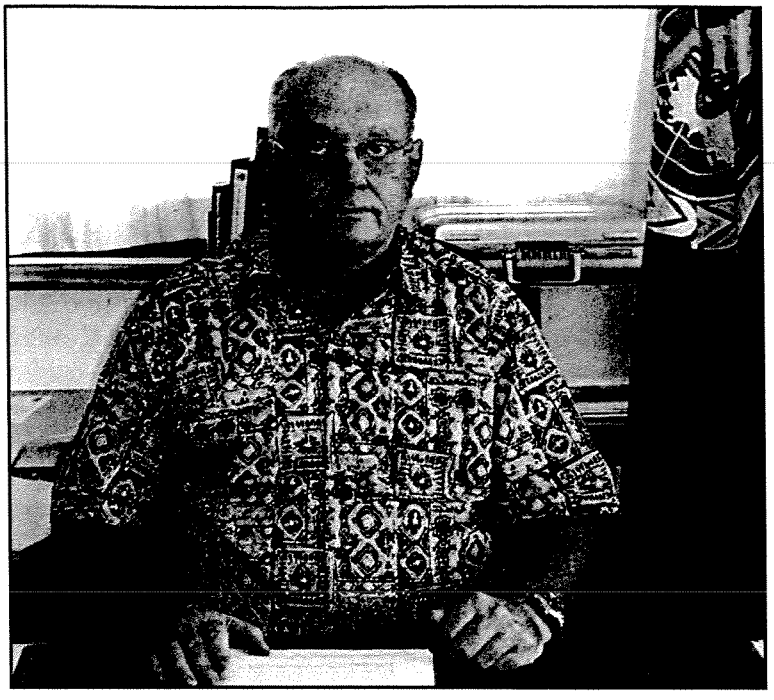
Though the percentage with raised blood pressure (SBP≥140 and/or DBP≥90 mmHg or currently on medication for raised blood pressure) was only moderately high at 13.6%, the overall prevalence of diabetes was quite high at 33.6%.

The Tokelau NCD STEPS Report is a milestone in our efforts to address the increasing NCD epidemic affecting our people. It marks an increased commitment by the Tokelau health system to

tackle the NCD challenge and will serve us well in the further development, monitoring and evaluation of effective health policies and programs appropriate to our context, and to our ongoing efforts in NCD and NCD risk factor surveillance.

I hope that this report will help readers understand the magnitude of the NCD burden and the vital role of NCD risk factors in the epidemic in Tokelau. I also encourage you to participate in concrete actions to promote healthier lifestyles within our population.

Hon. Pio Iosefo Tuia
Minister of Health
Tokelau



The WHO Stepwise Approach is a simple, standardized method for collecting, analyzing and disseminating data on NCD risk factors. The publication of the "Tokelau NCD Risk Factors STEPS Report" marks a milestone as it provides for the first time scientific data that will assist the Department of Health and partners in addressing the escalating issue of NCDs in Tokelau.

Determining the frequency of STEPS risk factors is a sequential process, starting with gathering information on key risk factors in a representative sample of the population using interviews and questionnaires, followed by simple physical measurements, and finally the collection of blood samples for biochemical assessment. The baseline data provided by NCD STEPS will ensure that the right emphasis is placed on the risk factors that need to be addressed in the efforts to control obesity, high blood pressure, diabetes, and increase physical inactivity.

Pacific island countries and areas can use STEPS results not only for monitoring national trends, but also for making comparisons between and among countries that can be useful in judging a country's overall performance in reducing risk factors. The approach encourages the collection of useful information on a continuing basis by adopting standard methodology to detect trends in age and sex groups.

The World Health Organization, through its offices in Apia, Suva, Manila and Geneva is proud to have played a critical part in the collaborative effort of the Tokelau Department of Health, the Fiji School of Medicine and AusAID in carrying out and publishing the results of this first STEPS survey.

Some of the important results were:

- 59.3% of the population smoke tobacco daily.
- 92.3% of the population consumed fewer than five combined servings of fruit and vegetables per day.
- 86.2% of the population were overweight or obese, 63.4% were obese.
- 33.6% of the population were diabetic.
- 35.6% of the population had high cholesterol levels.

Based on the summary of five combined risk factors, 0% of the population aged 25 to 64 of Tokelau was at low risk for NCDs (i.e. with none of the five risk factors) and 68.6% of population aged 25 to 64 were at raised risk (i.e. with at least three of the five risk factors). The risk was higher in females than

in males: 78.8% of females versus 58.8% of males in all age groups.

These results clearly document that NCDs are a major problem in Tokelau. Future priorities need to be given to aggressive programmes aimed at changes in lifestyle including increases in physical activity, reduction in smoking, and a healthier diet including more fruits and vegetables. Increased emphasis should be placed on the treatment of NCDs especially diabetes.

WHO is grateful to AusAID for their financial support, to the Fiji School of Medicine for their technical support and to the Tokelau Department of Health who collected the data and produced the report.

Dr Kevin Palmer
World Health Organization Representative for
American Samoa, Cook Islands, Niue, Samoa and Tokelau

EXECUTIVE SUMMARY

The Tokelau NCD STEPS survey was a nation-wide cross-sectional assessment of 15 to 64 year olds carried out from August to September 2005 using the WHO NCD STEPS methodology and instruments with these main objectives:

- To investigate and document the prevalence of key noncommunicable diseases (NCDs) in Tokelau.
- To better understand the major modifiable risk factors for common NCDs including smoking, alcohol consumption, physical inactivity, obesity, hypertension, raised blood glucose and cholesterol, and poor diet.
- To examine risk factors across different strata of age, gender, ethnicity, and locality.

The survey had a 98% response rate and all 586 participants were involved in all the three STEPS of the survey which involved an interview on behavioral risk factors, and the taking of physical and biochemical measurements. To minimize data entry error, all data were validated with double data entry, and after data cleaning a weighting factor was calculated for the analysis to accommodate the 2% non-response. However, since all Tokelauans aged 15-64 years were approached for the survey combined with the very high response rate, this has yielded 95% confidence intervals (CIs) that were essentially zero. Hence, all data reported herein are deemed to be precise population measures without CIs.

Behavioral risk factors

Overall, 73.3% of respondents reported having smoked tobacco in the past 12 months, and 59.3% reported smoking daily. The prevalence of current smokers among females was highest within the 35-44 age group, and among males within the 15-24 age group. Males started smoking earlier in life, smoked more cigarettes, and smoked longer than females. However, it is important to note that female daily smokers were more prevalent than males in all 10-year age groups, except for the youngest and the oldest groups. Also, there was somewhat higher proportion of current female smokers overall (81.0%) as compared to males (65.7%). Nukunonu reported the highest percentage of the population that smoked tobacco.

The results showed that 97.1% and 90.4% of males and females respectively consumed alcohol within the last 12 months (i.e. current drinkers). There were more male drinkers than females among the overall population and within each age group except for the 35-44 year age group. The prevalence of alcohol consumption among the females increased with increasing age and was highest within the 35-44 age group and decreased thereafter, while there was no significant trend difference in alcohol consumption among males. Nukunonu reported the highest prevalence of current alcohol consumption among atoll populations. Overall, 60% of current drinkers drank more than 6 standard drinks per drinking day, and 37.5% of males and 20% of females reported binge drinking within the past week.

Consumption of fruit and vegetables was very limited in all three atolls, although females reported more fruit and vegetable consumption than males. Overall, fruit was consumed on an average of only 1.9 days each week, and vegetables were consumed on average only 2.1 days each week. Furthermore, only 1.9 servings of either fruit or vegetables were eaten on one of those days. Overall, 92.3% of the population consumed less than five combined servings of fruit and vegetables on average per any given day of the week. Nukunonu reported a greater percentage of the population that consumed fruit and vegetables.

Overall, 41.2% of the population were classified as being physically "inactive" with less than 600 METminutes of physical activity (PA) per week. A higher proportion of males were involved in at least some vigorous physical activity as compared to females in all three atolls. Total PA per day across all settings averaged 148.1 METminutes per day overall, and this was almost three times higher for males (226.0 METminutes/day) than for females (80.5 METminutes/day). Overall, 74.6% of total PA was done in the work setting (110.6/148.2), and only 10.1% of total PA was done in the leisure setting

(14.9/148.2), suggesting that not much PA is done during leisure time for either sports or health gain.

Physical risk factors

A significant proportion of the population were overweight or obese (86.2%). Females had a higher mean BMI (33.2 kg/m^2) than did males (31.5 kg/m^2). In all age groups, there were more overweight and obese individuals than those with normal BMI.

The study revealed that the prevalence of hypertension among the 15-64 year olds in Tokelau was 13.6%, with the prevalence higher among females (13.9%) than in males (13.2%). The prevalence of hypertension increased with increasing age with the older population most affected. The prevalence of hypertension was higher in Nukunonu, followed by Fakaofo, and least in Atafu. A similar trend within age groups was also observed in all three atolls with the older population more affected.

Biochemical risk factors

The results indicated that the prevalence of diabetes among the 15-64 year olds in Tokelau was 33.6%, being higher among males (35.2%) than in females (32.2%). The prevalence increased with increasing age particularly among the female participants, whereas in males the prevalence was higher among the 45-54 year olds and decreased in the older population.

35.6% of participants had a raised cholesterol level, with a higher prevalence among females (37%) and within the 45-54 age group in both genders and in all three atolls.

Combined risk factors

Five common and critical risk factors for NCDs were selected, including current daily smoking, being overweight or obese (BMI ≥25 kg/m^2), having raised blood pressure (SBP≥140 and/or DBP≥90 mmHg or currently on medication for raised BP), eating less than 5 combined servings of fruit and vegetables per day, and having a low level of physical activity (<600 METminutes per week). Overall, 0% of the population between 25-64 was at low risk for NCDs (i.e. with none of the 5 risk factors). 66.4% of the population aged 45 to 64 years old was at raised risk (i.e. with 3 or more of the five risk factors). What should be paid more attention to was that 70.2% of the population were also at raised risk among the younger 25 to 44 year group.

Conclusion

Given that people with the key risk factors are at a significantly increased risk of developing NCDs in the future (e.g. diabetes, heart disease, stroke, cancer), it is essential that the Department of Health, the government of Tokelau, and the local communities work together aggressively to lower the proportion of these NCD risk factors in Tokelau. Many of these key NCD risk factors are linked and, as such, many individuals in Tokelau are exposed to multiple NCD risk factors. Subsequently, there is a great need to develop and implement integrated and comprehensive national strategies with a multi-sectoral approach to combat these serious risk factors.

In conclusion, the overall outcome of the survey indicated a high prevalence of NCDs and their risk factors highlighting the need for an integrated approach to prevent and control NCDs among the people of Tokelau.

1. INTRODUCTION

1.1 Background Information and Rationale

NCDs are the leading cause of death and disability worldwide and they represent a major challenge to health development as it is a burden that cannot be countered simply by accessing greater internal or external funding to spend within the system, due to the astronomical cost factor.

A WHO report on the NCD burden in the Pacific countries identified the essential need to mount preventative programs to halt the rapid rise in risk factors that underpins the emerging NCD epidemic.

Primary prevention based on comprehensive population-based interventions is one of the most cost-effective approaches to containing this emerging epidemic. Therefore, action to reduce NCDs should focus on preventing and controlling the risk factors in an integrated manner. Intervention at all levels of the society, from communities to governments, private organizations and nongovernmental organizations, is essential for prevention since the risk groups are entrenched in the framework of the society influenced by many areas of national policy. The description and quantification of the major risk factors of NCDs is the opportunity that the WHO STEPwise Approach to Surveillance of Risk Factors for NCDs (NCD STEPS) presents for the prevention and control of a disease group that has been neglected long enough.

As identified in the WHO STEPwise Approach, the underlying principle is that all surveillance sites gather the same core items on a limited number of risk factors, with the option of including additional items of local relevance. The WHO STEPS surveillance program aims to ensure that the STEPS implementation at the country level is strategic, coordinated, builds capacity, and is sustainable.

A vast body of knowledge now exists about the risk factors for NCDs and experience in the prevention and control of them. It also has been shown in a number of countries, both developed and developing, that a comprehensive, long-term approach has the potential to reduce risk factors in the population, and in turn, disability and death. In this sense, the risk factors of today predict the diseases of the future.

A risk factor refers to any attribute, characteristic or exposure of an individual, which increases the likelihood of developing a NCD. The major risk factors for one NCD are also likely to affect one or more of the other NCDs (Table 1).

In addition some of the NCD "risk factors" tend to appear in 'clusters' in individuals (i.e. physical inactivity often clustering with obesity and high blood pressure). It has been estimated, for example that social class, tobacco and alcohol use, obesity, blood pressure and diabetes explain about half of the variance in stroke in males and two-thirds in females.

Table 1 Risk factors common to major noncommunicable diseases

Risk factor	Condition			
	Cardio-vascular disease*	Diabetes	Cancer	Respiratory conditions**
Smoking	✓	✓	✓	✓
Alcohol	✓		✓	
Poor nutrition	✓	✓	✓	✓
Physical inactivity	✓	✓	✓	
Obesity	✓	✓	✓	✓
Raised blood pressure	✓	✓		
Raised blood glucose	✓	✓	✓	
Raised blood lipids	✓	✓		

* Including heart disease, stroke, and hypertension
** Including chronic-obstructive pulmonary disease and asthma

The changes brought about by the demographic and epidemiological transition have had a prominent impact on health patterns. NCD overrides infectious diseases and contributes to a double burden of diseases in most Pacific countries. Lifestyle changes have also contributed much to this shift in health pattern such as:

- Increase in tobacco use
- Reduction in physical activity
- Rapid change of diet
- Increase in alcohol use

In recognition of this increased burden of NCDs, WHO has given NCD prevention, control and surveillance high priority in its program of work. NCD surveillance is seen as a necessary tool in designing prevention and control programs with specific goals and measurable outcomes. Country-specific data on risk factors is essential in order to set priorities, develop targeted programs, and monitor interventions on NCDs.

The impacts of NCDs and related complications on the health of the people of Tokelau has become an issue not only in the health services but also in the political arena, and as a result, the Department of Health, Tokelau, in collaboration with the World Health Organization (WHO) and with the technical assistance of the Fiji School of Medicine (FSM), Suva, adopted the WHO stepwise approach for the surveillance of NCDs, with minor modification appropriate for the local environment and health needs in an attempt to assess the prevalence of NCDs and related factors in the Tokelau Islands.

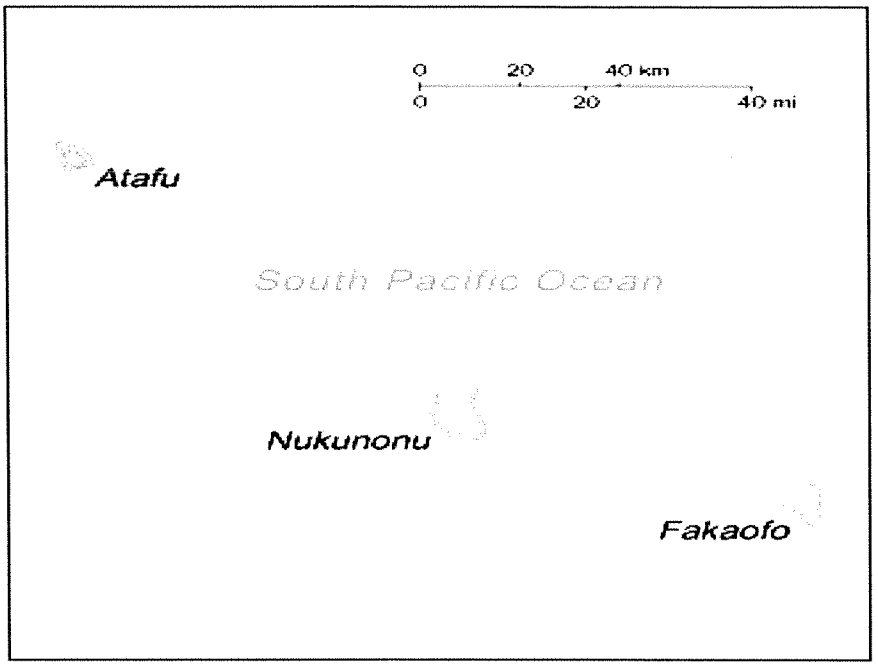
The challenge of NCD prevention and care in most Pacific countries is to deliver interventions, which will promote behavioral changes in the population, and to disseminate these changes nationally. A key feature of the community program is simultaneous application of medical and epidemiological knowledge to identify health problems and target risk factors in selecting the intervention objectives, while using behavioral and social knowledge to design the actual program contents and activities.

1.2 The National Context

1.2.1 Geography

Tokelau comprises of three atolls (Figure 1), which lie in the Pacific Ocean between 171' and 173'W longitude and 8' and 10'S latitude, approximately midway between Hawaii and New Zealand. It is located about 483 km north of Samoa with a total landmass of approximately 12 sq km and about 3-5 m above sea level and therefore very vulnerable to climate changes, sea level rise and hurricanes. The largest atoll is Nukunonu at 4.7 sq km; Fakaofo and Atafu are 4 sq km and 3.5 sq km respectively. Atafu is the northernmost atoll, 92 km north of Nukunonu, which in turn lies 64 km north of Fakaofo.

Figure 1 Map of Tokelau



Each atoll consists of a number of reef-bound islets (*motu*) encircling a lagoon. The islets vary in size from 90 m to 6 km in length and from a few metres to 200 metres in width. From Atafu in the north to Fakaofo in the south, the group extends for just under 200 km.

1.2.2 Demography

Tokelau has about 1500 Polynesian inhabitants living in three villages, who speak English and Tokelauan. From the Tokelau census 2001, Atafu has the largest population of 588, followed closely by Fakaofo with 479 and then Nukunonu with 361. Females are in a slight majority in the overall population. Their isolation and lack of resources greatly restrains economic development and confines agriculture to the subsistence level. The very limited natural resources and overcrowding, are contributing to the emigration to New Zealand resulting in population decline of about 0.9% per year.

On the island of Atafu, all inhabitants are members of the congregational Christian Church of Samoa, on Nukunonu, all are Roman Catholic, and on Fakaofo both denominations are present with the congregational Christian Church predominant. The total proportions are: Congregational Christian Church 70%, Roman Catholic 28%, and others 2%.

1.2.3 Government

Tokelau is a self-administering territory of New Zealand and therefore relies on New Zealand for its annual budget. However, the Tokelauans are drafting a constitution and developing institutions and patterns of self-government as Tokelau moves towards free association with New Zealand, like Niue and the Cook Islands. Tokelauans are New Zealand citizens.

1.2.4 Political

a. Administration

The head of state is Queen Elizabeth II, who is represented by the Administrator Neil Walter who is appointed by the New Zealand Minister for Foreign Affairs and Trade. The Administrator of Tokelau is currently based in Wellington, New Zealand and he is technically responsible for the administration of the executive government of Tokelau.

In 1994, these powers were formally delegated to Tokelau's general *fono* (parliament) or to the Council of the On-going Government of Tokelau when the *fono* is not in session. In 1996, the New Zealand parliament amended the 1948 Act to confer on the general *fono* limited legislative power, giving Tokelau in practice a large measure of administrative and political autonomy.

b. Council of the On-going Government of Tokelau (COGT)

This council functions as the cabinet, and it has six (6) members, consisting of three *Faipule* (one elected head of each village), and three *Pulenuku* (one elected Mayor of each village). These members are elected every three years.

The head of government (Ulu o Tokelau) is a titular title and is chosen from the three-elected *Faipule* (one from each village) for a one-year term and rotates annually between the three elected *Faipules*.

c. The General *Fono*

This body functions as the parliament of Tokelau, and includes all members of the COGT, and representatives from the three villages. These representatives are elected by universal suffrage for a term of three years and at present, Atafu has 9 seats, Fakaofo has 8 seats and Nukunonu has 7 seats.

The general *fono* is the paramount decision-making body and approves the national budget. The *Taupulega* of the host atoll elects the chairperson annually, and it has 24 seats at present.

d. Village

A Council of Elders or *Taupulega* governs each of the three villages. Atafu and Nukunonu *Taupulega* members are heads of extended families. Fakaofo membership of *Taupulega* is by invitation by existing *Taupulega* members.

The family and extended family constitutes the core of the social organization, with the village (*nuku*) being the foundation of Tokelauan society. Community welfare is paramount in what has been traditionally a subsistent environment.

1.2.5 Economy

Tokelau is a very poor community that is substantially dependent on financial assistance from New Zealand. Direct budget support from New Zealand accounts for $9 million (2004/05 financial year) of the net $11m of Tokelau's budgetary resources. New Zealand also provides significant project assistance that focuses on the development of governmental infrastructures. Economy is basically subsistence although cash is becoming an important part of everyday life.

Tokelau's size, geographical isolation and limited resources greatly restrain local economic development. Agricultural production is mainly subsistence. Its marine resource has not been fully explored as yet. The sales of fishing licenses for Tokelau's Exclusive Economic Zone (EEZ) now provides an important source of domestic revenue as well as sales of souvenir coins and stamps and remittance from Tokelauans living overseas, mainly in New Zealand. Tokelauan handicrafts, particularly woven items such as mats, hats, bags and fans are renowned throughout the Pacific for their detail and close work and this has added revenue to Tokelau.

1.2.6 Transport and Support Services

a. Shipping

Tokelau has yet to develop an airfield and the only medium of transport in between the three atolls and the closest Island, Samoa is by boat. Currently, there is a Tokelau-owned boat, the MV Tokelau that travels to and from Samoa fortnightly. It is the same boat that connects the three atolls. It takes about 36 hours from Samoa to the nearest atoll Fakaofo and about 4 hours from Fakaofo to Nukunonu and about 6 hours from Nukunonu to Atafu, and if the weather is not favourable, it might take longer.

There are no harbor facilities in all the three atolls, only narrow passages for small boats. The boat anchors off the reef, and a small dingy takes passengers and cargo onto the beach where unloading of cargo is done manually by the village males.

The Samoa Shipping Corporation provides assistance when there is an urgent need of transport to/from Tokelau such as for medical evacuation and urgent supplies for the villages/hospitals.

b. Telephones and Internet Connection

In 1997, TeleTok, a government-regulated telephone service was established, with three satellite earth stations that allows telephone calls within Tokelau and to outside countries as well. Almost every household in Tokelau has a telephone.

In September 2003, a high-speed internet connection was first established on the island of Fakaofo, and has now been offered in Atafu and Nukunonu.

Each atoll has a radio broadcast station that broadcasts shipping, weather reports and other programs and nearly every household has a radio.

1.2.7 Local Food

The coral sand of the atolls is porous, lacks humus and will support the food plants that flourish on high tropical islands. Coconut palms, pandanus, breadfruit and starchy aroids are the only food crops that are readily grown on the atolls. Ocean and lagoon fish and shellfish are available in quantity and are part of the staple diet. Coconuts, pulaka, breadfruit, banana, papaya, pumpkins and edible pandanus fruits are available locally. Livestock includes poultry and pigs. Some families grow their own vegetable garden while the majority rely on imported processed food.

In each atoll, there is one cooperative store, owned by the village that sells staple foodstuffs, mostly

imported. There is an observable diet shift and increasing over-reliance on imported, processed food contributing to lifestyle related diseases.

1.2.8 Education

Each atoll in Tokelau has a primary and a secondary school that provides free education for children age 5-18 years old. The education system is similar to that of New Zealand, and in Tokelau, the highest level in the school is Form 5. From the Form 5 exiting examination, the top 10 students are awarded with scholarships to further their studies in Apia or in New Zealand. Others may get sponsorship from local church organizations, or are privately sponsored to complete college education overseas. The rest may find employment in the village or help out at home.

1.3 Health

1.3.1 General Situation

The overall health status is reasonably good, but there have been changes observed in MOH data over the last few years. There has been an increase in NCDs, with cerebrovascular disease seen as the leading cause of death. The proportion of mortality due to cardiovascular diseases has increased from 31% in 1981 to 37.8% in the last five years (1990-1995). Blood pressure recordings of 90mmHg diastolic and greater are seen in 36% of females and 23% of males of 30 years of age or over. Random blood sugars of 7mmol/Litre and above for the same group appear in 18% of males and 28% of females.

Tobacco and alcohol consumption is relatively high among the adult population but is more prominent in males. Obesity is common and is attributed to diet and physical inactivity.

1.3.2 Health Services

Each of the three atolls has its own hospital manned by a medical officer, four to five registered nurses, one dental nurse, four to five nurse-aides and a handyman. Tokelau relies much on 'locum' doctors who come and work in any of the three hospitals for a limited duration of 3-6 months, and most often, there are no doctors on the island and the hospital is managed by nurses.

Each of the three hospitals is similarly equipped with the only X-Ray unit in the Nukunonu hospital. In each hospital, there is a Hospital Manager that is directly responsible for the day-to-day management of the hospital and local health services and he/she reports directly to the local Taupulega.

Prior to July 2004, all hospitals and health services were managed by the Department of Health through the Director of Health. Subsequently, as part of the Tokelau government reform, the three hospitals and local health services and management were transferred to the three local Taupulegas (council of elders). This means that budgeting, planning and implementation of local health programs is the responsibility of the local Taupulega and hospital staff members.

The national Health Department, whose national head office is in Nukunonu, comprises of the Director of Health and 8 health personnel in specific health areas providing support to the government and the three atolls in health related areas. The department also has an office in the Tokelau Apia Liaison Office (TALO) in Samoa. Its main purpose is to facilitate referral of patients in Samoa and to New Zealand. The TALO Health Office also serves as the storage and distribution points for medical supplies. For the financial year 2003/04, the Tokelau national budget was NZ$11, 381 770. Health was allocated 12.5%, about NZ$1, 424 502. For the previous financial year, health was allocated 8.2% as majority of the local health services including budget had been delegated to three local Taupulega. The national budget is made up of locally generated resources and other assistance coming from international aid agencies including WHO, United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA) and the Australian Agency for International Development (AusAID).

National health services include health training, ordering and dissemination of pharmaceutical supplies, recruitment of locum doctors and national health staff, national health policies and standards, liaising with regional organizations, and providing advice and support for the three local communities.

1.3.3 The Patient Referral Scheme

Due to unavailability of health resources and facilities, the Health Department has developed the Tokelau Patient Referral Scheme (TPRS) that has been in operation for some years now, and that allows patients to have further investigations and treatments outside of Tokelau, in Apia or New Zealand and recently in Fiji. Under this scheme, the department pays for all expenses, including travel, living allowances and medical costs. Depending on the severity of the condition of the referred patient, the Director of Health approves a medical attendant with/without a family attendant and this stresses the budget more.

The number of referred patients to Samoa and to New Zealand has doubled in the last three years, of which more than 80% are NCD-related. Under the TPRS, several patients with NCD-related conditions needed immediate referral from Tokelau. Most often, the one Tokelau boat is not on the island and therefore this requires a medical evacuation. Most often, MV Tokelau is available to pick up the patient, and the Department of Health pays for the charter at a cost of approximately *$16,000 NZD*/evacuation. However, if MV Tokelau is not available and speed of the boat is an issue in the evacuation, then a Samoa-owned boat is hired at approximately *$30-40,000 NZD*/evacuation. During the months of January and February 2006, there had been three medical evacuations from Tokelau, two of which were NCD-related and were further referred to New Zealand. The length of referral for a patient depends on the completion of their assessment and treatment, which is usually at a minimum of one month; some would stay on for more than six months while the Department of Health pays for all expenses. All these expensive treatments, and the long duration of being on the referral scheme have added burden on the Health budget.

1.3.4 Health Training

The Department of Health operates its own health-training program and this is a function of the National Health Office. The Health Training Coordinator is directly responsible for this program and works closely with the Director of Health and the Minister of Health. There are two main areas of health training under this program, one for undergraduate training and the other mainly for the continuing education of present health staff both at the national and village levels.

Identifying of training areas is based on the health needs of the people and the human resource training needs. Undergraduate training of health personnel is at the Fiji School of Nursing, FSMed, and through post-graduate and refresher attachments in Samoa, New Zealand and Fiji as well. Major sources of funds for this program are from the WHO biennial country budget and the Tokelau Health Department's annual budget.

Due to the shortage of qualified nurses and dental assistants, each hospital recruits members of the communities with certain criteria, and trains them on-the-job to become nurse-aides and dental assistants who provide assistance with the everyday operation of the hospital in respective areas. The chief nurse and the dentist working in each respective hospital often do training of these nurse-aides and dental assistants. There are also sponsored training attachments and regional health meetings by regional organizations that health staff are able to attend thereby attaining experience and skills related to their work in the field.

1.3.5 NCDs in Tokelau

As in most other Pacific island countries and areas (PICs), the prevalence of NCDs and their risk factors are increasing. A rich source of information on NCDs in Tokelau has been the Tokelau Island Migrant Study[1] (TIMS) that was conducted in three rounds of expeditions to the Tokelau Islands and

New Zealand. While this study was primarily interested in the degree of changes in NCD patterns when Polynesians from the Tokelau Islands immigrated to New Zealand, the study provides some of the best historical information available on the prevalence of NCDs in Tokelau.

Round I of TIMS was carried out in Tokelau in 1968-71 and in New Zealand in 1972-74, Round II in 1976 in Tokelau and 1975-77 in New Zealand, and Round III in 1982 in Tokelau and 1980-81 in New Zealand. Other than the information available through TIMS, other relevant sources of information on Tokelau NCDs comes from other studies in Tokelau, reviews of health services in Tokelau, as well as from reports on Tokelauan food, dietary habits and lifestyle.

DIETARY CHANGE IN THE PACIFIC:

The traditional Tokelauan diet was essentially rich in protein, fat and carbohydrates derived from fish, pork, poultry and coconuts[2]. Fish was the main source of protein since chicken and pigs were generally reserved for feasts[3]. The traditional diet had a higher percentage of fat, protein and carbohydrates, with rice, bread and sugar generally not being used on the island. Processed food was rarely used and salt (even sea water) was not used for cooking. The energy intake of people on the atoll was also shown to be low compared to migrants[4]. A study conducted in 1979 later confirmed that this diet was very low in zinc and copper[5].

Later, a review of health services of Tokelau in 1989 indicated that the dietary habits of Tokelauans underwent a considerable change influenced primarily by migrant Tokelauans returning to the island[6]. The fat and protein intake decreased with the introduction of rice and bread instead of coconuts, with fish and fresh leafy vegetables being consumed less. There was a marked increase in the intake of carbohydrates, processed food, salt, and sugar additives; leading to a decrease in fiber, vitamins and minerals. While the returning migrants had developed a taste for processed foods, it was also reported that some had become more health conscious with an increased preference for vegetables. However, while Tokelauans have been encouraged to find means of obtaining more freshly caught fish and locally grown produce in order to improve their diet, the consumption of imported, highly processed foods is reported to still be most prevalent.

HYPERTENSION:

TIMS[1] indicated several trends in mean blood pressure levels, which could be attributed to the different lifestyles of migrant versus non-migrant Tokelauans. The non-migrant Tokelauans had lower mean blood pressure levels compare to the immigrants. In males, the mean systolic levels were between 8 and 9 mmHg lower, and mean diastolic levels approximately 10 mmHg lower in non-migrants. In females, these differences were smaller, though the non-migrant Tokelauan females tended to have higher blood pressure levels than non-migrant males. Through the three rounds of TIMS there was no significant change in blood pressure levels.

The prevalence of borderline and definite hypertension was higher among females than males and higher among the migrants than the resident Tokelauans in all three TIMS rounds. While there was a minimal decline in borderline and definite hypertension from the first to the third study period for both migrants and non-migrants possibly attributable to improved treatment (see Table 2), the numbers of patients on treatment in both populations was small: 14% in Tokelau and 18% in New Zealand.

Table 2 Prevalence of hypertension and mean blood pressure in TIMS for non-migrant Tokelauans

Year of Survey	N	Prevalence of hypertension *(%)			Mean blood pressure (mmHg)	
		Borderline	Definite	Total	Systolic	Diastolic
1971	467	13.0	8.1	21.1	122.5	73.5
1976	445	5.6	8.3	13.9	123.9	70.9
1982	378	10.7	5.8	16.5	121.4	71.7

* Criteria for Diagnosis
WHO Expert Committee on arterial hypertension. Technical Report 628, 1978.
Normal blood pressure, diastolic ≤ 90 mmHg and systolic ≤ 140 mmHg.
Borderline hypertension, diastolic 91 to 94 mmHg and/or systolic 141 to 159 mmHg.
Definite hypertension, diastolic ≥ 95 and/or systolic ≥ 160 mmHg.

A migrant study comparing Tokelauan children and children who had migrated to New Zealand between 1971 and 1977[7] demonstrated that children in Tokelau had lower mean systolic and diastolic pressures and that these figures were statistically significant for males in the age group of 5 to 9 and for the diastolic pressure of females in the 5 to 9 age group. Weight and BMI were also significantly lower for both boys and girls in the younger age group of Tokelauan children.

CORONARY HEART DISEASE:

TIMS indicated that there was a decrease in the serum cholesterol levels in both males and females over the period 1971 and 1982. This was attributed to the decreased fat intake from 45% of total energy consumed in 1968 to 38% in 1982. The study also compared the prevalence of risk factors for coronary heart disease (CHD) with data from an Auckland Risk Factor Study[8] and found that non-migrant Tokelauans in general had lower rates of hypercholestrolaemia and hypertension in adults. Smoking was also less prevalent on Tokelau though more females were smokers compared to migrant females.

DIABETES MELLITUS:

It is important to note that methodologies used in determining prevalence of diabetes differ significantly between studies in many PICs. For TIMS, a glucose tolerance test (GTT) was used to compare the fasting plasma glucose level ≥13.9 mmol/L (250mg/dl) an hour after a 100g load of glucose. The results revealed that Type 2 diabetes was more prevalent[9] in females than males but that the overall prevalence was lower in Tokelau. During the three rounds of studies conducted, the rates rose consistently in both groups of males and females and were consistently higher in migrant Tokelauans than those on the atoll. The age-standardised incidence and risk of developing diabetes was lower among Tokelauans and more significant for females (Table 3) .

Table 3 Prevalence of diabetes (%) from 1968 to 1982

Tokelau	Reference (source)	N	Year of survey	Age range	Prevalence of diabetes (%)
Males – Tokelau Round I	(9)	197	1968-71	35-74	3.0
Males – Tokelau Round II		157	1976		5.1
Males – Tokelau Round III		158	1982		7.0
Females – Tokelau Round I		230	1968-71		8.7
Females – Tokelau Round II		212	1876		11.5
Females – Tokelau Round III		188	1982		14.3

Diabetes Classification
Plasma glucose level ≥ 13.9 mmol/L (250 mg/dl) following a 1-hour glucose load of 100g

OBESITY:

The mean weight for females and males by age group from Rounds II and III of the migrant study[1] were compared to the Round I baseline survey in Tokelau. The results indicate a substantial weight gain for both females and males between 1968-71 and 1980-82. Migrant Tokelauans were heavier than non-migrants at almost all ages. Trends showed that weight gain among the females increased up to 35 years, was maintained till 55 years and then declined dramatically. For males, weight gain increased up to 45 years and then gradually declined. Estimates of body mass index (BMI) were not available for comparisons with native Tokelauans (Table 4).

A subset of Tokelauans from the Round II expedition took part in a study of body-fat distribution[12]. The fat patterns were described using four skin fold measurements: triceps, sub-scapsular, supra-iliac, and medial-calf and were analysed to determine the effect of age and migration on the pattern of fat distribution. Migrant males had more central distribution of fat (sub-scapsular and supra-iliac) compared with fat deposition in the extremities (triceps and medial-calf). They also showed a greater fat distribution in the upper portions of the body (triceps and sub-scapsular) compared to the lower body (supra-iliac and medial-calf). In migrant females, both upper and lower body fat distribution were effected.

The same researchers carried out a similar study[12]on Tokelauan children aged 5-17 years using the same skin fold measurements as the adult study. They found that the triceps and sub-scapsular skin fold thickness of the native Tokelauan children were less than the migrants and that migration had an increased effect on skin fold thickness in both girls and boys but was most pronounced amongst the females. The native children also showed less fat deposition in the trunk and more in the extremities compared to the migrant children.

Table 4 Mean BMI by gender in 1968

Tokelau	N	Year of Survey	Age Range	Mean BMI
Males	72	1968	10-19	22.2
	27		20-24	25.0
	61		20-34	26.1
	80		30-44	27.2
	67		40-54	27.8
	41		50-64	26.7
Females	86	1968	10-19	25.7
	42		20-24	27.2
	76		20-34	28.2
	87		30-44	30.4
	66		40-54	31.3
	55		50-64	29.2

CANCER:

Unfortunately, the reporting of deaths by cause in many PICs is inaccurate or incomplete. The methodology used by Taylor et al. in the review of cancer in PICs[14] calculated the proportional mortality of cancer from the number of deaths from cancer over the total deaths. The proportional mortality was also calculated after excluding *Ill-defined* and *Other* causes of death. In the period 1993-7, the proportion of mortality from cancer in Tokelau was 5.2% and ranked 3rd as the leading cause of death.

SUMMARY:

The three rounds of TIMS had reported several trends in the prevalence of NCDs and risk factors in Tokelau from 1971-1982. A lot has happened in Tokelau since then, not only in the health system but also in the cultural, social, political and economical set-up of the atolls and this has brought about lifestyle changes that resulted in a rapid increase in NCDs in Tokelau. Annual Tokelau health reports and reports from the three local hospitals indicated that more than 80% of referred patients are NCD-related and NCDs had been the leading cause of death in Tokelau for the last five years.

The growing burden of NCDs in Tokelau is dramatic considering the small population, minute landmass, limited resources, and its isolation, and is expected to have significant social, economic and health consequences on the country and the rest of the world.

1.3.6 NCD Management Structure and Services

The NCD management and services in Tokelau are all included in the Public Health management and programs. There is no specific NCD unit to address NCDs and related complications. The National Chief Public Health Advisor is directly responsible for the Public Health unit in planning and implementation of Public Health programs including NCD programs. At the village level, the medical doctor on the island is directly responsible for the clinical management of NCDs, and since there are most often no doctors on the atoll, then the nurses are directly responsible for the management of NCDs and their complications. Again, prevention and care of NCDs and related complications are incorporated into the overall local health programs that are managed by local hospital managers.

Management of NCDs in Tokelau focuses on curative treatment with very little emphasis on the aspects of preventative and primary health care. There is also no standard clinical management for NCDs, especially for diabetes and hypertension. In practice, Tokelau relies on locum doctors from around the world who come and work for a limited time of about 3-6 months on the atoll. With individual doctor's preference and experience, management of NCDs for the same patient may well

differ from one doctor to another. This changing clinical management not only leaves the nurses on the atoll confused, but also contributes to wastage of pharmaceutical supplies. For example, a doctor may order antihypertensive and oral hypoglyceamic drugs that will not be used by the next doctor to work on the atoll.

These facts all have negative impacts on the annual health budget. Tokelau, at present, with the assistance of WHO is working on designing a diabetes guideline for Tokelau in an attempt to set standards and to ensure effective management of diabetes in Tokelau.

A majority of the patients with NCDs only call in at the hospital for check-ups when they experience complications which are then diagnosed and managed as they occur. Also, about 40% of patients with NCD-related disorders are non-compliant. In each hospital, there is one specific day every week for diabetes and hypertension clinic but a majority of known cases do not turn up for these clinics.

The increasing impacts of NCDs and related complications on the health of the people of Tokelau result from several factors and from the perspective of the Health Department are due to:

- Limited resources and an inadequate commitment to primary prevention.
- No clear NCD prevention and care strategies and policies both nationally and at the village level.
- Lack of community health education and promotion.
- Lack of regular community screening.
- Resident doctors and especially nurses who do not have in-depth knowledge and understanding of NCDs and their management.
- No clear-cut budget allocation for NCD programs in the Health Department's annual budget.
- Inadequate treatment guidelines.
- Lack of a NCD surveillance system and appropriate research into NCD and its complications.

NCD and related complications are still not a priority to the decision makers. There has been a recent paper submitted to the Tokelau general *fono* for an increase in the cost of alcohol and tobacco, which would have been an advantage to Tokelau both in terms of improved health and more expendable income. However, this was turned down. There are no national policies for alcohol and tobacco except is some village there are rules that limit the importation and selling of alcohol and tobacco, but this still needs reinforcement.

Because there is no specific NCD budget allocation in the Health Department's annual budget, there is no strategic plan for NCDs, and the management and prevention of their risk factors. Available health data is generally too outdated to be used as a basis for formulation of community-based programs on NCD risk factor prevention and care.

NCD STEPS is the WHO recommended surveillance tool which offers a simplified approach to surveillance and provides standardized materials and methods as part of technical collaboration with countries. Tokelau relies greatly on the data from this survey as a basis for NCD program development.

1.4 Developing WHO STEPS in Tokelau

In most countries, NCDs are responsible for a high proportion of the mortality and disability. In developing countries, the burden of disease caused by NCDs is increasing rapidly and will have significant social, economic, and health consequences for these countries. NCDs continue to be a major public health issue for Tokelau and various programs are underway to deal specifically with NCDs in Tokelau. In a world of finite resources, the priority is to collect essential data necessary for evaluating these programs and monitoring their impact. The information on NCD risk factors is essential for planning primary preventive programs and for predicting the future caseload of NCDs.

Data on major risk factors for NCDs is available in many developed countries. However, these data are scarce for most developing countries. Lack of this information seriously handicaps efforts to

control the emerging NCD epidemic.

The emerging significant consequences of NCDs on health in Tokelau, with the unavailability of up-to-date data, is quite critical to Tokelau for the control of this fast emerging epidemic. As a result, the Tokelau Department of Health (DOH) accepted and included the NCD stepwise survey in their budget proposal to WHO for the last two consecutive biennium, and only at the beginning of 2005, serious discussion of this survey commenced between DOH, FSM, and WHO and the survey was finally implemented by DOH.

As part of the preliminary preparation for the Tokelau stepwise survey, Dr Silivia Tavite (DOH) met with Dr Jan Pryor (FSM), Ms Vizo Halavatau (FSM), and Ms Elaine Chung (WHO) at the WHO office in Suva to discuss and set standards for the planning of the Tokelau STEPS survey.

Consecutive meetings and correspondences followed to:

- Define and confirm the study population.
- Agree on objectives of the activity and the data elements to be collected.
- Define the study methodology.
- Work out the budget for all phases of the survey, and identify funding sources.
- Identify and negotiate with relevant parties regarding personnel.
- Prepare training materials and a Tokelau STEPS operational manual.
- Prepare a study proposal for budget approval by DOH.
- Identify required equipment and materials and confirm procurement.
- Confirm the travel schedule to all three atolls with the Department of Transport and the respective Taupulega offices.
- Confirm details of field worker training and participants, travel arrangements, and budget requirements.

Field worker training was done in Apia, Samoa from the 25-29 July 2005, in which all personnel involved in the data collection phase in the field participated. This included one health staff member from each of the three hospitals that traveled by boat to Samoa and two FSMResearch Assistants. The training was conducted by research consultant Dr Jan Pryor from FSMed.

Thirty individuals from the Tokelau community in Samoa participated in a pilot survey which was conducted on 28 July 2005 in Apia. All preparations for the pilot survey replicated those planned for the field survey in Tokelau and all pilot survey participants went through all three steps of the survey commencing on STEP 3, then STEPS 1 and 2. The pilot survey identified certain areas that were improved upon before the end of the field workers training and prior to the data collection for the actual study population.

2. OBJECTIVES

2.1 General Objectives

The overall aim of the Tokelau STEPS survey was to investigate the prevalence of key NCDs and their associated risk factors and to provide baseline information and assistance in the development of an integrated National Strategy on NCD Prevention and Control. For surveillance purposes, the survey aimed to assist with:

- Defining the magnitude of trends of the NCD risk factors.
- Planning and evaluation of health promotion activities to reduce the prevalence of NCD risk factors.
- Predicting likely future demands for health services.

2.2 Specific Objectives

The main specific objectives of the Tokelau STEPS survey were to:

- Investigate and document the prevalence of key NCDs among the target population.
- Determine the prevalence of and to better understand the major modifiable risk factors for common NCDs including smoking, alcohol consumption, physical inactivity, obesity, hypertension, raised blood glucose and cholesterol, and poor diet.
- Study and compare NCDs and their risk factors across different strata of age, gender, ethnicity, and locality.

3. METHODOLOGY

The implementation of the Tokelau STEPS survey involved months of planning, a week-long field workers' training activity, a pilot survey and about six comprehensive weeks in the field which included boat trips from Samoa to Tokelau and from one atoll to another collecting the required data.

The ten-member survey team comprised of various staff members including a team leader, field officers, medical doctor, administrative staff and research assistants. On each atoll, 4-5 survey assistants were recruited and trained to provide assistance during the data collection in that atoll, and this training was done in the first day of arrival prior to the commencement of the survey. The survey was conducted from 3 August to 10 September 2005.

3.1 Survey Design

The 2005 Tokelau STEPS survey was designed as a whole population-based cross-sectional study of 15-64 year olds in the three atolls. There was no sampling involved in this survey as all eligible individuals were targeted for participation. The survey design followed the 3 STEPS as follows:

Step 1:	Interview data on selected health risk behaviours including smoking, alcohol consumption, fruit and vegetable consumption, and physical inactivity.
Step 2:	Physiological measures of health risks including blood pressure, height, weight, and waist circumference.
Step 3:	Biochemical measures of health risks including fasting blood glucose and total cholesterol.

The 2005 survey schedule was as follows:

2-3 August:	Survey team travelled on the MV Tokelau from Apia to Fakaofo
3-17 August:	Data collection in Fakaofo
Eve of 17 August:	Left Fakaofo for Atafu on the MV Tokelau
18-25 August:	Data collection in Atafu
Eve of 25 August:	Left Atafu for Nukunonu
26 Aug to 2 September:	Data collection in Nukunonu
5-9 September:	Completion of data entry in Nukunonu

Upon arrival on each atoll:

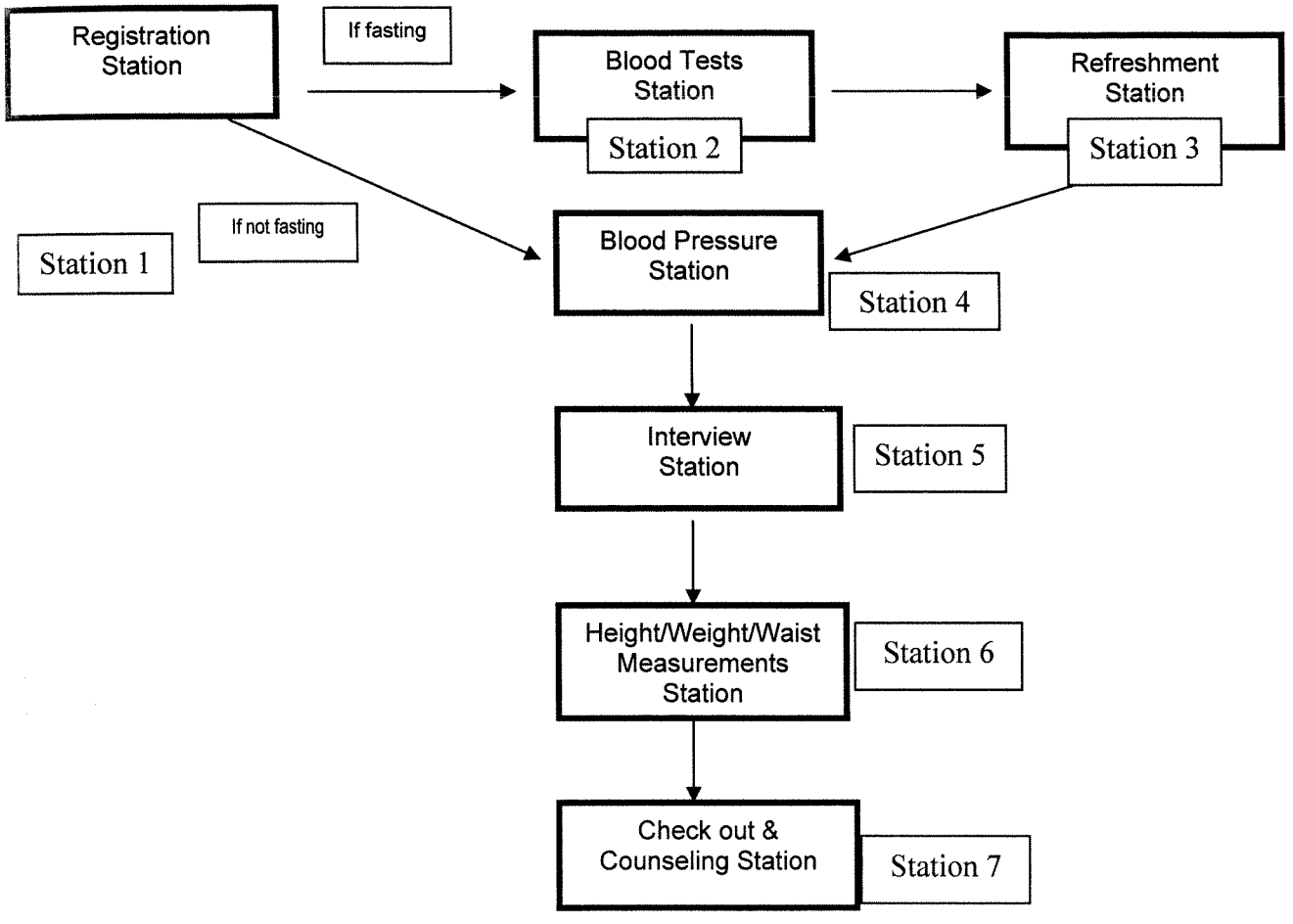
- The survey team met the Taupulega to seek their support, blessings and approval to select members of the local communities to assist during the data collection in that atoll. This provided an opportunity to introduce team members to the elders and to provide more detailed information on the survey and to allow the "toeaina" to have a better understanding of the survey.
- Survey assistants were selected from the community with the assistance of the health staff in respective atolls and were trained by respective core survey team members to provide assistance during the data collection.
- The team worked through appointment schedules for each person using the list of individuals

within the 15-64 age group in each atoll. Individual appointment sheets were attached to survey information sheets and consent forms and were distributed to prospective participants. Names and appointment times were also announced over the local FM radio station (both English and Tokelauan translations were available).

- The schedule appointed 40 persons initially to go through STEPS 1-3 in one day. On the first day, these were completed before midday and the number of scheduled persons increased to 60 persons per day.
- The team also had to set the survey venue. Details of the set-up were as in the diagram below (Figure 2).

3.2 Survey Venue Set-up

Figure 2 Survey station set-up



With financial support from the survey budget, each village prepared refreshment for scheduled individuals each day as well as food for the survey team during their stay in each atoll.

All individuals who participated in the survey went through all three STEPS of the survey.

3.3 Data Collection Process

3.3.1 Registration of Participants (Station 1)

At the first station (Station 1), there was a list of all possible participants in that atoll and all were

already pre-coded. Selected personnel for this station had been trained on the survey protocols and their tasks were to:

- Confirm consent of the participant to be involved in the survey.
- Ensure that participants understood all STEPS involved in the survey.
- Obtain participant date of birth and confirm that they were within the target age group.
- Confirm fasting status of the participant.
- Transfer all required details to the participant's questionnaire including codes.
- Direct the participant to the appropriate station depending on the fasting status of the patient (as in Figure 2).

3.3.2 Refreshment Station (Station 3)

Refreshments were prepared by the respective villages, and included varieties of food ranging from dry coconut, papaya, sandwiches, pancakes and traditional Tokelauan dishes. Refreshments were ready at about 7:00am every morning of each survey day at the survey site so participants had more than enough to have after STEP 3 before continuing on to STEPS 1 and 2 of the survey.

3.3.3 Step 1 - Behavioural Risk Factors (Station 5)

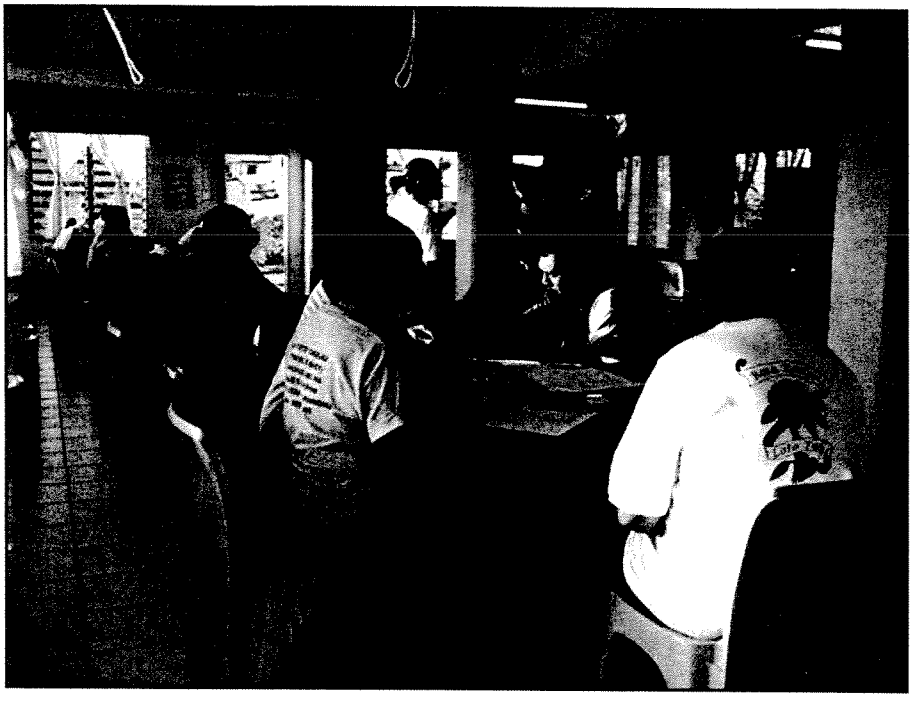
Data for behavioral risk factors were collected using a face-to-face structured interview with questions on selected health risk behaviors including smoking, alcohol consumption, fruit and vegetable consumption, and physical inactivity. The questions were mainly derived from the WHO STEPwise Approach to Risk Factor Surveillance generic questionnaire with minor adjustments with relation to the local culture and belief and health needs. The questionnaire is available on request from DOH, and a copy listed in Appendix 1 of this report.

While the interview form was in English, the actual interview was conducted in either English or Tokelauan depending upon the wishes of the participant. Interviews in Tokelauan followed a standardized script translated from the original English version. All interviews followed a standardized informed consent process and were conducted in a private setting as individually arranged by one of the interviewers who were a core survey team member specifically trained in the NCD STEPS

methodology. Also to assist interviewers, laminated show cards (for work status, standard drinks, fruits & veggies, physical activity), and measuring cups (for both fruits/vegetables and for standard drinks) were also available at this station.

As indicated in Figure 2, this Step 1 (Station 5) was completed midway through the course for one participant.

All of the 10 core members of the survey team were trained in all three STEPS and eight team members were trained especially in the interview methodology. This allowed all core members to help out in each station when there was a need. With the completion of this STEP, the interviewer directed the participant to the next station, which was for the measurement of height, weight, and waist and hip circumferences.



3.3.4 Step 2 - Physical Measurements

Targeted physiological measures of health risks for NCDs were measured including blood pressure (Station 4), and height, weight and waist circumference (Station 6). Selected core survey personnel were trained in conducting these measurements through the use of specific protocols with quality control monitored by using of periodically conducted performance checklists for each measurement.

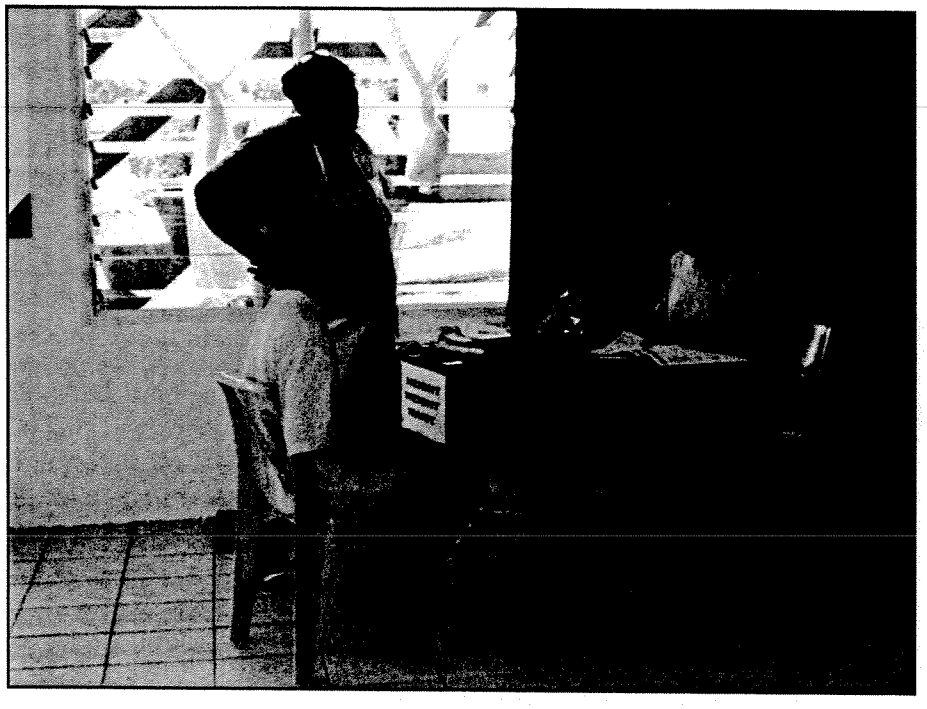
Blood pressure (BP) was measured with the OMRON M4 Digital Automatic Blood Pressure Monitor (DABPM). BP was measured first, recorded while the patient rested (without talking), and two more measurements taken with one minute intervals. The third reading was recorded as the blood pressure reading for that participant.

There were circumstances in which the manual sphygmomanometer was used to measure blood pressure following specific protocols, such as:

- If the DABPM was not functioning.
- If DABPM display showed multiple errors.
- To cross check DABPM readings in various clinical states such as irregular pulse, peripheral circulatory disturbance, and extreme hypertension/hypotension.
- If there was a need to use a different sized cuff.

Height was measured once using the Seca Leicester Height Measure to the nearest whole millimeter.

Weight was measured once as well to the nearest 0.1 kg with the Siltec PS500L scale, which was calibrated against standard weights at the beginning and end of each day.



Because of the specific protocols for the measurement of waist and hip circumference, a small partitioned corner in the survey venue was prepared for these measurements. Waist and hip circumference were measured once and recorded to the nearest 0.1 cm with the Figure Finder constant tension tape. Waist circumference was not measured in female participants who responded affirmatively to a question as to whether or not they were pregnant.

3.3.5 STEP 3 – Biochemical Measurements

Targeted biochemical measures of health risks for NCDs were measured including fasting blood glucose and total cholesterol. Selected core survey personnel were trained in conducting these measurements through the use of specific protocols with monitored quality control.

Each participant was provided with an appointment sheet and fasting instructions and also informed that there was refreshment prepared for them at the survey site so that they can have something to eat after measurement of their fasting blood glucose and total cholesterol.

As indicated in the diagram for the set-up of the venue, biochemical measurements were conducted in Station 2 after they had registered. Participants were instructed to fast from 10:00pm the previous night and scheduled for 7:00am the following morning for biochemical measurements with refreshment ready by the time they completed from this station so that participants had something to eat before continuing on to the next STEPS of the survey. The survey team as well had an early morning each day of the survey, at about 6:00am to ensure that all stations were ready before the first participant registered.

Fasting blood glucose was measured using the Advantage glucose meter with test strips and capillary blood samples using finger pricks. The blood sampling and measure of fasting blood glucose followed specific protocols and was measured once in mmol/Litre. The meter was calibrated for accuracy against specific control testing protocols, using the Accutrend Glucose control solution at the beginning of the day and after testing of about 20-25 patients or when there was an unusual

participant result.

With each finger prick, two blood samples were obtained, one for the fasting blood glucose, and one for the blood cholesterol measurement. Total cholesterol was measured using the Accutrend GC meter and appropriate cholesterol test strips. The total cholesterol was measured once in mmol/Litre. Also, the meter was calibrated for accuracy at the beginning of the day, after about 20-25 participants, or when there was an unusual participant result. Accutrend Cholesterol control solution was used in this calibration.

After completion of these biochemical measurements, participants were directed towards the refreshment station, however, a few preferred to continue on to the blood pressure station before refreshment.

3.3.6 Check-out Station (Station 7)

Selected personnel for this station had been trained on the protocols to be followed. This was the last station of the survey at which all completed participant questionnaires are collected. Also available at this station are participant results forms (both in English and Tokelauan) and pamphlets for NCDs and risk factors including diabetes, hypertension, obesity and diet, alcohol, and tobacco smoking. Responsible core survey personnel at this station:

- Checked the completed questionnaires to make sure that all parts had been correctly completed.
- Completed participant results forms (in preferred version by the participant) and discussed this fully with the participant especially areas of need.
- Provided specific health advice for participants.
- Thanked participants for their support of the survey.

Participants with alarming readings were referred for confirmatory examination and follow-up at the respective hospitals.

Participants were encouraged to take any of the available NCD pamphlets to read.

3.4 Data Management and Analyses

3.4.1 Data Entry and Cleaning

Double data entry for all three STEPS was used to transfer data from the questionnaires and completed forms manually into the Epidata computer application to ensure that all data were correctly entered. Selected core survey team personnel were trained on protocols in double data entry and they commenced double data entry on the atoll each day after completion of the day's data collection.

After completion of all data collection in all three atolls, selected team members completed double data entry for the whole survey in three days in Nukunonu while waiting for the boat and return to respective homes.

The Tokelau dataset was sent to the WHO Office for the South Pacific, together with log books for each station in the survey field, for data cleaning by using EpiInfo version 3.2.2. These activities included identifying, investigating, and resolving as necessary, various issues related to duplicate records, data values outside of preset ranges, and inconsistencies between answers to different but related questions to yield a 'cleaned' and valid dataset.

3.4.2 Weighting of Data

The Tokelau STEPS survey targeted a 100% population coverage of the target 15-64 age group based on the Tokelau 2005 pre-election population count. During the data collection phase of the survey, some of the target population was not on the atolls but an up-to-date listing was made for all potential participants who were on-island. Staff in WHO Office in Geneva finished calculations for the weighted dataset for Tokelau.

3.4.3 Data Analysis

Data analysis was accomplished using the Windows-based EpiInfo 2002 – Version 3.3.2. Frequency distributions were calculated using weighted complex sample frequencies for all categorical variables. Descriptive statistics including weighted complex sample means were calculated for all numeric variables. Given that the target sample is the whole population in Tokelau aged 15-64 years and that the survey yielded a very high response rate of 98% (586/597), 95% CI were not presented in this report. Associations between variables were analyzed for the major exposure variables of interest including 10-year age groups, gender, ethnicity and island (i.e. Fakaofo, Atafu or Nukunonu). These associations were calculated using EpiInfo's complex sample table function.

Two staff members, Dr Silivia and Mr Alapati from the Tokelau Health Department were supported by WHO to work at the WHO Office in Suva for three weeks (from 6-24 March 2006), under the supervision of Dr Jan Pryor, Mr Shalvindra Raj and Dr Li Dan to conduct initial analysis of the Tokelau dataset and to draft the Tokelau STEPS survey report.

Final data weighting and cleaning and analysis was conducted by the WHO Office in Geneva, supported by WHO Office in Suva.

Two "Workshops on Management, Analysis and Reporting of Data from Stepwise NCD Surveillance" were held in Suva, Fiji from 25 September to 3 October 2006. Dr Tekaai Nelesone, Director of Health, Tokelau DOH, participated the training. Ms Leanne Riley and Ms Jacklynn Lippe from the WHO Office in Geneva provided training to the participants.

4. RESULTS

The study targeted all 15-64 year olds in all the three atolls of Tokelau based on the Tokelau population count 2005. Population lists were updated on arrival on each atoll and data were collected from a total of 586 participants from a possible 597 participants in the target age group who were determined to be on-island during the data collection period. As such, the survey was able to collect data on 97.7% of the total population available for the survey. Subsequently, while complex statistical analyses were conducted with all calculations using weights to accommodate non-response, the very high response rate yielded 95% confidence intervals (CIs) that were essentially zero. Hence, all data reported herein are deemed to be precise population measures without CIs.

4.1 Characteristics of Survey Population

Details of the survey sample and country population characteristics are outlined in Table 5 below.

Table 5 Demographic description of study population

Population characteristic	Fakaofo		Atafu		Nukunonu		Total
	Participant	On-island	Participant	On-island	Participant	On-island	%
Gender							
Males	93	93	77	83	100	101	46.3
Females	106	107	116	122	91	91	53.7
Total	199	200	193	205	191	192	
Age Group							
15-24	57	58	47	50	48	48	26.1
25-34	29	29	37	41	45	45	19.0
35-44	47	47	46	49	39	39	22.6
45-54	48	48	35	37	26	27	18.7
55-64	18	18	28	28	33	33	13.6
Total	199	200	193	205	191	192	
Ethnicity							
Tokelauan born in Tokelau	143	144	160	169	124	124	73.2
Tokelauan born overseas	28	28	22	24	39	40	15.3
Samoan	14	14	7	8	20	20	7.0
Other	14	14	4	4	8	8	4.5
Total	199	200	193	205	191	192	
% of sample	34.1		33.1		32.8		100

Table 5 indicates the demographic details of the survey. On arrival on each atoll, updated target population list (ie. individuals with the 15-64 age group) came out as 200 for Fakaofo, 205 for Atafu and 192 for Nukunonu. From these updated lists of target population on the island at the time of the survey, 199 (34.1%) participated in Fakaofo, 193 (33.1%) in Atafu and 191(32.8%) in Nukunonu.

73.2% of participants were Tokelauans born in Tokelau, followed by 15.3% of Tokelauans who were born overseas. 53.7% were females and 46.3% were males. The largest 10-year age group in the study population was within the 15-24 age group (26.1%), followed by the 35-44 age group (22.6%).

The employment status of participants was 58.6% employed under the village workforce. With the recent political changes within the management of public servants in Tokelau and the delegation of the management of local education and health (ie. schools and hospitals) to the respective Taupulega, all health and education staff members also change employers from the Departments of Health and Education to the local Taupulega as the major employer at the village level. Recently, only a few local individuals had developed privately-owned businesses as reflected in the low 2.4% in this category, and with village cultural practices, all males should be employed by the village council of elders and therefore small business development is limited to females.

Physical capability of an individual was the main factor in categorising the participant as being unemployed but able to work or unable to work. Only 1.1% were categorised as unemployed but able to work and these were young single females. There are limited job opportunities for females whereas a high proportion of males are employed either at the national level or at the village level unless opted otherwise.

4.2 Tobacco Use

Prevalence of tobacco use was assessed according to the smoking status that each participant reported on their individual completed questionnaire in response to the standard questions. These are defined as follows:

- Current smokers – those who have smoked any tobacco product (such as cigarettes, cigars or rolled tobacco) in the past 12 months.
- Daily smokers – those who are smoking any tobacco product every day.
- Non-daily smokers – those amongst the current smokers who do not smoke on a daily basis but less frequently.

These categories of smoking status are of common use as they also give insight into the addictive nature of tobacco smoking.

Table 6 Current smoking status of the study population by gender and age group

Age	Daily		Non-daily		Daily and non-daily		Non-smokers	
	Males (N=231)							
	%	n	%	n	%	n	%	n
15-24	57.7	41	15.5	11	73.2	52	26.8	19
25-34	51.1	23	8.9	4	60.0	27	40.0	18
35-44	58.5	31	5.7	3	64.2	34	35.8	19
45-54	52.6	20	7.9	3	60.5	23	39.5	15
55-64	54.2	13	12.5	3	66.7	16	33.3	8
Total	55.4	128	10.3	24	65.7	152	34.3	79
Age	Females (N=313)							
	%	n	%	n	%	n	%	n
15-24	45.9	28	26.2	16	72.1	44	27.9	17
25-34	70.7	29	14.6	6	85.4	35	14.6	6
35-44	76.5	39	13.7	7	90.2	46	9.8	5
45-54	66.0	31	14.9	7	80.9	38	19.1	9
55-64	60.0	15	16.0	4	76.0	19	24.0	6
Total	63.3	142	17.7	40	81.0	182	19.0	43
Age	Total Population (N=584)							
	%	n	%	n	%	n	%	n
15-24	52.3	69	20.5	27	72.7	96	27.3	36
25-34	60.5	52	11.6	10	72.1	62	27.9	24
35-44	67.3	70	9.6	10	76.9	80	23.1	24
45-54	60.0	51	11.8	10	71.8	61	28.2	24
55-64	57.1	28	14.3	7	71.4	35	28.6	14
Total	59.3	270	14.0	64	73.3	334	26.7	122

Table 7 Mean age started smoking among current daily smokers

Age	Males (N=128)		Females(N=142)		Total Population (N=270)	
	n	Mean	n	Mean	n	Mean
15-24	41	16.5	28	17.4	69	16.9
25-34	23	16.9	29	18.2	52	17.6
35-44	31	19.6	39	21.1	70	20.4
45-54	20	18.8	31	23.4	51	21.5
55-64	13	21.8	15	26.6	28	24.4
Total	128	18.2	142	20.8	270	19.6

Table 6 indicates that 73.3% of the 15-64 year olds in Tokelau smoked. The highest of the current smokers were in 15-24 year age group for males (73.2%), and in 35-44 year age group for females (90.2%).

The table also shows a similar proportion of both genders that smoked daily (55.4% of males and 63.3% of females). However, for daily smokers in the 15-24 year age group, there was a considerably higher proportion among males (57.7%) as compared to females (45.9%). However, it is important to note that female daily smokers were more prevalent than males in the other 10-year age groups, except for among the oldest group. Also, there was somewhat higher proportion of current female

smokers overall (81.0%) as compared to males (65.7%).

The survey also indicated that the only form of tobacco consumed in Tokelau was manufactured cigarettes. Other kinds of tobacco, like cigars, betel nuts with tobacco were not consumed in Tokelau.

Table 7 indicates that males started smoking earlier in life on average (18.2 years) than did females (20.8 years) and that this pattern was true in all age groups. In both genders, age at which smoking started decreased with decreasing age with the youngest population starting smoking earlier in life.

Table 8 Mean number of years of smoking among current daily smokers

Age	Males (N=128)		Females (N=142)		Total Population (N=270)	
	n	Mean	n	Mean	n	Mean
15-24	41	2.8	28	2.7	69	2.8
25-34	23	12.8	29	11.5	52	12.1
35-44	31	19.5	39	17.8	70	18.6
45-54	20	32.3	31	25.7	51	28.3
55-64	13	38.2	15	31.9	28	34.8
Total	128	16.8	142	16.7	270	16.7

The mean number of years of smoking was similar between male (16.8 years) and female smokers (16.7 years). Not surprisingly, in both male and female smokers, the number of years of smoking increased with their increasing ages (Table 8).

4.3 Alcohol Consumption

Prevalence of alcohol consumption was assessed by status of its usage and the consumption behaviour of "binge drinking" was specifically assessed due to its associated risks. Below are the definitions used:

- Ever drinkers – those who have ever consumed a drink that contains alcohol (such as beer, coolers, wine, spirits, home brew or fermented cider).
- Current drinkers – those who have consumed a drink that contains alcohol in the past 12 months.
- Binge drinking – 5 or more drinks on at least one day during the past week for males; 4 or more drinks on at least one day during the past week for females.

Table 9 Percentage of alcohol consumption during the past 12 months by gender and age group

Age	Abstainers		Current Drinkers	
	Men (N=212)			
	%	n	%	n
15-24	----	0	100.0	60
25-34	4.4	2	95.6	43
35-44	2.0	1	98.0	48
45-54	8.6	3	91.4	32
55-64	----	0	100.0	23
Total	2.9	6	97.1	206
Age	Women (N=134)			
	%	n	%	n
15-24	12.9	4	87.1	27
25-34	9.7	3	90.3	28
35-44	----	0	100.0	39
45-54	22.7	5	77.3	17
55-64	9.1	1	90.9	10
Total	9.6	13	90.4	121
Age	Total Population (N=346)			
	%	n	%	n
15-24	4.4	4	95.6	87
25-34	6.6	5	93.4	71
35-44	1.1	1	98.9	87
45-54	14.0	8	86.0	49
55-64	2.9	1	97.1	33
Total	5.5	19	94.5	327

The results in Table 9 indicate that 97.1% of males and 90.4% of females consumed alcohol within the last 12 months. There was a higher proportion of male current drinkers than female in all age groups.

Table 10 Numbers of drinks per day among current drinkers by gender and age group

Age	1 drink		2-3 drinks		4-5 drinks		6+ drinks	
	Males (N=205)							
	%	n	%	n	%	n	%	n
15-24	6.8	4	13.6	8	15.3	9	64.4	38
25-34	----	0	----	0	14.0	6	86.0	37
35-44	----	0	10.4	5	14.6	7	75.0	36
45-54	----	0	12.5	4	25.0	8	62.5	20
55-64	13.0	3	13.0	3	13.0	3	60.9	14
Total	3.3	7	9.7	20	16.1	33	70.9	145
Age	Females (N=121)							
	%	n	%	n	%	n	%	n
15-24	14.8	4	14.8	4	25.9	7	44.4	12
25-34	10.7	3	21.4	6	14.3	4	53.6	15
35-44	12.8	5	20.5	8	23.1	9	43.6	17
45-54	5.9	1	41.2	7	23.5	4	29.4	5
55-64	30.0	3	30.0	3	30.0	3	10.0	1
Total	13.1	16	23.1	28	22.2	27	41.5	50
Age	Total Population (N=326)							
	%	n	%	n	%	n	%	n
15-24	9.3	8	14.0	12	18.6	16	58.1	50
25-34	4.2	3	8.5	6	14.1	10	73.2	52
35-44	5.7	5	14.9	13	18.4	16	60.9	53
45-54	2.0	1	22.5	11	24.5	12	51.0	25
55-64	18.2	6	18.2	6	18.2	6	45.5	15
Total	7.0	23	14.7	48	18.4	60	60.0	195

The survey shows that 70.9% of male and 41.5% of female current drinkers drank more than 5 standard drinks per drinking day, followed by 16.1% who drank 4 to 5 standard drinks in males and 22.2% who drank 4 to 5 standard drinks in females. Greater proportions of all age groups in males drank 6 or more standard drinks per drinking day. The proportion that drank 6 or more standard drinks per drinking day was highest in the 25-34 year age group for both males (86.0%) and for females (53.6%) (Table 10). Only 3.3% of current male drinkers drank one standard drink per drinking day, whereas 13.1% of current female drinkers drank only one standard drink per drinking day.

Table 11 Percentage of current drinkers who do heavy drinking by gender and age group

Males (N=203)				
Age	More than 5 drinks		More than 4 days	
	%	n	%	n
15-24	21.7	13	---	0
25-34	39.0	16	---	0
35-44	44.7	21	2.1	1
45-54	50.0	16	---	0
55-64	43.5	10	---	0
Total	37.5	76	0.5	1
Females (N=121)				
Age	More than 4 drinks		More than 4 days	
	%	n	%	n
15-24	3.7	1	---	0
25-34	25.0	7	---	0
35-44	25.6	10	---	0
45-54	23.5	4	---	0
55-64	20.0	2	10.0	1
Total	20.0	24	0.8	1

Binge drinking was defined as 5 or more drinks on at least one day during the past week for males; and 4 or more drinks on at least one day during the past week for females.

Table 11 shows that there was more binge drinker in males (37.5%) than females (20.0%), and that this relation was true in all age groups. Binge drinking for males peaked in the 45-54 year age group (50.0%) and for females in the 35-44 year age group (25.6%).

4.4 Intake of Fruit and Vegetables

Table 12 shows overall that the mean number of days in a week that fruit was consumed was higher in females (2.2 days) than males (1.7 days) and that this was so for each of the 10-year age groups. This difference by gender was even greater for vegetables with females reportedly consuming vegetables on 2.5 days each week compared to males on only 1.7 days per week, again with a similar difference in each of the 10-year age groups.

The number of days fruit was consumed was highest in the male age group of 15-24 years (1.9), and in the female age group of 35-44 years (2.7). The number of days vegetables were consumed was highest in the male age group of 45-54 years (1.9), and in the female age group of 35-44 years (2.9).

Table 12 Mean number of days in a week that fruit or vegetables are consumed by gender and age group

Age	Fruits		Vegetables	
	Males			
	n	Mean	n	Mean
15-24	74	1.9	75	1.7
25-34	52	1.7	52	1.8
35-44	59	1.7	58	1.6
45-54	52	1.5	52	1.9
55-64	33	1.4	33	1.5
Total	270	1.7	270	1.7
Age	Females			
	n	Mean	n	Mean
15-24	79	2.1	79	2.5
25-34	59	2.2	59	2.6
35-44	71	2.7	71	2.9
45-54	58	1.8	58	2.1
55-64	46	2.1	46	2.0
Total	313	2.2	313	2.5

Table 13 shows that the mean number of servings of fruit consumed overall on a day that fruit was consumed was only 1.0, with little difference between males (0.9) and females (1.1). The mean number of servings of vegetables consumed overall on a day that vegetables were consumed was also only 0.9, being somewhat lower in males (0.8) as compared to females (1.0).

Table 13 Mean number of servings of fruit or vegetables consumed on a day when fruit or vegetables were eaten

Age	Fruits		Vegetables	
	Males			
	n	Mean	n	Mean
15-24	74	1.0	75	0.8
25-34	52	1.1	52	1.0
35-44	59	0.7	58	0.7
45-54	52	0.7	52	0.9
55-64	33	0.6	33	0.6
Total	270	0.9	270	0.8
Age	Females			
	n	Mean	n	Mean
15-24	79	0.9	79	0.8
25-34	59	1.1	59	1.1
35-44	71	1.4	71	1.5
45-54	58	0.9	58	0.9
55-64	46	1.1	46	0.7
Total	313	1.1	313	1.0
Age	Total Population			
	n	Mean	n	Mean
15-24	153	1.0	154	0.8
25-34	111	1.1	111	1.0
35-44	130	1.1	129	1.1
45-54	110	0.8	110	0.9
55-64	79	0.9	79	0.7
Total	583	1.0	583	0.9

In order to determine the proportion of those who consumed less than five combined servings of fruit and vegetables on average per day of the week, the data on the number of days that fruit and vegetables were consumed in a week, and the data on the number of servings of fruit and vegetables consumed on one of those days, was used to calculate the mean number of combined servings of fruit and vegetables consumed on an average day. (Table 14) This table shows that on average survey participants consumed 1.9 combined servings of fruit and vegetables on an average day of the week.

Table 14 Mean number of combined servings of fruit and vegetables consumed per day of the week

Age	Fruit and Vegetables	
	Males	
	n	Mean
15-24	75	1.8
25-34	52	2.1
35-44	59	1.4
45-54	52	1.6
55-64	33	1.2
Total	271	1.7
Age	Females	
	n	Mean
15-24	79	1.8
25-34	59	2.2
35-44	71	2.9
45-54	58	1.8
55-64	46	1.8
Total	313	2.1
Age	Total Population	
	n	Mean
15-24	154	1.8
25-34	111	2.2
35-44	130	2.2
45-54	110	1.7
55-64	79	1.6
Total	584	1.9

Table 15 then shows that over 92.3% of participants across all gender and age groups consumed less than five combined servings of fruit and vegetables on an average per given day of the week. The youngest age group of 15-24 years showed a particularly high proportion (95.5%) that ate less than five combined servings of fruit and vegetables per day.

Table 15 Percentage who consumed less than five combined Servings of fruit or vegetables per day of the week

Age	Males (N=271)		Females(N=313)		Total Population (N=584)	
	%	n	%	n	%	n
15-24	94.7	71	96.2	76	95.5	147
25-34	92.3	48	91.5	54	91.9	102
35-44	96.6	57	83.1	59	89.2	116
45-54	90.4	47	93.1	54	91.8	101
55-64	93.9	31	91.3	42	92.4	73
Total	93.7	254	91.0	285	92.3	539

4.5 Physical Activity

4.5.1 Measurements

Participation in physical activity (PA) in the Tokelau STEPS survey was measured by asking participants to report on the frequency and amount of different types of activity they undertook on a typical day as part of work, transport and leisure.

In the work and leisure domains of activity, respondents were asked about the frequency (how many days per week) and duration (how many hours/minutes per day) of moderate- and vigorous-intensity activities to determine how much of each individual's work and leisure activity contributed towards the total recommended amounts of activity for health gain.

4.5.2 Analyses

In the analyses of the PA data, each domain of activity was firstly addressed separately. This enabled examination of the proportion and levels of PA in each of the leisure, work and travel settings as a component of overall PA in Tokelau. Subsequently, when these questions are repeated in future surveys, participation in each type of activity can be used as separate indicators of the impact of PA promotion strategies in the local communities.

To examine levels of participation in each type of activity, variables were created to estimate the proportion of participants who undertook sufficient PA for health gain. The criteria for sufficient activity were drawn from the widely cited recommendation to undertake moderate-intensity activity for 30 minutes or more on most days of the week, or 20 minutes of vigorous-intensity activity on at least three days per week, and were translated as noted below into three categories, namely inactive, moderately active, and vigorously active.

The term MET is an abbreviation for metabolic equivalent and is used to reflect the intensity of the specific PA. A MET is defined as the ratio of the associated metabolic rate for a specific activity divided by the resting metabolic rate. The resting metabolic rate is approximately 1 MET and reflects the energy cost of sitting quietly. The MET values for the three PA domains are as follows:

Moderate PA (work and leisure domain)	= 4.0 METS
Vigorous PA (work and leisure domain)	= 8.0 METS
Transport related walking/cycling	= 4.0 METS

In terms of METminutes the following levels of activity were defined:

Inactive:	<600 METminutes per week
Moderately active:	600-1500 METminutes per week
Highly active:	>1500 METminutes per week

4.5.3 Levels of Physical Activity in Tokelau

Table 16 shows that total PA per day across all settings averaged 148.1 METminutes per day overall, and that this was an almost three times higher for males (226.0 METminutes/day) than for females (80.5 METminutes/day). The table also shows overall that 74.6% of total PA was done in the work setting (110.6/148.2), and that only 10.1% of total PA was done in the leisure setting (14.9/148.2), suggesting that not much PA is done during leisure time for either sports or health gain.

Table 16 Level of physical activity (mean METminutes per day) by gender and age group

Age	Males (N=269)		Females (N=310)		Total Population (N=579)	
	Work					
	Mean	n	Mean	n	Mean	n
15-24	187.6	73	28.9	77	106.1	150
25-34	171.0	52	58.8	59	111.3	111
35-44	178.6	59	62.4	70	115.6	129
45-54	194.9	52	32.4	58	109.2	110
55-64	162.1	33	80.0	46	114.3	79
Total	180.7	269	50.5	310	111.0	579
Age	Travel					
	Mean	n	Mean	n	Mean	n
15-24	33.7	73	21.8	77	27.6	150
25-34	27.8	52	16.2	59	21.6	111
35-44	18.2	59	17.8	70	18.0	129
45-54	27.8	52	21.4	58	24.4	110
55-64	20.6	33	25.4	46	23.4	79
Total	26.4	269	20.2	310	23.1	579
Age	Recreation					
	Mean	n	Mean	n	Mean	n
15-24	29.0	73	20.8	77	24.8	150
25-34	33.7	52	15.1	59	23.8	111
35-44	12.8	59	2.5	70	7.2	129
45-54	5.6	52	4.1	58	4.8	110
55-64	5.0	33	3.5	46	4.1	79
Total	19.0	269	9.9	310	14.1	579
Age	Total physical activity across all three settings					
	Mean	n	Mean	n	Mean	n
15-24	250.3	73	71.5	77	158.5	150
25-34	232.5	52	90.0	59	156.8	111
35-44	209.6	59	82.8	70	140.8	129
45-54	228.2	52	57.9	58	138.4	110
55-64	187.6	33	109.0	46	141.8	79
Total	226.0	269	80.5	310	148.1	579

Table 17 shows that 41.2% of the total population were classified as being inactive with less than 600 METminutes per week of total PA, and that this involved a higher proportion of females (55.9%) than males (24.2%). 41.8% of those surveyed were classified as being highly active with more than 1500 METminutes per week of total PA, with this primarily involving the younger age groups.

Table 17 Categories of overall physical activity by gender and age group

Age	Inactive <600 METminutes/week		Moderately active 600-1500 METminutes/week		Highly active >1500 METminutes/week	
	Males (N=269)					
	%	n	%	n	%	n
15-24	17.8	13	11.0	8	71.2	52
25-34	25.0	13	3.8	2	71.2	37
35-44	27.1	16	11.9	7	61.0	36
45-54	26.9	14	15.4	8	57.7	30
55-64	27.3	9	18.2	6	54.5	18
Total	24.2	65	11.4	31	64.4	173
Age	Females (N=310)					
	%	n	%	n	%	n
15-24	50.6	39	24.7	19	24.7	19
25-34	61.0	36	16.9	10	22.0	13
35-44	57.1	40	22.9	16	20.0	14
45-54	60.3	35	22.4	13	17.2	10
55-64	50.0	23	21.7	10	28.3	13
Total	55.9	173	21.9	68	22.2	69
Age	Total Population (N=579)					
	%	n	%	n	%	n
15-24	34.7	52	18.0	27	47.3	71
25-34	44.1	49	10.8	12	45.0	50
35-44	43.4	56	17.8	23	38.8	50
45-54	44.5	49	19.1	21	36.4	40
55-64	40.5	32	20.3	16	39.2	31
Total	41.2	238	17.0	99	41.8	242

4.6 Overweight and Obesity

Height, weight, and waist circumference were measured using standard protocols. The height and weight measurements were used to calculate body mass index (BMI) for each participant as the body weight (kilograms) divided by the square of their height (metres^2). Waist circumference measurements were used to identify related risk levels within the survey population.

Risk categories were calculated for BMI as follows:

Non-obese	BMI < 25.0
Overweight	25.0 ≤ BMI < 30.0
Obese	BMI ≥ 30.0

4.6.1 Height and Weight

The overall mean height for 15-64 year olds in Tokelau was 167.4 cm and the overall weight was 90.9 kg. Males on average were taller (173.3 cm) and heavier (94.6 kg) than were females (162.4 cm, 87.5 kg), with such a difference noted across all of the 10-year age groups. Mean weight was greatest for males in the 35-44 year group (109.5 kg) and in females in the 45-54 year group (93.4 kg). Young cohorts tended to be taller than the older cohorts, particularly in females (Table 18).

Table 18 Mean height and weight by gender and age group

Age	Height (cm)		Weight (kg)	
	Males (N=271)			
	n	Mean	n	Mean
15-24	75	174.5	75	81.3
25-34	52	174.1	52	96.5
35-44	59	174.6	59	109.5
45-54	52	172.4	52	98.3
55-64	33	167.9	33	87.6
Total	271	173.3	271	94.6
Age	Females (N=313)			
	n	Mean	n	Mean
15-24	79	164.3	74	78.0
25-34	59	162.5	52	89.5
35-44	71	162.8	66	92.8
45-54	58	161.8	58	93.4
55-64	46	159.4	46	85.1
Total	313	162.4	296	87.5

4.6.2 Body Mass Index and Weight Categories

Table 19 shows the overall mean BMI for 15-64 year olds in Tokelau was 32.4. Females had an overall higher mean BMI (33.2) than males (31.5) and this was true for all age groups except for the 35-44 year group. As with weight, mean BMI was greatest for males in the 35-44 year group (35.9) and for females in the 45-54 year group (35.8), decreasing thereafter.

Table 19 Mean body mass index (kg/m^2) by gender and age group

Age	Males (N=271)		Females (N=296)		Total Population (N=567)	
	n	Mean	n	Mean	n	Mean
15-24	75	26.7	74	28.8	149	27.7
25-34	52	31.8	52	33.8	104	32.8
35-44	59	35.9	66	34.9	125	35.4
45-54	52	33.0	58	35.8	110	34.5
55-64	33	31.0	46	33.4	79	32.4
Total	271	31.5	296	33.2	567	32.4

Table 20 Percentage of overweight and obesity by gender and age group

Age	Normal < 25.0		Overweight ≥ 25 and < 30		Obese ≥ 30		Overweight or Obese (≥ 25)	
	Males (N=271)							
	%	n	%	n	%	n	%	n
15-24	42.7	32	32.0	24	25.3	19	57.3	43
25-34	11.5	6	32.7	17	55.8	29	88.5	46
35-44	3.4	2	13.6	8	83.1	49	96.6	57
45-54	5.8	3	15.4	8	78.8	41	94.2	49
55-64	12.1	4	27.3	9	60.6	20	87.9	29
Total	17.1	47	24.3	66	58.6	158	82.9	224
Age	Females (N=296)							
	%	n	%	n	%	n	%	n
15-24	27.0	20	35.1	26	37.8	28	73.0	54
25-34	5.8	3	19.2	10	75.0	39	94.2	49
35-44	6.1	4	13.6	9	80.3	53	93.9	62
45-54	5.2	3	15.5	9	79.3	46	94.8	55
55-64	4.3	2	21.7	10	73.9	34	95.7	44
Total	10.7	32	21.5	64	67.8	200	89.3	264
Age	Total Population (N=567)							
	%	n	%	n	%	n	%	n
15-24	34.9	52	33.6	50	31.5	47	65.1	97
25-34	8.7	9	26.0	27	65.4	68	91.3	95
35-44	4.8	6	13.6	17	81.6	102	95.2	119
45-54	5.5	6	15.5	17	79.1	87	94.5	104
55-64	7.6	6	24.1	19	68.4	54	92.4	73
Total	13.8	79	22.8	130	63.4	358	86.2	488

More than half of the population were overweight or obese (22.8% and 63.4% respectively) with only 13.8% with a normal BMI. The majority of the individuals who were within the normal range of BMI were within the 15-24 age group (34.9% of this age group) with much smaller proportions with a normal BMI in the other age groups (Table 20).

The highest proportions of combined overweight and obesity (BMI ≥ 25) for males was in the 35-44 year group and for females in the 55-64 year group. Overall, combined overweight and obesity was higher among females (89.3%) than in males (82.9%).

4.6.3 Waist circumference

Waist circumference was measured in cm for all participants (except pregnant females). Cut-off values identifying a substantially increased risk of NCDs are ≥102 cm for males and ≥88 cm for females[15].

Table 21 Mean waist circumference (cm) by gender and age group

Age	Males (N=269)		Females (N=296)	
	n	Mean	n	Mean
15-24	75	83.2	74	86.5
25-34	51	96.9	52	97.7
35-44	59	107.5	66	99.0
45-54	51	104.4	58	104.6
55-64	33	100.8	46	103.1
Total	269	97.4	296	97.4

Table 21 shows that the mean waist circumference was 97.4 cm and that this was the same for both genders. Compared with the different cut-off values for males and females, only 6.6% of males had an increased risk for NCDs as noted by their waist circumference only in comparison to 70.8% of females.

As with weight and BMI, mean waist circumference was greatest for males in the 35-44 year group and for females in the 45-54 year group, decreasing thereafter. The mean values indicate that the average male is at an increased risk for NCDs in the 35-54 year group and that the average female is at an increased risk for NCDs in all but the 15-24 year age group.

4.7 Blood Pressure and Hypertension

All participants were asked questions relating to when they had last had their blood pressure measured, whether they had ever been told by a health worker that they had high blood pressure, and whether they were currently receiving any treatment for high blood pressure. All participants also had repeat blood pressure measurements.

Summary data on the prevalence of hypertension includes those with:

- a mean systolic pressure ≥ 140 mmHg, whether or not they had previously been told by a health worker that they had high blood pressure, OR
- a mean diastolic pressure ≥ 90 mmHg, whether or not they had previously been told by a health worker that they had high blood pressure, OR
- normal mean systolic and diastolic pressures (i.e. normotensive) AND who were currently receiving anti-hypertensive medication, whether or not they had previously been told by a health worker that they had high blood pressure.

Those participants who reported having been ever told by a health worker that they had high blood pressure but who were normotensive and NOT on anti-hypertensive medication were NOT included among those considered to have hypertension.

Table 22 Mean resting systolic and diastolic blood pressure (mmHg) by gender and age group

Age	Systolic		Diastolic	
	Males (N=267)			
	n	Mean	n	Mean
15-24	71	117.0	69	62.7
25-34	52	122.9	52	72.2
35-44	59	125.9	59	78.3
45-54	52	125.4	52	77.3
55-64	33	129.0	33	77.8
Total	267	123.2	265	72.8
Age	Females (N=307)			
	n	Mean	n	Mean
15-24	79	105.4	78	64.4
25-34	54	106.7	54	67.0
35-44	70	114.0	70	73.2
45-54	58	123.7	58	76.8
55-64	46	134.5	46	77.7
Total	307	115.3	306	71.2
Age	Total Population (N=574)			
	n	Mean	n	Mean
15-24	150	110.9	147	63.6
25-34	106	114.6	106	69.5
35-44	129	119.5	129	75.6
45-54	110	124.5	110	77.1
55-64	79	132.2	79	77.7
Total	574	119.0	571	72.0

Table 22 shows that mean resting systolic and diastolic blood pressure readings were higher on average in males (123.2/72.8 mmHg) than in females (115.3/71.2 mmHg). Both systolic and diastolic resting blood pressure tended to increase with increasing age in both genders with the oldest age group having both the highest systolic and diastolic pressures. Despite this increasing trend, mean resting blood pressure readings were within the WHO optimal range of blood pressure readings across all age groups.

Table 23 Percentage with hypertension (SBP≥140 and/or DBP≥90 OR currently on medication for raised blood pressure)

Age	Males (N=264)		Females (N=301)		Total Population (N=565)	
	%	n	%	n	%	n
15-24	----	0	1.3	1	0.7	1
25-34	11.5	6	1.9	1	6.6	7
35-44	18.6	11	12.9	9	15.5	20
45-54	15.4	8	22.4	13	19.1	21
55-64	30.3	10	41.3	19	36.7	29
Total	13.3	35	13.9	43	13.6	78

Table 23 indicates that the prevalence of hypertension among the 15-64 year olds in Tokelau was 13.6% with a somewhat higher prevalence among females (13.9%) as compared to males (13.3%). The prevalence of hypertension increased with increasing age and was greatest for both males and females in the 55-64 year group, 30.3% and 41.3% respectively.

Tokelauans born in Tokelau had a greater proportion of individuals who were hypertensive (23.7%) in both genders when compared to other ethnic groups.

A significant proportion of females had their blood sugar level measured within the last 12 months with most of these being within the older age groups, whereas in males a high proportion had not had their blood sugar level checked with the past five years, again indicating that females used the health service more than males.

4.8 Fasting Blood Glucose and Diabetes

As with hypertension, all participants were asked questions relating to recent blood glucose measurements and treatment for diabetes.

Summary data on the prevalence of diabetes includes those with:

- fasting blood glucose greater than or equal to 6.1 mmol/L, whether or not they had previously been told by a health worker that they had diabetes, OR
- normal fasting blood glucose (i.e. < 6.1 mmol/L) AND who were currently receiving anti-diabetes medication prescribed by a health worker.

This is generally in accordance with the WHO guidelines on the diagnosis of diabetes for whole blood specimens.

Those participants who reported having been ever told by a health worker that they had diabetes but who had normal fasting blood glucose and who were NOT on anti-diabetes medication or on a special diet prescribed by a health worker were NOT included among those considered having diabetes.

Table 24 Mean fasting blood glucose in mmol/L by gender and age group

Age	Males (N=265)		Females (N=308)		Total Population (N=573)	
	n	Mean	n	Mean	n	Mean
15-24	70	5.2	76	5.0	146	5.1
25-34	52	5.4	58	5.2	110	5.3
35-44	56	6.5	67	6.1	123	6.3
45-54	43	8.1	50	6.7	93	7.4
55-64	30	6.5	36	7.6	66	7.1
Total	251	6.2	287	5.9	538	6.1

As noted in Table 24, the overall mean fasting blood glucose overall was 6.1 mmol/L, being somewhat higher in males (6.2 mmol/L) as compared to females (5.9 mmol/L). The mean fasting blood glucose tended to increase with increasing age, with the highest mean values being in the 45-54 year group overall (7.4 mmol/L), in the 55-64 year group for females (7.6 mmol/L), and in the 45-54 year group for males (8.1 mmol/L).

Table 25 Prevalence of diabetes by gender and age group

Age	Males (N=265)		Females (N=308)		Total Population (N=573)	
	%	n	%	n	%	n
15-24	1.4	1	3.9	3	2.7	4
25-34	23.1	12	15.3	9	18.9	21
35-44	46.6	27	35.7	25	40.6	52
45-54	73.1	38	49.1	28	60.5	66
55-64	45.5	15	76.1	35	63.3	50
Total	35.2	93	32.2	100	33.6	193

Table 25 indicates that the overall prevalence of diabetes in Tokelau was 33.6% with a somewhat higher rate among males (35.2%) as compared to females (32.2%). Diabetes overall prevalence increased with increasing age. This trend was true among the females participants with a prevalence of 76.1% among the 55-64 year group, whereas in males the highest prevalence was seen in the 45-54 year group (73.1%).

Further data analysis also revealed that while a high proportion of previously diagnosed diabetics had been advised to increase their level of exercise (82.1%), had been advised to lose weight (69.2%) and been put on a prescribed diet (70.4%).

4.9 Total Cholesterol

Elevated blood cholesterol (≥5.20 mmol/L) is recognized as an important risk factor for coronary artery disease. As such, the mean cholesterol for each subject was used to categorize individuals into a high-risk group with a total cholesterol ≥ 5.2mmol/L.

As shown in Table 26, the mean cholesterol level in the overall 15-64 year old population in Tokelau was 5.0 mmol/L with very similar levels overall in females (5.0 mmol/L) and males (4.9 mmol/L) both being below the 5.2 mmol/L cut-off value for increased risk. It is also noted that there was an overall trend for increasing mean cholesterol values with increasing age.

Table 26 Mean levels of total blood cholesterol (mmol/L) by gender and age group

Age	Males (N=174)		Females (N=212)		Total Population (N=386)	
	n	Mean	n	Mean	n	Mean
15-24	20	4.4	33	4.6	53	4.5
25-34	28	4.6	32	4.9	60	4.8
35-44	50	5.0	54	4.8	104	4.9
45-54	49	5.2	55	5.3	104	5.3
55-64	27	5.1	38	5.4	65	5.3
Total	174	4.9	212	5.0	386	5.0

While the population mean cholesterol values were less than the 5.2 mmol/L cut-off, Table 27 reveals that 35.6% of the total population was classified into the high-risk category (with a cholesterol ≥5.20 mmol/L). This proportion in the high-risk category was higher in females (37.0%) than in males (33.8%). The proportions at high-risk generally increased with age with the highest proportions being in the male 45-54 year group (53.1%) and in the female 55-64 year group (55.3%).

Across all three atolls, there was a greater percentage of females in the high-risk category than for males.

Table 27 Percentage with raised blood cholesterol (≥ 5.20 mmol/L)

Age	Males (N=174)		Females (N=212)		Total Population (N=386)	
	%	n	%	n	%	n
15-24	5.0	1	21.2	7	15.1	8
25-34	14.3	4	28.1	9	21.7	13
35-44	36.0	18	24.1	13	29.8	31
45-54	53.1	26	52.7	29	52.9	55
55-64	37.0	10	55.3	21	47.7	31
Total	33.8	59	37.0	79	35.6	138

4.10 Combined Risk Factors

There are five common and critical risk factors for NCDs, including:

- current daily smokers,
- overweight or obese (BMI ≥ 25 kg/m^2),
- raised blood pressure (SBP ≥140 and/or DBP≥90 mmHg or currently on medication),
- consumed less than five combined servings of fruit and vegetables per day, and
- low level of activity (< 600 METminutes per week).

These five risk factors can be combined to indicate the overall risk for NCDs as follows:

- Low risk: 0 of 5 risk factors
- Moderate risk: 1-2 of 5 risk factors
- High risk: 3 or more of 5 risk factors

Table 28 shows that 0% of the population aged 25 to 64 years old was at low risk for NCDs (i.e. with none of the five risk factors).

66.4% of the population aged 45 to 64 years old were at a high risk for NCDs (i.e. with three or more of the five risk factors), with 54.8% of males and 76.4% of females in this older age group being at high risk.

What should be paid more attention to was that 70.2% of the younger 25-44 year group were also at high risk for NCDs (i.e. with 3 or more of the five risk factors), with 61.2% of males and 80.7% of females in this younger age group being at high risk.

Table 28 Percentage of NCD risk categories by gender and age group

Age	Low Risk (0 of 5 risk factors)		Moderate Risk (1-2 of 5 risk factors)		High Risk (≥ 3 of 5 risk factors)	
	Men (N=264)					
	%	n	%	n	%	n
25-44	----	0	38.8	38	61.2	60
45-64	----	0	45.2	28	54.8	34
25-64	----	0	41.2	66	58.8	94
Age	Women (N=301)					
	%	n	%	n	%	n
25-44	----	0	19.3	16	80.7	67
45-64	----	0	23.6	17	76.4	55
25-64	----	0	21.2	33	78.8	122
Age	Total Population (N=565)					
	%	n	%	n	%	n
25-44	----	0	29.8	54	70.2	127
45-64	----	0	33.6	45	66.4	89
25-64	----	0	31.4	99	68.6	216

5. DISCUSSION

The WHO STEPwise approach to NCD risk factor surveillance employed in this survey has been the gold standard for NCD prevalence surveys throughout the Pacific since its inception. To the best of our knowledge, the Tokelau STEPS survey was the first all-inclusive, population-based survey among 15-64 year olds conducted anywhere in the world, making the Tokelau STEPS survey unique. Given the full coverage of the survey there was no need for a sampling strategy or to define a sampling fraction.

On arrival on each of the three atolls some of the targeted individuals were found to not be on-island. The Tokelau STEPS team was, however, able to get an updated listing on each atoll though not every single eligible person was enrolled. The overall participation rate, however, was nearly 98%.

The lengthy boat ride from Apia to Tokelau and from one atoll to another was not only time consuming but also made some of the team members physically ill requiring a one-day delay after arrival at each location so that the team could recover before the actual data collection commenced. This somewhat prolonged the overall schedule for the survey.

The duration of three weeks allocated for the data cleaning, analysis and report writing in Fiji was not sufficient to complete the required tasks. It subsequently took more time to complete these tasks from a distant, especially given that key personnel needed to shift their focus to other tasks upon return to Tokelau, as was also the care for colleagues in Fiji. As such, there has been a delay in the completion of the report.

The Tokelau STEPwise survey was a population survey including all 15-64 year olds in Tokelau with a 98% response rate. All survey participants took part in all the three STEPS of the survey.

There is a continuous flow of the Tokelauan population between Tokelau, Samoa and New Zealand. Some Tokelauans living in New Zealand are returning more often to the islands and would stay for a couple of months, while some families in Tokelau move to New Zealand for a couple of months and return again to Tokelau. Students and families working or schooling in Samoa would return for the holidays and either stay on or return again to Samoa. This population flow has significant impact on

the community set-up and the Tokelauan way of life. It is felt that this constant flow of Tokelauans and the increasing multi-ethnic character of the population have contributed to changing lifestyles that impact on some of the NCD trends observed in this study as compared to TIMS.

TIMS provided historical baseline records of NCDs in Tokelau and its findings are used frequently in this discussion for comparison purposes. Many of the findings of TIMS as they related to NCDs and their risk factors among Tokelauan migrants in New Zealand are now being reflected among Tokelauans in the atolls as outlined in the results of this survey.

The increasing proportions of smokers and alcohol drinkers in both genders and among the younger age group, and especially the high prevalence of these habits among the male population in all three atolls poses a significant challenge to the Tokelau health system. While there are a number of issues that could be contributing to these findings, a few to consider are the following:

- there is no established national tobacco and alcohol legislation, and hence no limitation to the amount of tobacco imported to the atolls;
- some of the atolls have village rules on alcohol and tobacco but these are poorly enforced;
- there are more outlets that sell tobacco and alcohol in each atoll as compared to ten years ago and, as such, these goods are more readily available than in past years;
- the cost of cigarettes and alcohol are very reasonable and affordable by those in the atolls as compared to those in other PICs; and
- as indicated by some of the survey participants, there seems to be many that smoke or drink because "there is nothing to do" and/or "to relax".

Indeed, the high percentage of binge drinkers and heavy smokers in Tokelau increases significantly the health risk for cardiovascular diseases and calls for an immediate health response.

The overall findings of the study regarding these unhealthy habits are a challenge that calls for vigorous anti-smoking and anti-alcohol campaigns and related programs. These are areas that need further exploration to more clearly define the specific factors that contribute to their adoption by the local population, and to assist in the formulation of targeted health strategies to reduce their prevalence.

Most of the 15-64 year olds in Tokelau are missing the health gains provided through the increased consumption of fruit and vegetables. Despite the infertility of the soil to grow fruit and vegetables such as cabbages, mangoes and the like; there are some local fruits and greens including pandanus, lu, lau, and pele that could be grown more. Some people buy fresh vegetables and fruit from Apia, and the village store in the atolls increasingly import fresh, frozen, and canned fruit and vegetables. There seems also to be a shift of people's preferences from locally grown fruits and vegetables to the imported ones. However, these imported goods are available only in limited quantity and quality and are not always readily available. Some individuals have commented that when the family buys fruit and vegetables, that they are usually rationed among the children.

The minimal proportion of the survey population that consumed the recommended amount of fruit and vegetables provides a clear impetus for more aggressive strategies by nutritionists, health educators, and the Health Department. Again, there are several factors involved and they need be identified as important considerations for the development of related health programs.

The traditional diet of atoll dwellers was high in saturated fats but low in dietary cholesterol and sucrose. Coconut was the chief source of energy. Vascular disease was uncommon and there was no evidence of the high saturated fat intake having a harmful effect in this population[16]. However, a huge dietary shift is being observed in Tokelau with people relying more on imported frozen meat such as chicken, mutton, salted beef, turkey tails/wings, sausages; and canned and processed food including canned meat, fruits and vegetables, sweet biscuits and lollies. People now prefer imported chicken to local chicken and more frequently use deep-frying of foods including fish, chicken, and potatoes that are increasingly popular among Tokelauans. The consumption of fish and coconuts has reduced even though the older age groups still prefer traditional diet, whereas the younger population has an increasing preference for processed and imported food. This dietary shift not only contributes

to the prevalence of NCDs but also has great impact on the dental health of Tokelauans, particularly in children.

W. Burrows, a visitor to Tokelau described the physique of the islanders as follows:

> *The natives of the Tokelau groups do not present uniform physical characteristics. They are a big people, but unlike the Samoans, do not seem to 'run to fat'. It is a rare thing to see either an old man or an old woman who has become ungainly, and the females especially keep their figures to an advanced age.... They appear to be a healthy race... One factor in the lives of the people that tends to keep them fit is the fact that they are compelled to put out in their canoes almost daily to obtain fish.*[10]

The result of this Tokelau STEPS survey showed that 86.2% of the total Tokelau population was either overweight or obese, with higher rates among females (89.3%) than in males (82.9%). This gender difference was seen on all three atolls.

41.8% of the survey population was classified as being highly active. But for most, vigorous activity was usually for insufficient duration to have much beneficial impact on overall physical activity measures. Higher proportions of those being highly active were among males, and most were within the younger age groups.

The survey revealed that the village employed 58.7% of respondents and that more than 90% of the males within each atoll are within the village workforce. The work done by many of these males involved vigorous activities such as collecting sand and stones from the islands for construction; construction of houses which involve digging, and mixing concrete; and unloading and loading of passengers and cargoes on boat days; with most of these tasks being done by manpower. This was reflected in the higher mean METminutes engaged by males in the work domain.

In contrast, a majority of the females are unemployed, with tasks being limited to house-keeping. A small fraction of females work in the offices, hospitals and schools and these individuals are within the younger age groups as reflected in the survey results. Office work involves mostly sitting compared to house-keeping tasks which may contribute to the higher involvement (as measured by METminutes) of the older female population in the work domain as compared to the younger female population.

The survey revealed that the prevalence of hypertension among the 15-64 year olds in Tokelau was 13.6% with a somewhat higher prevalence among females (13.9%) as compared to males (13.3%). The prevalence of hypertension increased with increasing age and was greatest for both males and females in the 55-64 year group, 30.3% and 41.3% respectively. This similar trend was also observed in all three atolls and was also indicated in the Fiji STEPS report, only that the overall prevalence of hypertension among the genders in Fiji (19.8% and 18.3% in males and females respectively) was higher than the prevalence indicated in this study for the Tokelau population.

Tokelauans born in Tokelau had a greater proportion of individuals who were hypertensive (23.7%) in both genders when compared to other ethnic groups. The prevalence of hypertension was highest among Nukunonu population, followed closely by Fakaofo, and least prevalent in Atafu.

The overall prevalence of diabetes in Tokelau was 33.6% with a somewhat higher rate among males (35.2%) as compared to females (32.2%). Diabetes overall prevalence increased with increasing age. This trend was true among the females participants with a prevalence of 76.1% among the 55-64 year group, whereas in males the highest prevalence seen in the 45-54 year group (73.1%).

The trends of the prevalence of diabetes and hypertension reported in the Tokelau study are similar to trends reported in the Fiji report. While the relatively lower overall prevalence of hypertension in Tokelau (13.7%) compared to Fiji (19.1%±1.9) could be an indication of the faster rate of lifestyle changes and modernization in Fiji, the higher prevalence of diabetes in Tokelau (33.6%) compared to Fiji (16.0%±3.1) is certainly of concern. It seems as though Tokelau is going through a similar transformation as in Fiji but perhaps at a slower rate.

6. CONCLUSIONS

The Tokelau NCD STEPS survey provided nearly full population coverage of all 15-64 year olds on the three atolls of Tokelau. The survey revealed that the prevalence of NCDs in Tokelau, mainly diabetes and obesity, are relatively high and that there has been an increase since the last TIMS in the 1980s. Risk factors including smoking, alcohol consumption, physical inactivity, obesity and minimal fruit and vegetable intake were also on the rise among the local population.

TOBACCO USE

Imported manufactured cigarettes were the only form of tobacco smoked in Tokelau. The survey indicated that 73.3% of the 15-64 year olds in Tokelau smoked. The highest of the current smokers were in 15-24 year age group for males (73.2%), and in 35-44 year age group for females (90.2%).

The survey also revealed a similar proportion of both genders that smoked daily (55.4% of males and 63.3% of females). However, for daily smokers in the 15-24 year age group, there was a considerably higher proportion among males (57.7%) as compared to females (45.9%). However, it is important to note that female daily smokers were more prevalent than males in the other 10-year age groups, except for among the oldest group. Also, there was a higher proportion of current female smokers overall (81.0%) as compared to males (65.7%).

The high proportion of smoking within the younger age groups suggests that more youths are taking up smoking in Tokelau as compared to older cohorts. The overall percentage of smokers decreased with increasing age and both males and females reported starting smoking earlier in life in the younger age groups.

ALCOHOL CONSUMPTION

The survey reports 97.1% and 90.4% of males and females respectively that had been drinking alcohol within the last 12 months (current drinkers). There were more male drinkers than females among the overall population and within each age group.

High proportions of male drinkers in all age groups consumed alcohol whereas the highest proportion of female drinkers was within the 35-44 year age group. The mean number of standard drinks for an individual in Tokelau per drinking day was 5.5 drinks, with a high proportion of current drinkers reporting that they binge drink on drinking days. Overall, 37.5% of males reported binge drinking as did 20.0% of females.

FRUIT AND VEGETABLE INTAKE

Consumption of fruit and vegetables was very limited in Tokelau, although females reported more fruit and vegetable consumption than males. Overall, fruit was consumed on an average of only 1.9 days each week, and vegetables were consumed on average only 2.1 days each week. On average survey participants only consumed 1.9 combined servings of fruit and vegetables on an average day of the week.

It is important to note that overall, 92.3% of the population consumed less than five combined servings of fruit and vegetables on average per any given day of the week.

PHYSICAL ACTIVITY

Overall, 41.2% of the population was classified as being physically "inactive" with less than 600 METminutes of PA per week. A higher proportion of males were involved in at least some vigorous physical activity as compared to females in all three atolls.

Total PA per day across all settings averaged 148.1 METminutes per day overall, and this was almost three times higher for males (226.0 METminutes/day) than for females (80.5 METminutes/day). Overall, 74.6% of total PA was done in the work setting (110.6/148.2), and only 10.1% of total PA was done in the leisure setting (14.9/148.2), suggesting that not much PA is done during leisure time for either sports or health gain.

Overweight and Obesity

The mean height and weight of the population were 167.4 cm and 90.9 kg respectively with a mean BMI of 32.4 for the overall population. Males were taller and heavier than females, and had a mean BMI of 31.5 as compared to females who had a higher mean BMI of 33.2. Females had a higher mean BMI than males in all age groups.

The study indicates a significant proportion of the overall population that were obese (63.4%) and overweight (22.8%) with only 13.8% having a normal BMI. In all age groups, there were much higher proportions of overweight and obesity than those with a normal BMI. There were more females than males who were obese, and more males than females who were overweight. However, overall females had a greater proportion of the population who were within the high risk categories for BMI. The majority of those who were within the normal category for BMI were within the 15-24 age group, and the prevalence of the high risk categories for BMI were higher among the older population.

Waist Circumference

Only 6.6% of males had an increased risk for NCDs as noted by their waist circumference only in comparison to 70.8% of females. The mean waist circumference was 97.4 cm for both genders. As with weight and BMI, mean waist circumference was greatest for males in the 35-44 year group and for females in the 45-54 year group, decreasing thereafter. The mean values indicate that the average male is at an increased risk for NCDs in the 35-54 year group and that the average female is at an increased risk for NCDs in all but the 15-24 year age group. Nukunonu recorded a higher mean waist circumference and Atafu recorded the smallest mean waist circumference.

Blood Pressure and Hypertension

The survey indicates a higher percentage of females who had their blood pressure checked within the last 12 months and this indicated that females used the health services more than males. The mean resting blood pressure reading was higher in males 123.2 / 72.8 mmHg as compared to females 115.3 / 71.2 mmHg. Blood pressure readings increased with increasing age with the older population having the highest resting blood pressure.

The survey showed that the prevalence of hypertension among the 15-64 year olds in Tokelau was 13.6% with a somewhat higher prevalence among females (13.9%) as compared to males (13.3%). The prevalence of hypertension increased with increasing age and was greatest for both males and females in the 55-64 year group, 30.3% and 41.3% respectively.

Tokelauans born in Tokelau had a greater proportion of individuals who were hypertensive (23.7%) in both genders when compared to other ethnic groups. The prevalence of hypertension was highest among the Nukunonu population, followed closely by Fakaofo, with the lowest prevalent in Atafu.

Among those with a previous diagnosis of hypertension, only 47.0% were taking anti-hypertensive medication. Even smaller proportions were receiving other treatments for hypertension (e.g. special diet, advice to lose weight or stop smoking, herbal or traditional remedies).

Fasting Blood Sugar and Diabetes

A significant proportion of females had their blood sugar level measured within the last 12 months with most of these being within the older age groups, whereas in males a high proportion had not had their blood sugar level checked with the past five years, again indicating that females used the health

service more than males.

The survey indicates that the prevalence of diabetes in the 15-64 year olds in Tokelau was 33.6% with a somewhat higher rate among males (35.2%) as compared to females (32.2%). The prevalence increased with increasing age. This trend was true among the females participants with a prevalence of 76.1% among the 55-64 year group, whereas in males the highest prevalence seen in the 45-54 year group (73.1%).

TOTAL CHOLESTEROL

The mean total fasting cholesterol level was 5.0 mmol/L in the overall population, 4.9 mmol/L for males and 5.0 mmol/L for females. Even though the overall mean cholesterol level was below the cut-off point for being at high-risk for coronary heart disease (CHD), further analysis of the cholesterol data indicated that 35.6% of the population were at high risk for CHD, 33.8% of males and 37.0% of females. For this high-risk category, the highest proportion was within the 45-54 age group in the overall population and in all three atolls. There were a higher proportion of females within this high-risk category in all three atolls.

COMBINED RISK FACTORS

Risk factors for NCDs are highly prevalent in all three local communities and in both genders. Five common and critical risk factors for NCDs were selected, including:

- current daily smokers,
- overweight or obese (BMI ≥ 25 kg/m^2),
- raised blood pressure (SBP ≥140 and/or DBP≥90 mmHg or currently on medication),
- less than five combined servings of fruit and vegetables per day, and
- low level of activity (< 600 METminutes per week).

The results show that 0% of the population aged 25 to 64 years old was at low risk for NCDs (i.e. with none of the five risk factors).

66.4% of the population aged 45 to 64 years old were at a high risk for NCDs (i.e. with three or more of the five risk factors), with 54.8% of males and 76.4% of females in this older age group being at high risk.

What should be paid more attention to was that 70.2% of the younger 25-44 year group were also at high risk for NCDs (i.e. with 3 or more of the five risk factors), with 61.2% of males and 80.7% of females in this younger age group being at high risk.

Given that people with these risk factors are at a significantly increased risk of developing NCDs (e.g. diabetes, heart disease, stroke, cancer) in the future, it is essential that the Department of Health, the government of Tokelau, and the local communities work together aggressively to lower the proportion of these NCD risk factors in Tokelau.

Many of these key NCD risk factors are linked and, as such, many individuals in Tokelau are exposed to multiple NCD risk factors. Subsequently, there is a great need to develop and implement integrated and comprehensive national strategies with a multi-sectoral approach to combat these serious risk factors.

7. RECOMMENDATIONS

- Take more aggressive measures in decreasing tobacco use, particularly targeting the younger age groups in both genders and in all three communities.
- Implement the WHO Framework Convention on Tobacco Control.
- Take more aggressive measures in reducing alcohol consumption, broadly targeting all age groups, both genders, and all three atolls.
- Greatly increase health promotion efforts to highlight the benefits of fruit and vegetable consumption across the entire Tokelau population.
- Increase both the importation and production of fruit and vegetables.
- Increase awareness regarding the adverse effects of excessive consumption of high-fat, high-salt, and high-sugar foods.
- Develop policies both at the village and national levels on importation of goods, with an emphasis on encouraging the availability of healthier food in Tokelau.
- Develop specific programs and improved environments to encourage increased physical activity in everyone, especially targeting females and adolescents.
- Increase the capacity of the healthcare system to identify, monitor, and treat individuals with hypertension in all three atolls.
- Increase the capacity of the healthcare system to identify, monitor, and treat individuals with diabetes in all three atolls.
- Put diabetes prevention and control as an entry point of NCD prevention and control. Control risk factors (like smoking, unhealthy diet, low physical activity, excessive alcohol consumption) of diabetes can contribute a lot to control other NCDs since the above risk factors are common ones of different kinds of NCDs.
- In NCD control, lifestyle interventions (primary prevention) and clinical interventions (secondary prevention) are equally important.
- Maintain ongoing NCD risk factor surveillance to monitor and assess the effectiveness of health promotion and disease prevention strategies targeting NCDs and their risk factors.
- Emphasize prevention and decreasing the prevalence of the five common and critical risk factors for NCDs, including current daily smoking, being overweight or obese, having raised blood pressure, eating less than five combined servings of fruit and vegetables per day, and having a low level of physical activity.
- Endeavor to decrease the proportion of those aged 45 to 64 years old who have three or more of the key risk factors (66.4% in this survey), and hence who are at a high risk for developing NCDs, especially among females (76.4% in this survey).
- Pay particular attention decreasing the proportion of those aged 25 to 44 years old who are at a high risk for developing NCDs (70.2% in this survey), especially in females (80.7% in this survey).

APPENDICES

Respondent Identification Number ☐ ☐☐☐

Appendix 1: Tokelau NCD STEPS Questionnaire

Government of Tokelau
Department of Health & World Health Organisation

The WHO STEPwise approach to Surveillance of noncommunicable diseases (STEPS)

Check if the following are completed **(to be checked by:)**		Yes	No
Fasting status	(Registration Station)	☐	☐
Checkout	(Check-out Station)	☐	☐
EpiData data entry	(Data entry personnel)	☐	☐
EpiInfo data entry	(Data entry personnel)	☐	☐
Data entry irregularities	(Data entry personnel)	☐	☐

Identification Information:

I 1	Island code	Fakaofo Atafu Nukunonu	1 2 3	☐
I 2	Island name			☐☐☐☐☐☐☐☐☐☐
I 3	Interviewer code			☐☐
I 4	Date of completion of the questionnaire			☐☐/☐☐/2005 Day Month Year

Respondent Id Number ☐☐☐☐

	Consent			
I 5	Consent has been read out to respondent	Yes No	1 2	☐ **If NO, read consent**
I 6	Consent has been obtained (verbal or written)	Yes No	1 2	☐ **If NO, END**
I 7	Interview Language [*Insert Language*]	English Tokelauan	1 2	☐
I 8	Time of interview (24 hour clock)			☐☐:☐☐
I 9	Family Name			☐☐☐☐☐☐☐☐☐☐
I 10	First Name			☐☐☐☐☐☐☐☐☐☐

Note: *Identification information I6 should be stored separately from the questionnaire because it contains confidential information. Please note Village Code is required as part of main instrument for data analyses. Date of interview is required to calculate age*

Respondent Identification Number ☐ ☐☐☐

Step 1 Demographic Information

			Coding Column
C1	Sex (*Record Male / Female as observed*)	Male 1 Female 2	☐
C2	What is your date of birth? *If Don't Know, See Note* below and Go to C3*	Day ☐☐ Month ☐☐ Year ☐☐☐☐	
C3	How old are you?	Years	☐☐
C4	In total, how many years have you spent at school or in full-time study (excluding pre-school)?	Years	☐☐
C5	What is the highest level of education you have **completed**?	No formal schooling 1 Less than tertiary 2 Tertiary 3 Post graduate degree 4	☐
C6	How long have you been residing in Tokelau? (select ONE only)	Less than 3 months 1 3 months to 12 months 2 1 year to 3 years 3 More than 3 years 4	☐
C7	What is your *cultural subgroup*?	Tokelauan born in Tokelau 1 Tokelauan born overseas 2 Samoan 3 Others 4	☐
C8	Which of the following best describes your main work status over the last 12 months?	National employee 1 Village employee 2 Privately employed 3 Student 4 Homemaker 5 Retired 6 Unemployed (able to work) 7 Unemployed (unable to work) 8	☐
C9	How many people, including yourself, live in your household?	Number of people	☐☐

Note: 1) Missing values are not permissible for Island code, Date of Interview and Sex.*
*2) The **Date of Birth** (C2) or the **age** (C3) or **both** (C2 and C3) have to be filled. CODE "DK" FOR DON'T KNOW or DON'T REMEMBER.*

Step 1 Behavioural Measures

Tobacco Use (Section S)				
Now I am going to ask you some questions about various health behaviours. This includes things like smoking, drinking alcohol, eating fruits and vegetables and physical activity. Let's start with smoking.				
		Response	**Coding Column**	
S 1a	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes?	Yes 1 No 2	☐	*If No, go to Next Section*
S 1b	**If Yes,** Do you currently smoke tobacco products **daily**?	Yes 1 No 2	☐	*If No, go to Next Section*
S 2a	How old were you when you **first started** smoking daily?	Age (years)	☐☐	*If Known, go to S 3*
S 2b	Do you remember how long ago it was?	In Years	Years ☐☐	
		OR in Months	Months ☐☐	
		OR in Weeks	Weeks ☐☐	

S 3	On average, **how many** of the following do you smoke each day?	a) Manufactured cigarettes	☐☐	
		b) Other (please specify):	☐☐	

Alcohol Consumption (Section A)

The next questions ask about the consumption of alcohol.

		Response		Coding Column	
A 1a	Have you **ever consumed** a drink that contains alcohol such as beer, wine, spirit or Kaleve (fermented coconut)? *USE SHOWCARD or SHOW EXAMPLES*	Yes No	1 2	☐	*If No, Go to Next Section*
A 1b	Have you consumed alcohol within the **past 12 months**?	Yes No	1 2	☐	*If No, Go to Next Section*
A 2	In the past 12 months, **how frequently** have you had at least one drink? *(READ RESPONSES)* *USE SHOWCARD*	5 or more days a week 1-4 days per week 1-3 days a month Less than once a month	1 2 3 4	☐	
A 3	When you drink alcohol, **on average**, how many drinks do you have during one day?	Number Don't know	 77	☐☐	
A 4	During each of the **past 7 days**, how many standard drinks of any alcoholic drink did you have each day? *(RECORD FOR EACH DAY* *USE SHOWCARD)*	Monday Tuesday Wednesday Thursday Friday Saturday Sunday		☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐	
A 5	In the past 12 months, what was the **largest number** of drinks you had on a single occasion, counting all types of standard drinks together?	Largest number		☐☐	
A 6a	**For men only:** In the past 12 months, on how many days did you have **five or more** standard drinks in a single day?	Number of days		☐☐☐	
A 6b	**For women only**: In the past 12 months, on how many days did you have **four or more** standard drinks in a single day?	Number of days		☐☐☐	

Note: Code ***DK*** for "Don't know" or "Don't remember".

Diet (Section D)

The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that describes for you examples of local fruits and vegetables, what I consider to be a fruit or vegetable, and what I consider to NOT be a fruit or vegetable. As you answer these questions please think of a typical week in the last year.

D 1a	In a typical week, on how many days do you **eat fruit**? *USE SHOWCARD*	Number of days	☐	*If Zero days, go to D 2a*
D 1b	How many **servings** of fruit do you eat on **one** of those days? *USE SHOWCARD*	Number of servings	☐☐	

Respondent Identification Number ☐ ☐☐☐

D 2a	In a typical week, on how many days do you **eat vegetables**? *USE SHOWCARD*	Number of days	☐	If Zero days, go to Section P
D 2b	How many **servings** of vegetables do you **eat on one** of those days? *USE SHOWCARD*	Number of servings	☐☐	

Physical Activity (Section P)

Next I am going to ask you about the time you spend doing different types of physical activity. Please answer these questions even if you do not consider yourself to be an active person.
Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, household chores, harvesting food, fishing or hunting for food, seeking employment.

P 1	Does your work involve mostly sitting or standing, with walking for no more than 10 minutes at a time?	Yes 1 No 2	☐	*If Yes, go to P6*
P 2	Does your work involve vigorous activity, like [*heavy lifting, digging or construction work*] for at least 10 minutes at a time? *INSERT EXAMPLES & USE SHOWCARD*	Yes 1 No 2	☐	*If No, go to P4*
P 3a	In a typical week, on how many days do you do vigorous activities as part of your work?	Days a week	☐	
P 3b	On a typical day on which you do vigorous activity, how much time do you spend doing such work?	In hours and minutes hrs ☐☐ : mins ☐☐ OR in Minutes only or minutes ☐☐☐		
P 4	Does your work involve moderate-intensity activity, like brisk walking *[or carrying light loads]* for at least 10 minutes at a time? *INSERT EXAMPLES & USE SHOWCARD*	Yes 1 No 2	☐	*If No, go to P6*
P 5a	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Days a week	☐	
P 5b	On a typical day on which you did moderate-intensity activities, how much time do you spend doing such work?	In hours and minutes hrs ☐☐ : mins ☐☐ OR in Minutes only or minutes ☐☐☐		
P 6	How long is your typical work day?	Number of hours	hrs ☐☐	
Other than activities that you've already mentioned, I would like to ask you about the way you travel to and from places. For example to work, for shopping, to market, to church. [*insert other examples if needed*]				
P 7	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2	☐	*If No, go to P9*
P 8a	In a typical week, on how many days do you walk or bicycle for at least 10 minutes to get to and from places?	Days a week	☐	
P 8b	How much time would you spend walking or bicycling for travel on a typical day?	In hours and minutes hrs ☐☐ : mins ☐☐ OR in Minutes only or minutes ☐☐☐		
The next questions ask about activities you do other than work or travel. You might consider this as leisure or recreation time. Think about activities you outside of work or travel including recreation, fitness or sports activities *[insert relevant terms]*. Remember to not include the physical activities you do at work or for travel mentioned already.				
P 9	Does your [*recreation, sport or leisure time*] involve mostly sitting, reclining, or standing, with no physical activity lasting more than 10 minutes at a time?	Yes 1 No 2	☐	*If Yes, go to P 14*
P 10	In your [*leisure time*], do you do any vigorous activities like [*running or strenuous sports, weight lifting*] for at least 10 minutes at a time? *INSERT EXAMPLES & USE SHOWCARD*	Yes 1 No 2	☐	*If No, go to P 12*
P 11a	If Yes, In a typical week, on how many days do you do vigorous activities as part of your [*leisure time*]?	Days a week	☐	

Respondent Identification Number ☐ ☐☐☐

P 11b	How much time do you spend doing this on a typical day?	In hours and minutes OR in Minutes only	hrs☐☐ : mins☐☐ or minutes ☐☐☐	
P 12	In your [*leisure time*], do you do any moderate-intensity activities like brisk walking,[*cycling or swimming*] for at least 10 minutes at a time? *INSERT EXAMPLES & USE SHOWCARD*	Yes 1 No 2	☐	*If No, go to P 14*
P 13a	If Yes In a typical week, on how many days do you do moderate-intensity activities as part of [*leisure time*]?	Days a week	☐	
P 13b	How much time do you spend doing this on a typical day?	In hours and minutes OR in Minutes only	hrs☐☐ : mins☐☐ or minutes ☐☐☐	
The following question is about sitting or reclining. Think back over the past 7 days, to time spent at work, at home, in *[leisure]*, including time spent sitting at a desk, visiting friends, reading, or watching television, but do not include time spent sleeping.				
P 14	Over the past 7 days, how much time did you spend sitting or reclining on a typical day?	In hours and minutes OR in Minutes only	hrs☐☐ : mins☐☐ or minutes ☐☐☐	

Note: Code ***DK*** for "Don't know" or "Don't remember".

History of High Blood Pressure				
H 1	When was your blood pressure last measured by a health professional?	Within past 12 months 1 1-5 years ago 2 Not within past 5 yrs 3	☐	
H 2	Have you ever been told by a doctor or other health worker that you have elevated blood pressure or hypertension? *(Note: Do not include Pregnancy Induced Hypertension)*	Yes 1 No 2	☐	*If No, skip to Next Section*
H 3	Are you currently receiving any of the following treatments for high blood pressure prescribed by a doctor or other health worker?			
H 3a	Drugs (medication) that you have taken in the last 2 weeks	Yes 1 No 2	☐	
H 3b	Special prescribed diet	Yes 1 No 2	☐	
H 3c	Advice or treatment to lose weight	Yes 1 No 2	☐	
H 3d	Advice or treatment to stop smoking	Yes 1 No 2	☐	
H 3e	Advice to start or do more exercise	Yes 1 No 2	☐	
H 4	During the past 12 months have you seen a traditional healer for elevated blood pressure or hypertension	Yes 1 No 2	☐	
H 5	Are you currently taking any herbal or traditional remedy for your high blood pressure?	Yes 1 No 2	☐	

Respondent Identification Number ☐ ☐☐☐

History of Diabetes				
H 6	When was your blood sugar last measured by a health professional *(Note: Do not include self measurements)*	Within past 12 months 1 1-5 years ago 2 Not within past 5 yrs 3	☐	
H 7	Have you ever been told by a doctor or other health worker that you have diabetes? *(Note: Do not include Gestational Diabetes)*	Yes 1 No 2	☐	*If No, skip to Next Section*
H 8	Are you currently receiving any of the following treatments for diabetes prescribed by a doctor or other health worker?			
H 8a	Insulin	Yes 1 No 2	☐	
H 8b	Oral drug (medication that you have taken in the last 2 weeks	Yes 1 No 2	☐	
H 8c	Special prescribed diet	Yes 1 No 2	☐	
H 8d	Advice or treatment to lose weight	Yes 1 No 2	☐	
H 8e	Advice or treatment to stop smoking	Yes 1 No 2	☐	
H 8f	Advice to start or do more exercise	Yes 1 No 2	☐	
H 9	During the past 12 months have you seen a traditional healer for diabetes?	Yes 1 No 2	☐	
H 10	Are you currently taking any herbal or traditional remedy for your diabetes?	Yes 1 No 2	☐	
Comments: Step 1		**(to be answered by the interviewer)**		
V 3	Are there any irregularities or problems with the interview?	Yes 1 No 2	☐	

If yes, please describe. _____

_____

Respondent Identification Number ☐ ☐☐☐

Step 2 Physical Measurements

Height and weight			Coding Column	
M 1	Technician ID Code		☐☐	
M 2a & 2b	Device IDs for height and weight	(2a) height ☐☐	(2b) weight ☐☐	
M 3	Height	(in Centimetres)	☐☐☐.☐	
M 4	Weight *If too large for scale, use two scales*	(in Kilograms)	☐☐☐.☐	
M 5	***(For women)*** Are you pregnant?	Yes 1 No 2	☐	*If Yes, Skip Waist*
Waist				
M 6	Technician ID		☐☐☐	
M 7	Device ID for waist		☐☐	
M 8	Waist circumference	(in Centimetres)	☐☐☐.☐	

Blood pressure				Coding Column	
M 9	Technician ID			☐☐	
M 10	Device ID for blood pressure			☐☐	
M 11	Cuff size used		Standard 1 Extra Large 2	☐	
M 12a	Reading 1	**Systolic BP**	Systolic mmHg	☐☐☐	
M 12b		**Diastolic BP**	Diastolic mmHg	☐☐☐	
M 13a	Reading 2	**Systolic BP**	Systolic mmHg	☐☐☐	
M 13b		**Diastolic BP**	Diastolic mmHg	☐☐☐	
M 14a	Reading 3	**Systolic BP**	Systolic mmHg	☐☐☐	
M 14b		**Diastolic BP**	Diastolic mmHg	☐☐☐	

Respondent Identification Number ☐ ☐☐☐

Step 3 Biochemical Measurements

Blood glucose			Coding Column	
B 1	Since 10pm last night, have you had anything to eat or drink, other than water?	Yes 1 No 2	☐	
B 2	Technician ID Code		☐☐	
B 3	Device ID code		☐☐	
B 4	Time of day blood specimen taken (24 hour clock)		hrs ☐☐ : mins ☐☐	
B 5	Blood glucose		mmol/l ☐☐.☐	
		Low 1 High 2 Unable to assess 3	☐	
Blood Lipids				
B 6	Technician ID Code		☐☐	
B 7	Device ID code		☐☐	
B 8	Total cholesterol		mmol/l ☐☐.☐☐	
		Low 1 High 2 Unable to assess 3	☐	
Comments: Step 2 and 3		**(to be answered by any Step 2 or 3 technician)**		
V 4	Are there any irregularities or problems with the measurements?	Yes 1 No 2	☐	

If yes, please describe. _____

_____

_____

_____

Appendix 2. List of STEPS Field Staff from Tokelau

Core Survey Team:
Dr. Tekie Iosefa, former Director of Health, Tokelau 2002-2005
Dr. Silivia Tavite, Tokelau NCD STEPS Survey Coordinator
Mr. Alapati Tavite, Public Health Officer/Policy Advisor, Tokelau Health Department
Ms. Fenuafala Faafoi, National Health Officer, Tokelau Health Department
Ms. Malae Fepuleai Etuale, Registered Nurse, St. Joseph's Hospital
Ms. Faimanifo Peseta, Registered Nurse, Fanuafala Hospital
Ms. Makerita Reuelu Sili, Registered Nurse, Lomaloma Hospital
Ms. Tekave Reuelu Olive, Health Education and Promotion Officer, Tokelau Health Department

Council of the On-Going Government of Tokelau:
Faipule Kolouei O'Brien
Faipule Kuresa Nasau
Pulenuku Sakalia Vaha Tavite
Acting Pulenuku Tinielu Tuumuli
Pulenuku Iosua Aleni

Stakeholders from other Government Agencies:
Mr. Zak Patelesio, Director, Tokelau Transport and Support Services
Mr. Kele Kelekolio, Tokelau Department of Statistics

Stakeholders from Community Level:
Mr. Casimilo Perez, General Manager, Office of the Taupulega Nukunonu
Ms. Luisa Naseri Sale, Director, Office of the Taupulega Atafu
Mr. Simona Sale, Coordinator, Office of the Taupulega Fakaofo
Mr. Tamiano Perez, Acting Faipule, Nukunonu
Mr. Iaseto Lui, Acting Pulenuku, Nukunonu
Mr. Mika Perez, Acting General Manager, Nukunonu
Ms. Ianeta Tuumuli, Fanuafala Hospital
Dr. Lameka Sale, Lomaloma Hospital
Ms. Apolonia Sakaria, St. Joseph Hospital

Village Survey Assistants:
Ms. Tekie Katieli, Fakaofo
Hela Gaualofa, Fakaofo
Noela Iona, Fakaofo
Peteli Mei, Fakaofo
Talisala Heleme, Fakaofo
Rosa Iupati, Atafu
Matagofie Toloa, Atafu
Luisa Kuresa, Atafu
Reneigh Sirila, Atafu
Epe Reuelu, Atafu
Ake Pasilio, Nukunonu
Pele Aselemo, Nukunonu
Malia Felise, Nukunonu
Telesia Pio, Nukunonu
Hili Aleki, Nukunonu

Appendix 3. References

1. Wessen AF, Hooper A, Huntsmman J, et al. Migration and health in a small society: the case of Tokelau. Oxford University Press, New York; 1992.

2. Jardin C. Food and dietary habits in the Cook Islands, Niue and Tokelau. SPC, Noumea, New Caledonia. n.d. unpub. original French.

3. Davidson F. The Tokelau island migrant study: Atoll diet. In Stanhope J, ed. Migration and health in New Zealand and the Pacific: Proceedings of a seminar 1975, Epidemiology Unit, Wellington Hospital, Wellington; 1977:109-12.

4. Harding W. The diet of Tokelau island migrants in New Zealand. In: Stanhope JM, ed. Migration and health in New Zealand and the Pacific: Proceedings of a seminar 1975, Wellington. Epidemiology Unit, Wellington Hospital; 1977:113-6.

5. Mckenzie JM, Guthrie BE. Zinc in Tokelau Islands diet. NZ Med J 1979; 118-9. letter.

6. Naylor R. A review of health services of Tokelau. SPC, Noumea, New Caledonia; 1990.

7. Beaglehole R, Eyles EF, Prior IA. Blood pressure and migration in children. Int J Epidemiol 1979;8(1):5-10.

8. Jackson, R.T. The Auckland Risk Factor Study. M Med Sci Thesis. University of Auckland, New Zealand; 1984.

9. Ostbye T, Welby TJ, Prior IAM, Salmond C, Stokes YM. Type 2 (non-insulin-dependent) diabetes mellitus, migration and westernization: the Tokelau Island migrant study. Diabetologia 1989;32:585-90.

10. Burrows W. Some notes and legends of a South Sea island. J Poly Soc 1923;32:142-52.

11. Ramirez ME. Biological variability in a migrating isolate: Tokelau effects of migration of fat patterning in adults. Hum Biol 1987;59(6):901-9.

12. Ramirez ME, Mueller WH. The development of obesity and fat patterning in Tokelau children. Hum Biol 1980;52(4):675-87.

13. Prior IA, Stanhope JM, Evens JG, Salmond CE. The Tokelau Islands migrant study. Int J Epidemiol 1974;3(3):225-32.

14. Taylor et al. Review of cancer in Pacific Island Countries and Territories. 1985

15. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults (http://www.nhlbi.nih.gov/guidelines/obesity/ob_home.htm). National Heart, Lung, and Blood Institute (NHLBI), in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

16. Ian A Prior, and colleagues (Cholesterol,coconuts and diet on polynesian atolls: a natural experiment : The pukapuka and Tokelau Islands studies.) (Am.J Clin.Nutr 34:1552-1561,1981)

KEY CONTACTS

Tokelau Department of Health Contact:

Dr Tekaai Nelesone
Director of Health
Health Department
Tokelau
Tel: (685) 20822
Fax: (685) 21761
E-mail: ttafune@yahoo.com.au;
tnelesone@hotmail.com

WHO Contact:

Dr Li Dan
Medical Officer
Noncommunicable Diseases
WHO Office for the South Pacific
P. O. Box 113
Suva, Fiji
Tel: (679) 3234103
Fax: (679) 3234166
Email: LiD@wpro.who.int
lidanzjh@hotmail.com

Fiji School of Medicine Contact:

Dr Jan Pryor
Director - Research
Fiji School of Medicine
Private Mail Bag
Suva, Fiji
Tel: (679) 3233401
Fax: (679) 3311940
E-mail: j.pryor@fsm.ac.fj
pryor.jan@gmail.com