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A PROBABILITY MODELING, PSYCHOLOGICAL WELL-BEING AND ECONOMIC ANALYSIS OF STROKE IN FIJI

by

Jagdish Chand Maharaj

A thesis submitted in fulfilment of the
requirements for the degree of
Doctor of Philosophy

School of Social Sciences
Faculty of Arts and Law
The University of the South Pacific

September, 2011

DECLARATION

Statement by Author

I, Jagdish Chand Maharaj, declare that this thesis is my own original work and that, to the best of my knowledge, it contains no material previously published, or substantially overlapping with material submitted for the award of any other degree at any institution, except where due acknowledgment is made in the text.

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Statement by Supervisor

The research in this thesis was performed under my supervision and to my knowledge is the sole work of Dr Jagdish Chand Maharaj.

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DEDICATION

To my parents

&

family

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I initially commenced my research thesis while working at the Tamavua Hospital, Fiji but I had to re-locate to my new job with the Catholic Healthcare and New South Wales Health, and the University of Sydney, Australia. I wish to thank these institutions for their support towards my study.

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ABSTRACT

Aim: This population-based study of a random selection of stroke survivors living in the community for six or more months and their matched controls in Fiji aimed to quantify the relationship between the socio-economic factors and the likelihood of having a stroke event, to assess psychological well-being of stroke survivors, to analyse the relationship between the matched controls and the stroke survivors, and to perform an economic analysis of stroke, computing the annual human capital loss from pre-mature stroke mortality.

Methodology: All stroke survivors and their matched controls were interviewed concurrently over a 12-month period from April 2003 to March 2004. Utilising Probit Modeling and imputing the pre-stroke risk factors gathered during the population-based study, the likelihood of having a stroke event amongst the stroke cases was mapped. Quantitative relationship modeling allowed us to rigorously test and determine the significance of various socio-economic factors. Six core theoretical dimensions of psychological well-being was assessed using the Ryff Measure of Psychological Well-being. A new Psychological Well-being Index was developed and its relationship amongst stroke survivors analysed. An economic analysis of stroke, taking into account the national stroke mortality and per capita National Income, calculated the annual national human capital resource loss for Fiji for the year 2001.

Results: A comparative analysis of 102 stroke survivors and matched controls is provided. Stroke survivors, majority of whom were admitted to acute hospital following stroke, had lower cognitive ability on mental test score ($p < 0.001$), had multiple medical risk factors with 50% of them having at least one of them diagnosed following stroke: high blood pressure ($p < 0.001$), diabetes mellitus ($p = 0.01$), heart disease ($p = 0.01$), report being overweight ($p = 0.02$), took alcohol ($p = 0.01$), consumed Kava ($p = 0.01$), reported poorer health status ($p < 0.001$), were on greater number regular medications ($p < 0.001$), reported restriction in physical/social activities ($p < 0.001$), were found more dependent on mRankin Scale ($p < 0.001$), had carers ($p < 0.001$), carer's had income loss ($p = 0.04$), family relationship was less than very good ($p < 0.01$), had lesser average number of family visits ($p < 0.01$), lesser average number of visits from others ($p < 0.001$), and perceived need for more organisational ($p < 0.001$), family ($P < 0.01$) and outside assistance ($p < 0.001$).

In this study, Probit Modeling indicates that gender of a person, and whether the person smoked, took alcohol or Kava (SAK) increased the likelihood of having a stroke, by 25.2% for male gender and 21.3% for SAK.

The results demonstrate that stroke survivors compared to controls, were significantly ($p < 0.001$) disadvantaged in all the six core dimensions of psychological well-being. The level of Psychological Well-being Index had a significant association with certain characteristics of stroke survivors. There was a statistically significant association of mental test score ($p < 0.001$), level of education attained prior to stroke ($p = 0.01$), employment status of being unemployed after stroke ($p < 0.001$), Kava consumption ($p = 0.01$), participation in regular exercise ($p = 0.04$), self-reported health status ($p = 0.01$), physical functional activity restrictions ($p = 0.01$), admission to rehabilitation ($p < 0.01$), visit to doctor/health facility within past three months ($p < 0.01$), relationship with family members ($p < 0.01$), average number of family visits ($p < 0.01$) and perceived assistance received from organisations ($p < 0.01$).

The annual national human capital resource loss from pre-mature stroke mortality in Fiji, represented 1% of the national government revenue and almost 10% of the Ministry of Health's total annual budget for the year 2001.

Conclusion: Probit Modeling proves to be a desirable econometric tool for quantifying the impact socio-economic risk factors on the probability of having a stroke. Stroke is costly in terms of both human psychological well-being and economic resource loss.

ABBREVIATIONS

A	– Autonomy
ACE	– Angiotensin Converting Enzyme
ADL	– Activities for Daily Living
AMTS	– Abbreviated Mental Test Score
ANOVA	– Analysis of variance
BMI	– Body Mass Index
CBR	– Community Based Rehabilitation
CHW	– Community Health Worker
CI	– Confidence Interval
CSHA-2	– Canadian Study of Health and Aging
CT	– Computerised Tomography
CVA	– Cerebrovascular Accident
CVE	– Cerebrovascular Event
DALYs	– Disability Adjusted Life Years
df	– Degrees of freedom
D/N	– District Nurse
EM	– Environmental Mastery
FFS	– Fee For Service
FNCDP	– Fiji National Council for Disabled Persons
FSAD	– Fiji Sports Association for the Disabled
GDP	– Gross Domestic Product
HMO	– Health Maintenance Organisation
HOPE	– Heart Outcome Prevention Evaluation
HRQoL	– Health Related Quality of Life
IBR	– Institutional Based Rehabilitation
IADL	– Instrumental Activities for Daily Living
ICF	– International Classification of Functioning, Disability and Health
ICH	– Intracerebral Haemorrhage
ISC	– Ischemic Stroke

LOS	– Length of stay
MCR	– Monthly Consolidated Report
MONICA	– Multinational MONItoring of trends and determinants in CArdiovascular disease
MRU	– Medical Rehabilitation Unit
NCD	– Non-Communicable Disease
NEMESIS	– North East Melbourne Stroke Incidence Study
NGO	– Non-Governmental Organisation
NMES	– National Medical Expenditure Survey
OLS	– Ordinary Least Squares
OR	– Odd Ratio
OT	– Occupational Therapist
PCR	– Polymerase Chain Reaction
PEG	– Percutaneous Endoscopic Gastrostomy
PG	– Personal Growth
PL	– Purpose in Life
PR	– Positive relationship with others
PT	– Physiotherapist
PV	– Present Value
PWI	– Psychological Well-Being Index
QALYs	– Quality Adjusted Life Years
SA	– Self-acceptance
SAH	– Subarachanoid Haemorrhage
SPSS	– Statistical Package for Social Sciences
SD	– Standard deviation
TIA	– Transient Ischaemic Attack
WHO	– World Health Organisation

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

The epidemiological transitions via socio-economic advancements and changing demographics have altered the profile of the major causes of mortality and morbidity. While infectious and parasitic diseases have been historically the main killers in the past, today, they are no longer a major cause of death in most countries. In addition, urbanization and globalization have brought changes in lifestyles that have produced a surge in mortality and morbidity due to injuries, and non-communicable diseases (NCDs) such as cancer, cardiovascular diseases including stroke and heart disease, chronic pulmonary (respiratory) obstructive disease, mental disorders and other chronic illnesses. Most of these NCDs share common risk factors like smoking, excess alcohol, unhealthy diets, lack of physical activity, and poverty or even affluence. It has been reported that NCDs account for sixty two per cent (62%) of all deaths and half of the disability burden in the Economic and Social Commission for Asia and the Pacific (ESCAP) region (Sen, 2006).

The theoretical conundrum of the correlation between the level of socio-economic status and health, as proposed by Young (2004), is explained in a later section of this thesis. To combat the globally rising trend in poverty and ill health, the United Nations at its 2000 Millennium Summit established defined priorities and targets as the Millennium Development Goals (MDGs) (United Nations, 2006). The MDGs are the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions including income, poverty, hunger, diseases, lack of adequate shelter, and exclusion, while promoting gender equality, education, and environmental sustainability. The targets are also basic human rights, which encompass the rights of each person on the planet to good health, education, shelter, and security and safety.

Although the MDGs do not specifically address NCDs, these are contained in several target areas seeking to influence individual and population health through improvements in education levels; as individuals with higher education (Avendano *et al*, 2006) are more likely to understand and engage in healthier lifestyles. A better and safer environment protects against respiratory and certain types of cancers, and measures against discrimination and exclusion will improve overall health. The MDGs specifically refer to health in order to reduce under-five age group mortality; reduce maternal mortality; and combat HIV/AIDS, malaria and other diseases. Although the prevalence of NCDs has been associated with affluence (Leeder, 2005), its existence can also be accredited to poverty and lower socio-economic status (United Nations, 2006).

Amongst the various NCDs, stroke is a leading cause of death and chronic disability. Annually, 15 million people worldwide suffer a stroke and this burden of stroke is projected to rise from around 38 million disability-adjusted life years (DALYs) globally in 1990 to 61 million in 2020 (World Health Organisation, 2008a). Some reports in the literature implicate stroke as the second most common cause of death in developing countries (Liu, 2001; Lyons, 2006; Donnan *et al*, 2008) with an increasing incidence (Shahram, 2007) with eighty seven percent (87%) of stroke deaths being in low-income and middle-income countries (Strong *et al*, 2007). While in developed countries, stroke is the third leading cause of death and an important cause of hospital admission, morbidity and long-term disability (Bonita, 1992; Ramani *et al*, 1996; Beers and Berkow, 2000; Brandstater, 2005; Fink, 2006; Air and Kissela, 2007). The age-standardised mortality, case fatality and prevalence of disabling stroke in Africa is seen to be similar to or higher than those measures in most high-income regions (Mensah, 2008). Overall, with 9.6% of deaths globally, stroke was only second to ischaemic heart disease with 12.6% in 2002 (Mathers *et al*, 2003).

Over the decades, some decline in stroke mortality has also been reported (Shahar, 1995; Mayo, 1996; Heart and Stroke Foundation of Canada, 1999; Islam *et al*, 2008) thus, increasing the likelihood of more stroke survivors living and experiencing residual impairments, physical, functional and social activity limitations that lead to participation restriction and require ongoing rehabilitation and support.

Recent reports indicate an increase in figures of disease burden from stroke, particularly in developing countries like Fiji. The World Health Organisation (2005) in its NCD Surveillance, STEPwise approach to stroke surveillance, estimated that, in 2002, stroke resulted in 5.5 million deaths worldwide, making it the leading cause of death. The projections to the year 2020 indicate that the number of people suffering from stroke each year will substantially increase; the majority of the disease burden being in the developing countries (World Health Organisation, 2005).

According to a report compiled by the Ministry of Health, there is a very high prevalence of chronic disability in Fiji, largely from preventable diseases in persons of working age and among the young old (60-74 years) (Price, 1997). The study has confirmed that a high proportion of the elderly admitted to general medical wards at the Colonial War Memorial Hospital in Suva, with disorders of cerebrovascular, cardiovascular and respiratory conditions had a high prevalence of co-morbidities (Maharaj and Ehrlich, 1999) and that a trend towards an earlier onset of disability is evident in Fiji's population (Panapasa, 2002). Data compiled from the Ministry of Health Annual Reports show a rise in the number of strokes in past decades (Maharaj, 1999).

With a chronically disabling condition, the victims of stroke represent a unique economic and health care burden to individuals, caregivers, families, health care systems and the national economy and support services. In developing countries, the rapidly increasing burden of stroke will pose many challenges, in particular, the raising prevalence of stroke risk factors such as hypertension and diabetes mellitus in the community (Cornelius *et al*, 2008) and to some extend, the unusual patterns of occurrence (e.g. high incidence of cardio-embolic stroke secondary to cardiac events and rheumatic heart disease). A recent hospital-based study over a 23-month period from December 2005 to November 2007 at Colonial War Memorial Hospital in Fiji reported 3.8% of stroke directly due to rheumatic heart disease (Steer *et al*, 2009). There is growing need for provision of appropriate, long-term care for those stroke survivors to eliminate or minimise residual impairments, activity limitation, participation restriction and psychological impact.

Fiji is undergoing a rapid epidemiological transition as is occurring in most other developing regions of the world. As such, non-communicable diseases, namely diabetes mellitus, hypertension, ischaemic heart disease and stroke are fast replacing the traditional enemies, in particular, infectious diseases and malnutrition, as the leading causes of premature disability and death (Mathers *et al*, 2000; Poole-Wilson, 2005). By 2002, around seventy percent (70%) of deaths in Fiji were due to NCDs including stroke; fifteen percent (15%) to communicable diseases; and another fifteen percent (15%) to other causes (World Health Organisation, 2008b). Largely, the ageing of populations augmented by increasing lifestyle changes drives these transitions.

The epidemiological transition is a useful tool for understanding trends and changes in diseases and risk factor burden in populations to prevent increases in the emergence of new diseases, resultant complications and sequalae. Economic development and lifestyle changes can alter not only the overall disease profile of a country, but also the subtypes of a disease, such as stroke. The latest results from the Sino-MONICA-Beijing project 1984 - 2004 in rapidly developing China demonstrate that the rates for first-ever hemorrhagic stroke remained stable around 40 to 50/100,000 in the early phase, but was then followed by a rapid decrease from 40/100,000 in 2000 to only 26/100,000 in 2004; at the same time, this pattern coincided with a marked increase in ischemic stroke rates (Truelsen, 2008; Zhao, 2008). There was a decrease in stroke case-fatality from one-in-four in 1995 to less than one-in-ten in 2004. As Fiji is undergoing a rapid epidemiological transition and economic development, stroke subtypes and outcomes are likely to be influenced and altered.

In Australia, it is projected that there will be a seventy percent increase in the prevalence of disability and associated common health conditions, such as musculoskeletal, nervous system, respiratory, circulatory and stroke, for older Australian citizens, between the period 2006 – 2031 (Giles, 2003). Any decrease in the incidence and mortality from stroke as a result of health promotion is likely to be offset by an increase in the ageing population at risk, with the result that the overall absolute prevalence of stroke related consequences will continue to increase. In Fiji, given the increasing number of older people in the population, the problem of long-term morbidity and suffering related to stroke is unlikely to disappear.

The projections from the existing patterns of stroke in Fiji suggest that the prevalence of stroke will rapidly increase in the near future (Maharaj and Panapasa, 2002). This rapid increase will result in a significant additional burden to families, medical and health care services, and social support networks that are already struggling to meet current demand for services. This burden will continue to escalate unless appropriate and adequate preventative and rehabilitative services are devised and implemented. To do so successfully would require an in-depth understanding of all the risk factors for stroke in the local population and the health, psychosocial, and economic impact of stroke in Fiji.

The origins of the word 'stroke' and its definition are discussed below. In medical terms, stroke is also known as cerebrovascular accident (CVA) or cerebrovascular event (CVE) or preferably just stroke – as in the true sense, it is not an 'accident' as such.

The word 'stroke' was originally short for 'stroke of apoplexy'. 'Apoplexy' is derived through French and Latin from the Greek word *apoplexia,* meaning a sudden loss of feeling and motion, as if struck by a thunderbolt (Cowie, 1989). *Apoplexia* is derived from *apoplessein* ('to disable by a blow'); from *plessein* ('to strike') and *apo* (meaning 'off' or 'from', in this case indicating 'completely').

A stroke is a clinical syndrome characterized by an acute loss of focal brain function lasting more than 24 hours or leading to death. This is due to either spontaneous haemorrhage into or over the brain substance (primary intracerebral haemorrhage or subarachnoid haemorrhage respectively – haemorrhagic stroke) or inadequate blood supply to a part of the brain as a result of low or no blood flow, thrombosis or embolism associated with diseases of the blood vessels, heart or blood (ischaemic stroke/cerebral infarction) (World Health Organisation, 1978). A more recent definition states that a stroke is 'a syndrome of rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin' (Wolfe, 2000). The definitions of stroke includes subarachnoid haemorrhage, but excludes transient ischaemic attack (TIA), subdural haematoma, and haemorrhage or infarction caused by infection or tumour. It also excludes silent cerebral infarcts. Thus, it would appear that such studies are likely to underestimate the total burden of stroke.

A transient ischaemic attack (TIA) of the brain is a clinical syndrome characterized by the acute loss of focal brain function lasting less than 24 hours. A TIA of the brain is therefore, the same as an ischaemic stroke, as defined above, but by definition, the symptoms resolve within 24 hours (World Health Organization, 1978). The 24-hour time limit for the duration of symptoms was decided by a World Health Organization committee in 1978 on purely arbitrary grounds, having more to do with the earth's rotation than biology. A newer "tissue-based" definition of TIA that relies on the absence of end-organ injury as assessed by imaging or other techniques is defined as "a brief episode of neurologic dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction" (Albers *et al*, 2002). Cases of TIA are outside the scope of this study; however, its occurrence does increase the probability of stroke onset.

In Fijian societies, there is a deep-rooted tradition of respect and care for the elderly and sick members with an expectation on family members to provide care. However, with rapid developments and associated lifestyle changes in Fiji (Senilagakali, 2007), the capacity of families to provide adequate care for the frail and disabled elderly people in the community is likely to decline with changes in family structures, values and social dynamics.

As has been the tradition, the outcome of medical and rehabilitation interventions, particularly in relation to stroke patient, can no longer be viewed solely in terms of morbidity and mortality. One very important dimension of health, which needs to be measured and understood, is broader health status, or health-related quality of life and, in particular, the person's psychological well-being.

For a stroke survivor and the family, support in the form of adequate and appropriate psychological and social intervention or adjustment are needed in order to effectively function, participate, and to independently create quality of life for both the caregiver and the survivor. The exact nature of psychological and social restrictions caused by stroke amongst Fiji's population is not well understood. No published study was found that has researched on this issue as it prevails amongst community dwellings of stroke survivors in Fiji.

1.2 Purpose of the Study

Although, mainly medical and some socio-economic risk factors are postulated in the causation of stroke; the quantitative probability of a stroke event occurring in relation to any specific socio-economic risk factors in Fiji is not well reported or understood. Furthermore, the impact on the individual's psychological and social functioning at micro and macro levels within the family and economic consequences of stroke in Fiji are not known. There is no published study pertaining directly to socio-economic risk factors for stroke, psychological impact, and economic consequences of stroke amongst Fiji's population.

This population-based study of a random selection of community dwelling stroke survivors and their matched controls assessed an individual's socio-economic factors for risk of stroke, quantifying the relationship between the factors and the likelihood of having a stroke event. The study evaluated the positive and negative aspects of psychological well-being of the sample and compared the findings with community controls and within the stroke survivor group. A comparison with persons without stroke in the case control study design was used to further delineate the impact of stroke. This study also performed an economic analysis of stroke mortality, computing the national human capital resource loss from stroke mortality in Fiji.

1.3 Research Questions

1) With the given socio-economic factors for stroke, what is the quantitative relationship between a factor and the likelihood of having a stroke event in Fiji?

2) What is the difference between the psychological well-being of community dwelling stroke survivors and their matched controls, and amongst the stroke survivors themselves in Fiji?

3) What is the economic impact in terms of national human capital resource loss from stroke mortality in Fiji?

1.4 Significance and Usefulness of the Study

Accurate information on the extent and the nature of socio-economic factors for risk of stroke, the impact of stroke on the psychological well-being of community dwelling stroke survivors, and the national economic burden of stroke mortality is extremely important for setting priorities for health care, and in generating strategies for prevention, management, rehabilitation and successful community integration of stroke survivors.

Such information is limited in current literature, and in particular, in the area of appropriate methods and modes of successful intervention in Fiji's population and community dwelling stroke survivors.

An understanding of the quantitative relationship of socio-economic factors to the likelihood of causing a stroke event will assist policy makers, individuals, families, carers and the society in determining an appropriate weighting and emphasis on various risk factors and implementing effective targeted stroke preventative strategies.

A comprehensive understanding of the psychological impact of stroke on community dwelling stroke survivors and their family will assist in better designing interventional programmes for rehabilitation, harnessing traditional and family values to address these issues.

Awareness of another different aspect of economic burden in the form of the national human capital resource loss from stroke mortality will encourage and support better prevention, better acute care, rehabilitative and vocational programmes for the stroke survivors.

1.5 Hypotheses

Therefore, given the above stated research questions the null hypothesis can be stated as follows:

1) There is no quantitative relationship between socio-economic factors and the likelihood of having a stroke event in Fiji.

2) There is no difference in psychological well-being of community dwelling stroke survivors and their matched controls and amongst the stroke survivors themselves in Fiji.

3) There is no economic national human capital resource loss from stroke mortality in Fiji.

The study aimed to answer the stated research questions based on the above hypotheses.

1.6 Structure of the Thesis

This thesis is organised into nine chapters. The first chapter identifies the rationale and introduces the study and its usefulness. The projected increase in the incidence of stroke in Fiji and associated burden is also discussed and highlighted.

Chapter Two, to set the scene, briefly introduces the reader to Fiji, the geography and people, the political trajectory, the economy, organisation of health services, health status, disease pattern, and increasing disabilities: a case for medical rehabilitation and rehabilitation support for disability groups.

Chapter Three provides an overview of stroke including epidemiology of stroke, medical and socio-economic risk factors for stroke, including stroke risk factors and stroke in Fiji; review of quality of life and psychological well-being issues after stroke; and economic impact of stroke available in the literature.

Chapter Four presents the methodology and research design. It describes the sampling procedure, study instruments, data collection, ethical considerations, data analysis and issues of rigour.

Chapters Five of the thesis presents demographic details of the study sample and provides a comparative analysis between stroke survivors and controls in relation to all the study variables.

Chapters Six to Eight describes the findings in terms of the impact of Socio-economic Variables on Stroke likelihood: A Probability Modeling (Chapter 6), Psychological Well-being of Stroke Survivors in Fiji (Chapter 7), and Economic Analysis of Stroke in terms of national human capital resource loss from stroke mortality in Fiji (Chapter 8).

Chapter Nine summaries the study and discusses policy implications including future research recommendations.
References and appendices are placed after the chapters.

1.7 Referencing style

There are two commonly used standard formats of referencing by the Faculties of Medicine and Science (Biological Sciences). These are the VANCOUVER system (also known as number or citation-sequence) and the HARVARD scheme (also known as author-date or name-year). There are variations to these styles, particularly the Harvard scheme. Whichever style is used, it is important, above all, to be consistent in the approach.

The referencing style adopted for this thesis is the style recommended by the University of the South Pacific. This style of citation has been used consistently in this thesis.

This citation style uses the author's surname name followed by initial(s), then the initial(s) followed by name(s) of other author(s), and date of publication in parentheses as follows:

Surname, initial. initial., initial. initial. surname, initial. initial. surmane and initial. initial. surmane (Year). "Title", *Journal*, Vol(Number):page-page.

1.8 Limitations of the Study

The community dwelling stroke survivors or "cases" were selected from the CounterStroke Fiji National Stroke Register with the assumption of completeness of the registration of stroke survivors. This was the only up-to-date source of "currently living" community dwelling stroke survivors living in the community for six or more months. There is a gender disparity between cases and controls. This is further discussed in chapter on methodology.

The sampling did not include cases outside of the main island of Viti Levu for logistical reasons. Population-based study is very time consuming and expensive to perform. However, almost seventy seven percent (76.7%) of the national population reside on the main island.

As reported in Chapter 6, Impacts of Socio-economic Variables on Stroke Likelihood: A Probability Modeling some socio-economic factors, such as smoking, alcohol and kava use (SAK), had to be combined to detect a positive likelihood of the stroke from a composite of these factors. The study was unable to delineate the likelihood of separate individual factors. However, the used of this methodology and further study of socio-economic factors in Fiji should be a subject for future research.

The main aim of Chapter 7, Psychological Well-Being of Stroke Survivors in Fiji, was to compare the “cases” with the “controls” based on the in-depth statistical analysis of the 84-item 6-point likert scale Ryff Measure of Pyschological well-being. Further to this limited univariant statistical analysis is conduct as multivariate modelling was not the scope of this work.

While efforts were made to maintain the accuracy of information gathered, which relied on self and proxy reporting, it has their own limitations. Although the Research Assistants who conducted the fieldwork were trained, multi-lingual and able to express clearly, the accuracy of the information is subject to the interpretation of the meaning by the interviewee and his or her proxy.

In Chapter 8, Economic Analysis of Stroke, the main intention was only to show the national human capital resource loss from pre-mature stroke mortality of working age group as another aspect of burden of stroke and not to evaluate all the direct or indirect costs of stroke care in Fiji. Although not available for Fiji, there are numerous studies in the literature stating methodologies for evaluating direct or indirect costs of stroke care.

1.9 Summary and Conclusion

The epidemiological transitions through advances in socio-economic development and changes in demographics have altered the profile of the major causes of mortality and morbidity. Amongst the various NCDs, stroke is a leading cause of death and disability, and is implicated as the second leading cause of death in some developing countries and the third leading cause of death and an important cause of hospital admission and long-term disability in developed countries. The World Health Organisation predictions indicate that stroke will become the primary cause of mortality and morbidity in developing countries by the year 2020 (World Health

Organisation, 2005). The projections from the existing patterns of stroke in Fiji suggest that the incidence of stroke will only rapidly increase in the near future.

To combat the global raising trend in poverty and ill health, the United Nations, at its 2000 Millennium Summit established time-bound defined priorities and targets as the Millennium Development Goals. As a member of the United Nations, Fiji, through its various Ministries is committed to a successful outcome from the Millennium Development Goals for Fiji.

This chapter has outlined the background, purpose, research questions, significance and usefulness, the hypotheses, the structure of the thesis, the University of South Pacific recommended referencing style, and the limitations of the study.

CHAPTER TWO

COUNTRY AND HEALTH PROFILE

2.1 Fiji - The Geography

Fiji lies 3,100 km northeast of Sydney and 2,100 km north of Auckland, straddling the international dateline, and lying between 15 degrees and 22 degrees south of the equator. It is the hub of the South Pacific region, lying east of Vanuatu, west of Tonga and south of Tuvalu, and has come to be a major crossroad for air and shipping transportation in the region.

Fiji occupies an archipelago of 322 islands of different sizes, some of which are only islets, in the South Western Pacific Ocean. Just over 100 of these islands are permanently inhabited, while many more are used for planting food crops or as temporary residence. The two principal Islands are Viti Levu (covering 10,400 sq km) and Vanua Levu (covering 5,630 sq km). Eighty seven percent (87%) of the total national population live on these two Islands. Altogether, the archipelago covers a vast area of about 650,000 sq km, with only 18,272 sq km made up of dry land.

The islands are mountainous, with peaks up to 1,300 metres, and covered with tropical forests. The capital city of Suva is on the main island of Viti Levu, which has over 76% of the total national population (Table 1). Other important towns are Nadi, where the international airport is located, and Lautoka city. The main towns on Vanua Levu are Labasa and Savusavu. Other Islands and Island groups include Taveuni and Kadavu (the third and fourth largest islands respectively); the Mamanuca Group (just outside Nadi); Yasawa Group, which are popular tourist destinations; the Lomaiviti Group, outside of Suva, and the remote Lau Group. Rotuma, some 500 kilometres north of the archipelago, has a special administrative status in Fiji.

Table 1: Population of Fiji by Divisions

Division	Population	Percentage	Viti Levu
Central	297,607	38.40	} 76.70%
Western	297,184	38.30	
Eastern	40,770	5.30	
Northern	139,516	18.00	
Total	**775,077**	**100.00**	

Source: Bureau of Statistics, 1998.

2.2 Fiji - The Political Trajectory and People

On 10th October 1874, Fiji became a British Crown Colony when it was formally ceded to Britain. The economic development of the island over the next one hundred years under the British Colony resulted in a multi-ethnic society. The two main groups being Fijians and Indians. Other ethnic groups include Rotumans, Pacific Islanders, Europeans, part-Europeans, and Chinese. Just five years after the British Colonisation, in 1879, the first indentured or contract labourers were brought from India to work on the sugar plantations. When the indenture system ended in 1916, some 64,000 Indians had arrived, of which 40,000 chose to stay on after the expiry of their work contracts. Later, other Indian settlers came, principally as merchants. By 1970, more than 90% of the Fiji-Indian population had been born in Fiji. Fiji gained full independence from the British Crown Colony on 10th October 1970, following a constitutional conference held in London in April and May of 1970.

Fiji remained a member of the Commonwealth until democratic rule was interrupted by two military coups in 1987. Both the coups eventuated because the government was perceived as dominated by the Indian community. The second 1987 coup saw the British Monarchy and the Governor General replaced by a non-executive President, and the country changed the long form of its name from *Dominion of Fiji* to *Republic of Fiji* (and later to *Republic of the Fiji Islands* in 1997). Fiji was re-admitted to Commonwealth in 1997, and suspended again following the coup of 5th December 2006.

Politics of Fiji normally take place in the framework of a parliamentary representative democratic republic, where the elected Prime Minister of Fiji is the head of government, the nominated President is the head of state and a multi-party parliamentary system. The government exercises executive power. Legislative power is vested in both the government and the Parliament of Fiji. The Judiciary is independent of the executive and the legislature. Since independence, there have been four coups in Fiji, two in 1987, one in 2000 and one in late 2006. The military has been either ruling directly, or heavily influencing governments since 1987.

The total population at the most recent census conducted on 25th August 1996 was 775,077 (Bureau of Statistics, 1998), as shown in Table 2. This was made up of 393,575 (50.78%) Fijians, 338,818 (43.71%) Indians and 42,684 (5.51%) Others, of which just over half (53.62%) resided in the rural areas.

The total estimated population in 2004 was 848,647, made up of 52.2% ethnic Fijians, 42.6% Indians and 5.2% other races (Ministry of Health, 2004). Ethnic grouping in Fiji, categorised as "Others" is comprised of Rotumans, Europeans, Part-Europeans, Chinese, Pacific Islanders and other minority groups who are neither Fijian nor Indian.

Table 2: Population of Fiji by Age Groups and Ethnicity

Age Group	Fijians	Indians	Others	Total	% age
0 - 14	149,152	110,521	14,491	274,164	35.37
15 - 59	222,442	213,059	25,605	461,106	59.49
60 +	21,981	15,238	2,588	39,807	5.14
Total	393,575	338,818	42,684	775,077	
% age	**50.78**	**43.71**	**5.51**	**100.00**	**100.00**

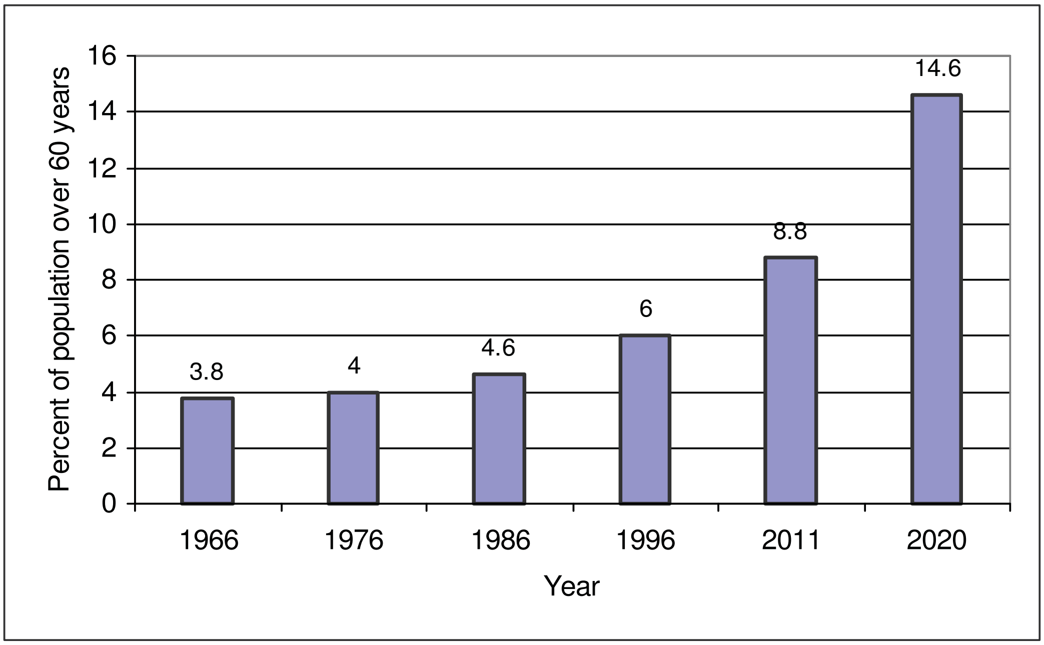
Source: Bureau of Statistics, 1998.

The age distribution shows that Fiji still has a relatively young population with 0 – 14 year age group making up thirty five percent (35.37%); 15 – 59 year age group making sixty percent (59.49%); 60 years and over comprising only five percent

(5.14%), and three percent (3%) of whom were aged 65 years and over (Bureau of Statistics, 1998).

Increasing longevity and decreasing mortality and fertility rates cause ageing in Fiji. During the national census in 1986, people aged 60 years and over comprised only 4.6%. That rose to 6.0% in 1996 and compared to 1986 will almost double to 8.8% by the year 2011 and is projected to triple to 14.6% by 2020. This is illustrated in the Figure 1 below.

Figure 1: Percent of Population Aged 60 years and over in Fiji



Source: Bureau of Statistics. (1966, 1976, 1986, 1996-Census data. 2011, 2020-projected)

There were slightly more males than females in the general population, but as expected, females outnumbered males, especially in the 65 years and over age group.

The country is still predominantly rural with rapid occurrence of urbanisation. Fiji's mutli-ethnic population is also multi-religious, with Christians comprising fifty-two percent (52%); Hindus thirty eighty percent (38%); Muslims eight percent (8%); and other religions comprising two percent (2%).

Most of the indigenous Fijians and some Pacific Islanders grew up in a culture, which is bound up in communalism with an administrative hierarchical system. In such a system, a strong extended family relationship exists, as result of which much sharing takes place. Although of a very different non-communal nature, Indians also demonstrate strong extended family ties.

The socio-economic developments in Fiji have resulted in a rapid increase in the size of urban communities and nuclear families. The shift from an agricultural-based subsistence economy to a cash economy has influenced the lifestyles of most. Accompanied with the economic changes has been the breakdown of the extended family system, which was previously taken for granted in these cultures. This has repercussions on the lives of people like limited activity, restricted participation and special care needs in a health care delivery system, which to some extent relies heavily on the participation of the members of the family and the community in overall patient or client care.

2.3 Fiji - The Economy

At the beginning of the nineteenth century, ships came to the islands searching for sandalwood, a profitable, but short-lived trade; and later for beche-de-mer. During the 1860s, settlers arrived from Australasia to establish the first cotton plantations. The American Civil War had caused a boom in the cotton prices and exports rose rapidly accompanied by an influx of new settlers (Central Office of Information, 1970). During the 1870s, sugar began to replace cotton as the main plantation crop.

Fiji, gifted with forest, mineral, and fish resources, is one of the more developed of the Pacific Island economies, though still with a large subsistence sector. Fiji experienced a period of rapid growth in the 1960s and 70s, but the growth stagnated in the early 1980s. The coups of 1987 caused further slowing of the economy. Economic liberalisation in the years following the coup created a boom in the garment industry and a steady overall growth rate despite growing uncertainty of land tenure in the sugar industry. The expiry of leases for sugar cane farmers has led to a decline in sugar production, despite a subsidised price. Sugar exports and a rapidly growing tourism industry — with 430,800 tourists in 2003 and increasing in the subsequent years — are the major sources of foreign exchange. Sugar processing makes up one-third of industrial activity. Long-term problems include low investment and uncertain property and land rights. The political upheavals in Fiji have had a severe impact on the economy.

Fiji has a buoyant economy with sugar and tourism accounting for the majority of the Gross Domestic Product (GDP) along with thriving industries from abundant natural resources.

2.4 Organisation of the Health Services

Fiji enjoys a well-developed geo-administrative infrastructure to deliver its health care services, as well as other governmental services. Ministry of Health, the main provider of health care in the country, offers preventive, promotive, curative and rehabilitative health services. The organisation comprises the headquarters with the Minister for Health as the political head charged with the responsibilities of formulating medical and health policies throughout Fiji, and the Permanent Secretary for Health is responsible to the Minister for the execution of those policies and for the provision of professional advice. The Directors and support staff from medical, paramedical, administrative, finance, planning and other sectors in turn assist the Permanent Secretary for Health.

Fiji was no exception to the tradition of disastrous epidemics that followed the appearance of the white man in most of the Pacific islands. According to McHugh (1929), "Fiji had a very limited variety of germs when it was discovered by the Europeans. European civilisation also upset native custom, and much of the native custom was of importance in hygiene and sanitation. A native medical school was started at the Colonial Hospital, Suva, in 1884. Hospitals, for use by Fijians have been opened in several provinces, and each of these has a native medical practitioner either in sole charge or acting as house surgeon under the European District Medical Officer". Thus, Fiji’s current comprehensive geo-administrative infrastructure had its beginnings during its early medical history and British Administration.

For the purpose of health care delivery, Fiji is divided into three large governmental geo-administrative divisions. These are the Central/Eastern, the Western and the Northern Divisions. Fiji’s health administrative organisational management structure recently went under a major reform, with the three divisions assuming autonomy in terms of operational activities, with the Ministry Headquarters retaining policy direction.

These divisions are sub-divided into "medical subdivisions" which are further divided into "medical areas" and "nursing zones". At the subdivisional level, the preventive and curative health services are integrated. Health care in Fiji is mainly provided through public hospitals and health centres, and is heavily subsidised by the Government.

There are three Divisional hospitals located at Suva, Lautoka and Labasa; 2 specialist hospitals – one providing physical rehabilitation including stroke and the other Psychiatric hospital; 16 Sub-Divisional hospitals; one Area hospital; 74 Health Centres; 100 Nursing Stations; 17 Village Health Workers; and 3 Old Peoples Homes. The three divisional hospitals have 1002 beds; Sub-Divisional hospitals 571; Area hospitals 32; and the two specialist hospitals have 289 beds (Ministry of Health, 2004).

Through this structure, theoretically, health care reaches every individual in the nation via the Zone Nurse (Z/N) or District Nurse (D/N) who are the "last link" in the official health personnel "chain". From the Zone Nurse level upwards, the referral lines are fairly well defined via the Area Medical Officer level through to the Sub-Divisional hospital and to the Divisional "base" hospital. Referral can be made directly to any specialist or base hospital services from any level in the system.

Thus, a stroke survivor, depending on the severity of the stroke, may be referred to a tertiary hospital or for rehabilitation from any level within the health service structure. The referral may be initiated from a tertiary hospital, a smaller sub-divisional hospital or from the community.

2.5 Health Status

Health is defined as "a state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity" (World Health Organisation, 1948). In the absence of indicators to fully describe individual or population health, the following indicators, from the Ministry of Health report, are presented in Table 3 below. The national health indicators compare favourably with other developing countries, and infant and child mortality rates, the maternal mortality ratio and the incidence of low birth weight have all shown gradual decreases over the last decade.
(World Health Organisation, 2008b).

A four year trend from 2001 to 2004 is presented for comparison. There was a slight increase in the Crude Birth Rate from 20.00/1000 to 20.87/1000 population; a decrease in Crude Death Rate from 7.00/1000 to 6.63/1000 population; and an increase in Infant Mortality Rate from 15.40/1000 to 17.84/1000 live births and the Maternal Mortality Ratio from 6.40 to 7.97 (Ministry of Health, 2004).

This crude death rate gives the annual number of deaths during a year per 1,000 population at midyear. The death rate, while only a rough indicator of the mortality situation in a country, is thought to accurately indicate the current mortality impact on population growth. This indicator is significantly affected by age distribution, and most countries will eventually show a rise in the overall death rate, in spite of continued decline in mortality at all ages, as declining fertility results in an ageing population.

Table 3: Vital and Health Statistics for Fiji 2001-2004

Variables	2001	2002	2003	2004
Population	861,003	872,985	866,099	848,647
Total Live Births	17,222	17,002	17,910	17,714
Crude Birth Rate/1000 pop	20.00	19.48	20.68	20.87
Total Death	5,774	5,632	6,116	5,628
Crude Death Rate/1000 pop	7.00	6.48	7.06	6.63
Infant Mortality Rate/1000 births	15.40	17.76	18.87	17.84
Maternal Mortality Ratio	6.40	8.65	9.60	7.97
% Natural Increase	1.33	1.30	1.36	1.42

Source: Ministry of Health, 2004.

Life expectancy at birth is a measure of overall quality of life in a country and summarizes the mortality at all ages. Life expectancy in Fiji has been gradually increasing for both male and female. For the male counterpart, life expectancy at birth in 1990 was 63 years, which increased to 65 years in 2000 and to 66 years in 2006. For females, life expectancy at birth in 1990 was 69 years, which increased to 71 years in 2000 and to 72 years in 2006 (World Health Organisation, 2008c). This is tabulated in Table 4 below.

Table 4: Life Expectancy at Birth in Years for Fiji 1990-2006

Gender	1990	2000	2006
Male	63	65	66
Female	69	71	72

Source: World Health Organisation, 2008c.

Over the sixteen year period from 1990 to 2006, both genders have had a three year addition to their life expectancy at birth.

2.6 Disease Pattern

Over the years, as a developing country, Fiji has managed to contain most of the infectious diseases through its very successful immunisation program, improved hygiene and living conditions, sanitation, and water supply. Non-communicable diseases have emerged with their resultant chronic and disabling effects.

Mortality and hospital admissions due to cardiovascular diseases and diabetes mellitus have increased steadily in Fiji over the 20 years compared to 1985 (Tuomilehto *et al*, 1985). Although there has not been any formal study conducted on the incidence or prevalence of stroke in Fiji, data compiled from the Ministry of Health annual reports show a rising trend for the 26 years up to 1986 (Maharaj, 1999). This is further discussed in Chapter 3 Stroke – An Overview.

The five major causes of hospital mortality in 2004 were diseases of the circulatory system, which includes stroke with a high of almost forty percent (39.37%), followed by neoplasms (9.82%), diseases of respiratory system (8.79%), endocrine, nutritional and metabolic disorders (7.95%), and injury, poisoning and certain consequences of external causes (6.28%) (Ministry of Health, 2004). This is shown in Table 5 below. Although this trend has remained similar for some years, the latest percentages tabulated, were available for the year 2002 (Ministry of Health, 2004).

Table 5: Five Major Causes of Hospital Deaths in Fiji

	Disease Group	**% age**
1.	Diseases of the Circulatory System (including stroke)	39.37
2.	Neoplasm	9.82
3.	Diseases of Respiratory System	8.79
4.	Endocrine, Nutritional and Metabolic Disorders	7.95
5.	Injury, Poisoning and certain consequences of External Causes	6.28

Source: Ministry of Health, 2002.

Non-Communicable Diseases (NCDs), like stroke and coronary heart disease, have become the leading cause of death in Fiji over the last few decades. Over fifty percent (50%) of all deaths were attributed to NCDs in a survey in 1980, and this had risen to eighty two percent (82%) in 2000 with stroke and coronary heart disease accounting for just over thirty percent (30%) of all deaths in the 40-59 year age group (Ministry of Health, 2003).

The World Health Organisation (2005) projected that if the current world trends in NCDs continue, by 2020, they would probably account for seventy three percent (73%) of deaths and sixty percent (60%) of the total world disease burden, but this had already been surpassed in Fiji in 2001 (Ministry of Health, 2004), that is, nineteen years prior to the World Health Organisation prediction!

Discussion about increasing prevalence of stroke risk factors, number of strokes in Fiji, and related literature review is presented in Chapter 3 Stroke – An Overview under the sub-section 3.3 Stroke risk factors and stroke in Fiji.

2.7 Increasing Disabilities: A Case for Medical Rehabilitation

In response to increasing number of persons with long term disabilities, particularly from stroke and spinal cord injury occupying acute hospital beds, in 1984, the Ministry of Health established its first separate specialist inter-disciplinary Medical Rehabilitation Unit (MRU) at the Tamavua Hospital. This was a timely development in the health care services in Fiji, as stroke and spinal cord injuries result in a high degree of chronic disability with high demand for rehabilitation services. Prior to this development, medical rehabilitation was generally limited to services provided mainly at the acute and district hospitals, by some non-governmental organisations (NGO), by family members, and carers in the community.

The Fiji National Council for Disabled Persons (FNCDP) (1993) supported "Directory of Services for People with Disabilities in the Greater Suva Area" listed some 27 governmental and non-governmental organisations categorised into "Retraining / rehabilitation / prevention", "Counselling / advocacy", "Residential" and "Provision of Equipment" as the organisations providing some form of rehabilitation in the greater Suva area alone.

The Medical Rehabilitation Unit operates both, a 35-bed inpatient and outpatient rehabilitation services catering for stroke survivors, persons with spinal cord paralysis, cases of multiple fractures, debilitating and neurodegenerative diseases, traumatic brain injury, and limb amputees for prosthetic rehabilitation.

As a specialist service provider, the Medical Rehabilitation Unit receives patients including stroke survivors, for rehabilitation through the well-developed Ministry of Health referral network superimposed on the geo-administrative infra-structure, as well as through the private sector referrals.

From 1988 to 1992, the staff of Medical Rehabilitation Unit organised and conducted regular Community Based Rehabilitation (CBR) workshops at National and Sub-divisional level with assistance from the Cumberland Foundation in Australia. These workshops were held to generate awareness and provide training on medical rehabilitation in the community to care for all forms of disabilities, including care for stroke survivors.

Although the institutional and Community Based Rehabilitation programs have been developed and various self-help disability-specific non-governmental organisation rehabilitation support groups are operating in Fiji, the provision of acute medical care and rehabilitative services for stroke survivors has been reported to be inadequate (Lowe, 2001).

2.8 Rehabilitation Support Disability Groups

Three disability-specific non-governmental organisation rehabilitation support groups were developed through the works of staff and patients of the Medical Rehabilitation Unit.

CounterStroke Fiji, a Charitable Organisation with Registration Number 272, was established on 4th December 1988 by staff of Medical Rehabilitation Unit and some prominent persons in the society namely Commander Stan Brown, Dr Maciu Salato, Dr Jona Senilagakali and Mrs. Chris Saumaiwai. The organisation was founded to promote stroke prevention and support the re-integration of stroke survivors into the community. The organisation has evolved to become a well established non-governmental organisation with a high profiled service to the community. It commenced and maintains a comprehensive National Stroke Register since 1989. There were field workers employed by the CounterStroke Fiji, who visit hospitals and followed up stroke survivors in the community for entry into the Register.

The Spinal Injuries Association was formed in 1993 to cater for the special needs of many people with spinal cord paralysis living in the community. This organisation has evolved well and continues to meet on a regular basis to cater for clients living in the community with spinal cord paralysis.

The Medical Rehabilitation Unit staff and clients have been major partners in organising annual national games for the disabled since 1984, as well as supporting preparation of national sporting teams competing overseas. It played a leading and pivotal role in the formation of Fiji Sports Association for the Disabled (FSAD) in 1990, which is now the National Paralympic Committee. Many stroke survivors, persons with spinal cord injury and limb amputees participate in this program with Cerebral Palsy and intellectually challenged children from Special Education Schools from around the country.

2.9 Summary and Conclusion

Fiji, a multi-ethnic nation, lies in the hub of the South Pacific Ocean. The two major ethnic groups are Fijians and Indians, and “Other” races comprising Rotumans, Chinese, Europeans, Part-Europeans, and other Pacific Islanders make up only five percent (5%) of the population. The majority of the population live on the main Island of Viti Levu.

Fiji, previously a British Colony, has a political framework of a parliamentary representative democratic republic, but its political stability and economy have suffered during the last two decades due to four coups and related political upheavals.

Fiji's population is regarded as still being young, but rapidly ageing. Fiji has a well-developed health care administrative and infra-structural system, which has managed to contain most of the infectious diseases through its very successful public health initiatives and immunisation program, but is now plagued with a Non-Communicable Disease burden with the likes of stroke, coronary heart disease and diabetes mellitus topping the list of causes of morbidity and mortality.

Some basic medical rehabilitation and community based rehabilitation services have been established along with complementary Rehabilitation Support Disability Groups. However, the provision of acute medical care and rehabilitative services for stroke survivors has been reported by Lowe (2001) to be inadequate.

CHAPTER THREE

STROKE – AN OVERVIEW

3.1 Introduction

This chapter provides an overview of stroke in terms of its types, distribution in accordance to gender, ethnicity, geography and its burden of morbidity and mortality, including its impact on socio-economic and psychological well-being of stroke survivors, their families, carers and the nation. Appropriate reports from the literature are reviewed and available information on stroke from Fiji is cited in this chapter as a separate sub-section.

The literature reviewed is spread across the chapters and the topics. The literature search included search of electronic data bases and print materials. The key words used for electronic data base searches were stroke and stroke with all the other study variables and themes such as probability of stroke, stroke prevention, stroke risk factor assessment, psychological well-being after stroke and economic cost and burden of stroke. Information on Millennium Development Goals and country information on Fiji were also accessed via electronic data base and print material search.

A stroke happens suddenly, often with devastating impact on individuals and their families, robbing them of their independence. It is the most common cause of adult disability (Bonita, 1992; Ramani *et al*, 1996; Beers and Berkow, 2000; Brandstater, 2005; United States Department of Health and Human Services, 2005; Fink, 2006; Air and Kissela, 2007; Salter *et al*, 2008). Thus, stroke typically represents the entry into a lifetime of chronic disability, ongoing medical care, rehabilitation and need for support.

The World Health Organisation (2005) in its NCD Surveillance: STEPwise approach to stroke surveillance estimated that in 2002, strokes resulted in 5.5 million deaths worldwide, making it the leading cause of death. The projections for the year 2020 indicate that the number of people suffering from stroke each year will substantially increase; the majority of the disease burden being in the developing countries (World Health Organisation, 2005).

3.2 Stroke Incidence, Prevalence, Morbidity and Mortality

The risk of stroke increases with age (World Health Organisation, 2005; Australian Institute of Health and Welfare and the National Stroke Foundation, 2006; Frost, 2007; Donnan *et al*, 2008), and the risk more than doubles for each decade of life after the age 55 years (American Heart Foundation, 2008). Only about a quarter of cases occur below the age of 65 years. The burden of stroke is highest for those who are 80 years and older, contributing about thirty three percent (30%) of health care utilization and sixty percent (60%) of deaths within 30 days (Marini *et al*, 2004). Consequently, the absolute number of stroke patients and burden from stroke is likely to increase in the future because of the ageing of most populations. In terms of stroke sub-types approximately 80% are due to ischaemic courses and 20% cerebral haemohage (Thrift *et al*, 2001; Markus, 2008) and large vessel disease has been reported to be four times higher in men than in women (Petty *et al*, 1999).

Stroke incidence and mortality seems to have geographical variation. This is documented by the “Stroke Belt” studies (Rich *et al*, 2007), concept of early life exposure (Glymour *et al*, 2007), and possible shifting nature of the regional phenomenon (Howard *et al*, 2001), which is likely due to regional variation in socio-economic indices such as deprivation, ethnicity (Maheswaran *et al*, 1997), and the higher prevalence of stroke risk factors such as hypertension and diabetes in some populations (Voeks *et al*, 2008).

Apart from within country disparities in the stroke incidence and mortality, there are differences between countries. Stroke incidence appears to be higher, up to twice as common in Russia, Eastern Europe and China, when compared with Dijon, in France (Thorvaldsen *et al*, 1995).

Stroke prevalence also depends on incidence and survival rates. The prevalence of stroke is generally somewhere between 5 and 12 per 1,000 population (i.e. 1% of the population), but this figure depends on factors like age and the sex structure of the population. In women and men aged 65-74 years, the prevalence of stroke is 25 and 50 per 1000 respectively, and the mortality rate of stroke varies from about 20 to 250 per 100,000 population per year (Thorvaldsen *et al*, 1995). This is due to the fact that stroke mortality is determined by many factors, such as the incidence of stroke and its aetiological subtypes, the severity and case-fatality of stroke, and the age and gender of the population affected by stroke. For example, stroke subtypes with a very low case fatality (e.g. lacunar infarction) contribute little to mortality statistics, whereas subtypes with a high case fatality (e.g. total anterior circulation infarction) do.

Any assessment of mortality must account for age because it rapidly rises stroke mortality. In addition, any comparisons in mortality must be age-standardized or, perhaps better, restricted to certain age groups, where the number of strokes and related mortality begin to rapidly rise such as amongst 65-74 year, 75-84 year and other higher age groups. However, even after adjusting for age, the age-standardized death rate attributed to stroke varies sixfold among developed countries (Thorvaldsen *et al*, 1995). Very little is known about stroke mortality in the developing world, nor about the relative distribution of stroke subtype mortality among different countries.

Stroke mortality varies substantially within countries, even within large cities such as London. Furthermore, some of the variation in mortality could be due to differences, both in time and place; in how death certificates are completed and coded, as well as uncertainties about the population denominators in terms of both age and sex. Indeed, the rate of over and under reporting of stroke on death certificates is unacceptably high, even in places such as Framingham, which are dedicated to measuring stroke mortality (D'Agostino *et al*, 1994). Despite these potential sources of artefact, some very large observed differences in stroke mortality are probably real, particularly the very high rates reported in eastern Europe and Japan; and the very low rates in Northern America and some, but not all, western European countries (Thorvaldsen *et al*, 1995).

The following section on stroke statistics is divided according to various countries or regions. Further review on risk factor, psychological well-being and economic cost of stroke are provided in specific subsections in this chapter, as well as in chapters specifically dedicated to those themes.

United States of America

In the United States, more than 500,000 Americans have a stroke each year, with about 145,000 dying from stroke-related causes accounting for 1 in every 15 deaths during 1992 (Sacco *et al*, 1997; United States Department of Health and Human Services, 2005), making stroke mortality the third leading cause of death in the United States. This incidence has risen to 780,000 with about 600,000 first attacks and 180,000 recurrent attacks of stroke each year (American Heart Association, 2008).

Despite the changing demographics in the United States, the burden of overall stroke mortality rates are among the lowest in the world, being 36.7 per 100,000 for women and 46.6 per 100,000 for men (Sacco *et al*, 1997). There has been a striking sixty percent (60%) decline in stroke mortality in United States between 1960 and 1990, and despite this decline, nearly 150,000 Americans died of a stroke during 1995, which corresponds to one death in every 3.5 minutes (Sacco *et al*, 1997). In 2004, stroke mortality in the United States accounted for 150,074 deaths making it one in every 16 deaths (American Heart Association, 2008). The burden of stroke is greater amongst the elderly African-American men. In the southeastern part of the United States, stroke risk is approximately 1.4 times greater than that of other regions (Sacco *et al*, 1997; United States Department of Health and Human Services, 2005).

Unlike stroke mortality estimates derived from vital statistics data, incidence estimates have been made indirectly or by extending estimates in small communities to the entire nation. In Olmsted County (Rochester, Minn), stroke incidence rates declined from 205 per 100,000 in the period 1955-1959 to 128 per 100,000 1975-1979. From 1980 to 1984, incidence increased to 153 per 100,000; and has since remained relatively constant (145 per 100,000) from 1985 to 1989 (Sacco *et al*, 1997). Sacco *et al* (1997) also state that data from Framingham and Minneapolis depict that stroke incidence has not substantially declined since the mid 1980s. Importantly, the most reliable estimates of stroke incidence are provided in predominantly white communities with a high access to health care. As such, stroke incidence data on groups at high risk of stroke mortality (African-Americans, residents of the southeastern United States) are lacking. While stroke incidence rates have been level since the mid 1980s, the decline in stroke mortality has continued at least through 1992. This decline in stroke mortality, in the face of a likely stable incidence rate, suggests a declining case fatality among stroke victims. This may be so, as 1-year survival after stroke improved from 49% to 62% in five North Carolina counties between 1970-1973 and 1979-1980 (Sacco *et al*, 1997). The authors further reported that this trend of improving case fatality was also noted between 1980 and 1990 in the Minneapolis area, where 2-year survival after stroke improved from approximately 62% to 73% in men and from approximately 57% to 73% in women.

Besides mortality and morbidity, that there are more than 3,000,000 surviving stroke victims (prevalent cases), is also substantial, making stroke the leading cause of serious disability in the United States (United States Department of Health and Human Services, 2005). This prevalence is reported to have risen to 5,800,000 (2,300,000 males and 3,400,000 females) (American Heart Association, 2008). Among long-term (>6 months) stroke survivors, 48% had hemiparesis; 22% could not walk; 24% to 53% reported complete or partial dependence on activity of daily living (ADL) scales; 12% to 18% were aphasic; while 32% were clinically depressed (United States Department of Health and Human Services, 2005).

While stroke incidence appears stable and stroke mortality is slowly declining, the absolute magnitude of stroke prevalence is likely to grow. Stroke in Asian and Pacific Islander populations living in the United States was reported to be the principal cause of death among adults with uncontrolled hypertension and high dietary saturated fat believed to be responsible for the high stroke incidence rates (Yatsu, 1991). In 1995, 12.8% of the United States population were older than 65 years. By 2025, that percentage is expected to increase to 18.7%. Similarly, in 1995, 12.6% of the United States population were African-American who have almost twice the risk of first-ever stroke compared to whites (American Heart Association, 2008). By

2025, the African-American population in the United States is expected to increase to 14.5% (United States Department of Health and Human Services, 2005). Blacks have been shown to be significantly ($P<0.05$) more likely than whites to have hypertension history, diabetes history, higher low density lipoproteineamia, higher total cholesterol, lower triglycerides, unmarried, unemployed, non-private insurance, no insurance, stroke as qualifying event, <70% stenosis, symptomatic anterior circulation vessel, no antithrombotic medication before qualifying event, and no family history of myocardial infarction (Waddy *et al*, 2008). With ageing population and an increased proportion of African-Americans, the absolute number of stroke victims (and demands on healthcare and other support systems) is likely to increase substantially in the future.

Brazil

Stroke is reported to be one of the main causes of death in Brazil with wide socio-economic difference and many ethnic disparities (Massaro, 2006). In a population-based study in the city of Matao (population, 75 053) from 1st November 2003 to 31st October 2004 and follow-up at 1 month and 1 year after the episode of 141 suspect stroke cases, 81 were found to be first-ever-in-a-lifetime strokes giving a crude annual incidence rate per 100,000 per year of 108 (95% CI, 85.7–134.1) and the rate adjusted for sex and age was 137 (95% CI, 112.0 to 166.4) per 100,000 inhabitants per year (Minelli *et al*, 2007). Ischaemic stroke occurred in 69 (85.2%) subjects, intracerebral haemorrhage in 11 (13.6%), and subarachnoid haemorrhage in 1 (1.2%). The 30-day case fatality rate was 18.5 and the 1-year case fatality rate was 30.9%. After 1 year of follow-up, 43% of the patients were independent in activities of daily living, 49.4% had independent gait, and 15.9% had a recurrent stroke. These results are similar to those obtained in other stroke population-based studies.

Caribbean

A population-based epidemiological study in Martinique, French West Indies showed that stroke in African Caribbean’s was comparable to those reported in blacks from the United States and United Kingdom (Smadja *et al*, 2001) and a high prevalence of hypertension and diabetes in the stroke population compared with those observed in continental France.

In a study of first-ever stroke patients drawn from a prospective community stroke register based in a multi-ethnic population in South London between 1995 and 2004, which included 9% black Caribbeans, 15% black Africans and 63% whites, 566 incident stroke patients were registered with 395 primary intracerebral haemorrhage and 171 subarachnoid haemorrhage. For the primary intracerebral haemorrhage, age- and sex-adjusted incidence rate ratios were higher in blacks and were particularly pronounced for patients' age 0 to 64 years with pre-stroke hypertension being more prevalent (Smeeton *et al*, 2007). The higher incidence of PICH observed in both groups of blacks could be explained by pre-stroke hypertension being more common among this sample of young blacks.

Europe

The landmark World Health Organisation Multinational MONItoring of trends and determinants in CArdiovascular disease (MONICA) Project (Thorvaldsen *et al*, 1995) is a multinational study comparing stroke incidence, case fatality, and mortality rates. During the first years of the Project, from 16 European and 2 Asian populations, a total of 13,597 stroke events were registered from 1985 through 1987, from a total background population of 2.9 million people aged 35 to 64 years. The age-standardized stroke incidence rates per 100,000 varied from 101 to 285 in men and from 47 to 198 in women. Stroke incidence rates were very high among the population of Finnish men tested. The incidence of stroke was, in general, higher among populations in Eastern than in Western Europe. It was also relatively high in the Chinese population studied, particularly among women. The case-fatality rates at 28 days varied from 15% to 49% among men, and from 18% to 57% among women. In half of the populations studied, there were only minor differences between official stroke mortality rates and the rates measured on the basis of fatal events registered and validated for the World Health Organisation MONICA Project.

For the Danish MONICA Study Group, a stroke register was established at the Glostrup Population Studies in 1982, with the objective to continuously monitor stroke occurrences within the population for duration of 10-years, and contribute findings to the MONICA Project. All stroke events in the study population were ascertained and validated according to the standardised criteria outlined by the World Health Organisation MONICA Project. This study population comprised all subjects >=25 years of age. Stroke was defined by the clinical presentation and 5,262 stroke events in >2 million person-years were analysed. The overall annual stroke attack rate per 100,000 person-years in the age range >=25 years was 272 in men and 226 in women. Over the study period, the age-adjusted stroke incidence rates declined by 2.9% in men and by 3.1% in women. The trends were statistically significant in both sexes. However, the proportion of elderly people in the study population increased during the course of the study. Hence, the numbers of stroke victims in the population remained largely unaltered (Thorvaldsen *et al*, 1999). This showed that the decreasing age-adjusted stroke incidence rates point to a reduction in overall stroke risk during the period of the study.

It is believed that the cardiovascular disease prevention, in particular improved hypertension control contributed to reduction in incidence. However, the burden of stroke on the healthcare system did not substantially diminish, as whilst less are dying from stroke, more patients are surviving with a high level of disability – consequently there is an increased burden on the healthcare system (World Health Organisation, 2008a). The gain likely achieved from reduction of preventable risk factors was almost counterbalanced by the ageing population.

According to the Stroke Association (2006) in the United Kingdom, there are occurrences of over 100,000 – 150,000 strokes a year, that is, one person is affected in every three minutes. It is the third most common cause of death, and the commonest cause of disability, with nine out of ten strokes affecting people over 55 years of age. Those having their first stroke, roughly a third recover well; a third have a moderate to severe disability; while the other third die in the coming year. In the United Kingdom, 250,000 - 300,000 people are living with stroke-related disabilities (Stroke Association, 2006). Recent report based on study from the London Stroke

Register showed a decrease in incidence of stroke over a 10-year period between different ethnic groups with the greatest decline being observed in black women, however, still indicating a higher stroke risk in black people compare with white people (Heuschmann *et al*, 2008).

In Sweden, as the elderly population grows, stable incidence and increasing survival will result in a rapidly increasing prevalence of stroke survivors, which is projected to increase by fifty nine percent (59%) by 2050 (Hallstrom *et al*, 2008). While in Norway, as in several other countries, a decreasing mortality from stroke has occurred during recent decades. The age-standardized stroke mortality for all age groups combined was 74 and 59 per 100,000 per year in men and women, respectively for 2001-2005 compared to 207 and 204 respectively, earlier in 1961-1965 (Indredavik *et al*, 2008). Bejot *et al* (2007), in a French prospective population-based study over a 20 year period, demonstrated a significant reduction in case fatality, but did not observe any significant gender based difference.

Asia

The epidemic of cardiovascular disease across most of Asia is at a different stage from that in the West; the incidence and prevalence of stroke are increasing steadily, associated with nutritional changes and ageing of the population (Thammaroj *et al*, 2005). It is now know that ischemic stroke is actually the most frequent type of cerebrovascular accident in Asia, although hemorrhagic stroke remains more common in Asia than in the West.

Stroke rates in middle-aged people (30 to 69 years) is reported to be 5 to 10 times higher in large countries such as Russia, India, China, Pakistan and Brazil, compared with the United Kingdom or the United States (Strong *et al*, 2007). The long-term survival after stroke continues to improve in Asia. However, Liu *et al* (2001) from Japan reported a slowing down in the decline of stroke mortality rate especially for men. The first prospective cohort longitudinal follow-up study in Singapore to describe the incidence of ischaemic heart disease and stroke among Chinese, Malays and Asian Indians showed that the overall incidence of ischaemic heart disease was

3.8/1000 person-years and that of stroke was 1.8/1000 person-years (Heng *et al*, 2000). This study reported that in both males and females, Indians had the highest ischaemic heart disease incidence, followed by Malays and then Chinese. For males after adjusting for age, Indians were 2.78 times ($p < 0.0001$, 95% CI 1.86 - 4.17) and 2.28 times ($p = 0.002$, 95% CI 1.34 - 3.88) more likely to get ischaemic heart disease than Chinese and Malays respectively, and for females after adjusting for age, Indians were 1.97 times ($p = 0.03$, 95% CI 1.07 - 3.63) and 1.37 times ($p = 0.39$, 95% CI 0.67 - 2.80) more likely to get ischaemic heart disease than Chinese and Malays respectively. For stroke, male Chinese and Indians had higher incidence than Malays (though not statistically significant). However, in females, Malays had the highest incidence of stroke, being 2.57 times ($p = 0.008$, 95% CI 1.31 - 5.05) more likely to get stroke than Chinese after adjustment for age. Age and sex standardised mortality rates have continued to decline in Singapore since 1970 (Venketasubramanian, 2008).

The incidence and prevalence of stroke in India has been reported to be higher than many Western nations with age standardized average annual incidence rate of first-ever-in-a-lifetime stroke of 145.30 (95% CI 120.39 - 174.74) per 100,000 persons per year and the age standardized prevalence rate of stroke of 545.10 (95% CI 479.86 - 617.05) per 100,000 persons (Das *et al*, 2007). The thirty-day case fatality rate was 41.08% (95% CI 30.66 - 53.80). Women had higher incidence and case fatality rates and despite the marked differences in socio-economic status between the slum and non-slum dwellers, stroke parameters were not significantly different. Although risk factors for stroke in urban Indian populations are similar to developed nations, it is likely that they may be quite different among the majority afflicted by poverty. The treatment options for stroke being fewer in developing countries like India with well-organized stroke services and emergency transport services lacking at the same time many treatments being unaffordable with socio-cultural factors influencing access to medical care for many stroke victims (Pandian *et al*, 2007).

Australia

In 2004-05, 18% (approximately 3.5 million) of Australians reported having a long-term cardiovascular condition (Australian Bureau of Statistics, 2006). The most common cardiovascular condition was hypertension reported by 11% (2.1 million) and the combined proportion reporting heart, stroke or vascular conditions was 3.8% with 12% of these having stroke or cerebrovascular disease.

With over 48,000 strokes occurring in Australia every year, with a stroke occurring every 11 minutes, it was the third leading cause of death and one of the leading causes of disability amongst adults (National Stroke Foundation, Australia, 2005) and the projections with the ageing population, this number will rise to 74,000 by the year 2017. Of the 48,000 people that experience a stroke each year, one third die in the first 12 months and approximately 220,000 Australians, who have suffered a stroke are living in the community (National Stroke Foundation, Australia, 2005). Whilst stroke is more common amongst the elderly, it is not confined to this particular age bracket. Over 50% of strokes occur in people under the age of 75 years, with around 5% of strokes even under the age of 45 years.

The contributions towards changes in incidence and improved survival to the downward trend in mortality from stroke in Australia had not been quantified mainly because of the difficulties in measuring the incidence of stroke accurately (Bonita and Beaglehole, 1995). However, a later recent study by Jamrozik *et al* (1999) describes trends in the key indices of cerebrovascular diseases over six years from the end of the 1980s in a geographically defined segment of the city of Perth, Western Australia, with a population of approximately 134,000 residents in a triangular area of the northern suburbs of Perth. Case fatality was measured as vital status at 28 days after the onset of symptoms. Data for first-ever strokes and for all strokes for equivalent periods of 12 months in 1989–1990 and 1995–1996 were compared by age-standardized rates and Poisson regression. There were 355 strokes in 328 patients and 251 first-ever strokes (71%) for 1989–1990; and 290 events in 281 patients and 213 first-ever strokes (73%) for 1995–1996. In Poisson models, including age and period, overall trends in the incidence of both first-ever strokes (Rate ratio=0.75, 95% CI

0.63 - 0.90) and all strokes (Rate ratio=0.73, 95% CI 0.62 - 0.85) were significant, but only the changes in men were independently significant. Case fatality did not change, and the balance between haemorrhagic and occlusive strokes in 1995–1996 was almost indistinguishable from those observed in 1989–1990. This longitudinal population-based data for key indices of stroke, suggest that it is a change in the frequency of stroke, rather than its outcome, that is chiefly responsible nationally for the fall in mortality from cerebrovascular disease. Although mortality from stroke in Australia has been falling since the early 1950s (National Heart Foundation, Australia, 1997; Thrift *et al*, 2008), the rate of decline has recently slowed (Jamrozik, 1997).

The number of Australians with heart, stroke or vascular conditions decreased from 4.3% of the population in 2001, to 3.8% in 2004-05 (age adjusted) (Australian Bureau of Statistics, 2006), however, stroke is now implicated as Australia's second single greatest killer after coronary heart disease and has become the leading cause of disability (National Stroke Foundation, 2008).

New Zealand

Stroke is generally a disease associated with ageing and older people, and has a high case fatality. The mortality rate of stroke cohort in Auckland has been reported to be nearly twice the mortality rate of the general New Zealand population (Anderson *et al*, 2004).

Anderson *et al* (2005), utilising data from the Auckland Regional Community Stroke (ARCOS), analysed long-term trend in stroke incidence in the mixed population of Auckland, New Zealand, and reported a modest decline in stroke incidence over two decades. However, they demonstrated that some favourable downward trend in vascular risk factors such as cigarette smoking were counterbalanced by increasing age and body mass index, and frequency of diabetes in patients with stroke.

Further analysis of ARCOS data looked at quantifying the impact of stroke in Auckland, and identified whether factors such as socio-economic circumstances, ethnicity, case mix, and quality of healthcare delivery influence variations in impact (Anderson *et al,* 2006). The study created a prospective population-based stroke register for the total population of Auckland in 2002/2003. All new cases of stroke were ascertained over a 12-month period, and all survivors were followed up for 6 months. In addition, the study used both qualitative and quantitative measures to determine the impact of stroke. This study confirmed that stroke is the third leading cause of death in New Zealand and also a major cause of disability. The study concluded that stroke had an enormous impact on patients, caregivers and the society at large. It is estimated that 18,000 people are living with the effects of stroke in New Zealand. This number is projected to double by 2020. There are uncertainties about what key socio-economic and health service factors influence recovery from stroke in this country.

Carter *et al* (2006), in another analysis of ARCOS data from New Zealand, assessed the changes in trends in ethnic-specific stroke incidence and attack rates, and of associated risk factors, over recent decades. They assessed trends in ethnic-specific stroke rates in Auckland using standard diagnostic criteria and community-wide surveillance procedures for years 1981-1982, 1991-1992, and 2002-2003. Indirect and direct methods were utilised to adjust first-ever (incident) and total (attack) rates for changes in the structure of the population and reported with 95% CIs. Ethnicity was self-defined and categorized as "NZ/European," "Maori," "Pacific peoples," and "Asian and others". The results suggest that the stroke attack (19%; 95% CI, 11% to 26%) and incidence rates (19%; 95% CI, 12% to 24%) declined significantly in NZ/Europeans from 1981-1982 to 2002-2003. These rates remained high or increased in other ethnic groups, particularly for Pacific peoples, in whom stroke attack rates increased by 66% (95% CI; 11% to 225%) over the same periods. The study has highlighted underlying factors that could account for the increase in Pacific and Maori stroke rates, including smoking, and the growing incidence of diabetes and obesity. It has also shown strokes are being suffered earlier in life by Maori and Pacific Island people than those of European origin. The mean age of stroke victims in New Zealand Europeans is 75 years, in Maori it is 61 years, and in Pacific peoples 65 years.

Table 6: Stroke Incidence, Prevalence and Mortality in Selected Regions and Countries

Region	Study	Incidence	Prevalence	Mortality
Asia -				
Singapore	Heng *et al*, 2000	180/100,000		
India	Das *et al*, 2007	175/100,000	545/100,000	41 %
Australia	National Stroke Foundation, 2005	48,000 new cases per year	220,000 cases	
Europe	Thorvalden et al, 1995	M 101-285/100,000 F 47-198/100,000		
New Zealand	Anderson *et al*, 2006		18,000 cases	
United Kingdom	Stroke Association, 2006	150,000 new cases per year	300,000 cases	
United States	Sacco *et al*, 1997	500,000 new cases per year		145,000 per year
United States	US Dept of Health & Human Services 2005		3,000,000 cases	
United States	American Heart Foundation 2008	780,000 new cases per year	5,800,000 cases	150,074 per year
West Indies	Smadja *et al*, 2001	Similar to blacks in US & UK		
Sweden	Ghatnekar *et al*, 2004	213/100,000		

The stroke incidence, prevalence and mortality as discussed above from different countries and regions are summarized in the Table 6. The incidence is reported to be the highest in old age and in Asians, Pacific people and African American living in the United States and in other countries. While stroke incidence has declined or declining in many developed countries it is still increasing n developing countries.

3.3 Stroke risk factors and stroke in Fiji

Fiji's population, culturally and medically, closely resemble the "Pacific people" of New Zealand. This section discusses stroke risk factor profile of Fiji and available stroke statistics from Fiji.

It is evident that over the last few decades, associated with lifestyle changes, stroke risk factors and number of strokes in Fiji's population has rapidly increased. Some 3 to 4 decades ago, the incidence and prevalence of stroke risk factors such as hypertension, diabetes mellitus, obesity, poor diet, hyperlipideamia, smoking and binge drinking were low in Fiji. A review of available local literature on stroke risk factor profile and number of strokes for Fiji is presented here.

Hypertension

Maddocks (1961), in one of the earliest studies on hypertension in Fiji, observed that some populations did not show the higher blood pressures of later life characteristic of Western populations. Tempted to associate the apparently indolent, secure, and unhurried life of the Pacific Islanders, of that time, with this relative freedom from hypertension, as he stated that "hurry and worry that accompany Western civilization are often invoked as etiologic factors in hypertension", and set out to compare a group of 121 Indian businessmen in Suva, selected for their relatively high standard of living, with a group of 1208 poorer rural Indian male sample. He reported that the mean of both systolic and diastolic pressures were significantly higher in the urban sample (average BP 135/88) when compared to the rural (average BP 129/79) Indian male population. Although by definition, both groups studied were non-hypertensive with BP below 140/90 (Whitworth, 2003; National Heart Foundation of Australia - National Blood Pressure and Vascular Disease Advisory Committee, 2008), Maddock managed to show that the urban Indian business men living in Suva, on the average, had higher blood pressure compared to poorer rural Indian male counterpart.

Fiji Non-communicable Disease (NCD) STEPS survey of 2002 (Cornelius *et al*, 2008) found the prevalence of hypertension in the population of 15-64 year age group to be 19.1% with 63% of these being newly diagnosed. Fijians had a higher prevalence of 21% compared to 16% in Indians. The proportion of uncontrolled previously diagnosed cases was higher amongst Fijians (81%) compared to Indians (58%).

These findings confirm the presence of a high proportion of persons with untreated hypertension, at a risk of stroke, living in the community in Fiji.

Diabetes Mellitus

Diabetes mellitus is a well known risk factor for stroke. Kissela *et al* (2005) in a population-based study found that diabetes mellitus was clearly one of the most important risk factors for ischemic stroke, especially in those patients less than 65 years of age with estimates that 37% to 42% of all ischemic strokes in both African Americans and whites being attributable to the effects of diabetes mellitus alone or in combination with hypertension.

Diabetes mellitus was relatively rare amongst Fijians in the past, but in recent years, it has become a major public health problem. Several epidemiological and clinical studies on diabetes mellitus in Fiji, in the last decades, indicate worsening trend on diabetes incidence, prevalence, and related morbidity and mortality.

The first major study on diabetes was carried out by Cassidy (1967) in 1964 - 1965. He screened 1000 adult Indians (>21 years) and 1000 adult Fijians from urban and peri-urban areas. He reported that the overall prevalence of diabetes was 3.1%, with Indians having a higher rate of 5.7% and Fijians with a relatively lower rate of 0.6%. The ratio of known diabetics to new cases was 2:1. This ratio was same for both ethnic groups.

There were differences in clinical presentation of diabetes mellitus between the two major ethnic groups in Fiji. Cassidy (1967) also studied 410 hospital admissions to the Colonial War Memorial Hospital in Suva, the main referral and teaching hospital in the country. He reported striking differences in the clinical presentation. In Indians, 50% presented with classical symptoms of polyuria, polydipsia and weight loss; 25% with complications; while 25% were asymptomatic and detected on routine urine testing. Whereas, in Fijians 44% presented with diabetic sepsis, mainly of lower limbs; 19% had classical symptoms; while 25% with complications. Vascular complications were more frequent in Indians and infections in Fijians. Retinopathy, neuropathy and nephropathy occurred with equal frequency in both the ethnic groups. Diabetic coma was extremely rare even under the stimulation of major sepsis.

The second major study, a National Diabetes and Cardiovascular Diseases Survey was carried out in 1980 by the Fiji Ministry of Health with assistance from the World Health Organization and two Melbourne Hospitals (Ram *et al*, 1982; Zimmet *et al*, 1983; Taylor *et al*, 1984). In this study, both urban and rural samples were included. The overall prevalence of diabetes mellitus in urban settings was 5.4%, up from previous 3.1% in 1967, and was five times the rural prevalence rate of 1.1%. There were again ethnic differences in prevalence of diabetes mellitus in rural and urban areas. For Fijians, the urban prevalence rate was 10.4% and rural 4.7%, while for the Indians, the rates were similar in urban (11.8%) and rural (11.7%) areas.

The study also reported that the level of physical activity had an association with the prevailing rate of diabetes mellitus. The prevalence was lower amongst those engaged in moderate to heavy physical activity compared to those in the sedentary group. This difference was present in both ethnic groups and maintained when age, obesity and urban/rural status were taken into account. This indicates the role of physical inactivity as an independent risk factor contributing towards non-insulin dependent diabetes in Fiji.

The above, and a number of other clinical studies (Ram, 1979; World Health Organisation, 1980; Tuomilehto *et al*, 1982; Ram, 1983; Ram *et al*, 1983; Naidu *et al*, 1983; Tuomilehto *et al*, 1984), show that diabetes mellitus has become a major public health concern in Fiji. If the impaired glucose tolerance test and diabetes mellitus rates are combined with the 1980 study, the results can be compared with those from the earlier study conducted in 1964-65, which shows a three fold increase.

The hospital admissions for diabetes mellitus over the decades show a similar increase in trend. Sicree *et al* (1985) reported doubling of diabetes related hospital admissions for every 10 years with 170 admissions in 1952 to 356 in 1962; and from 677 in 1972 to 1335 in 1980. The percentage increase was greatest in ethnic Fijians, in whom there was a 34 fold increase over this period. Diabetes mellitus was associated with several adverse health outcomes.

The most recent major study, Fiji Non-communicable Disease (NCD) STEPS survey conducted in 2002, reported a prevalence of diabetes mellitus of 16% for the age group 25-64 years with 53.2% being recently diagnosed. The prevalence amongst Indians had risen to 21.2% when compared to 11.5% amongst Fijians. The urban rate of 24.7% was twice as high as the rural rate of 12.8% (Cornelius *et al*, 2008).

Diabetes mellitus continues to be a devastating disease in Fiji with estimates that one in every eight people is affected in some way by the disease; and around 80% of all hospital admissions into medical and surgical wards were diabetes related (World Health Organisation, 2008b).

Like the ethnic difference in clinical presentation of diabetes mellitus in Fiji, whether there are clinical differences in stroke presentation, complications, recovery, outcome, incidence and prevalence amongst Fiji's two major ethnic groups is not known. This could be an interesting area for future research.

Diet, Obesity and Hyperlipideamia

There has been increasing levels of obesity amongst Fiji population with higher mean body weight associated with urban living. Maddocks (1961), based on the measurements of average difference between the arm circumference of 1.6cm between the two Indian samples in his blood pressure study in Fiji, estimated that there was a weight difference of approximately 6Kg between urban and rural samples with urban dwellers being heavier.

Comparing urban and rural populations of Fijians over the age of 40 years, Russell-Jones *et al* (1990) reported highly significant differences in mean weight, body mass index, prevalence of impaired glucose tolerance, prevalence of diabetes, mean glycosolated haemoglobin, mean systolic blood pressure, fasting cholesterol, immunological albumin, immunological transferrin, and Al and B apolipoproteins. The higher value was associated with urban dwellers. The metabolic syndrome has been shown to be the only predictor of large vessel atherosclerotic stroke among the older patients (OR 1.58, 95% CI 1.17-2.12 for Korean; OR 1.75, 95% CI 1.07-2.84 for Californian), but not in the young or oldest groups (Bang *et al*, 2009).

In a longitudinal cohort study of Body Mass Index (BMI) in a traditional Fijian village, from 1989 to 1998, Becker *et al* (2005) reported a dramatic increase of 84% in the prevalence of overweight. The authors stated that this is one of the highest in the world.

Fiji Non-communicable Disease (NCD) STEPS survey conducted in 2002 (Cornelius *et al*, 2008) confirmed a rapid increase in the proportion of overweight and obesity in both genders prior to the age of 30 years with a prevalence of central obesity amongst female of 45% and male 4%. The overall proportion of overweight (BMI 25-29.9) in the 15-64 age group was 29% and obesity was 8%. Generally, females and Fijians had a higher mean BMI which co-relates to Becker *et al* (2005) study.

Along with increasing obesity, the findings confirmed poor dietary practice, generally with low consumption of fruit and vegetables, with 66% of survey participants eating less than one serve of fruits per day and 26% eating less than one serve of vegetables per day.

The Fiji Non-communicable Disease (NCD) STEPS survey conducted in 2002 (Cornelius *et al*, 2008) also found a trend of increasing mean cholesterol level with age, with a persistent tendency for levels in each age group to be higher for male than female.

Smoking and Alcohol

The overall prevalence of “current smokers” in Fiji was 37%. Quantitative level of number of cigarettes or pack-years smoked was not assessed. Smoking has been shown to be a predictor of large vessel atherosclerotic stroke. Among young patients, after adjusting for covariates, current smoking was the only predictor of atherosclerotic stroke at both Korean (OR 2.04; 95% CI: 1.13-3.69) and Californian study samples (OR 4.78, 95% CI 1.54-14.89) (Bang *et al*, 2009). Binge drinking was defined as having a mean of 5 or more standard drinks per drinking day for males and a mean of 4 or more standard drinks per drinking day for females. Overall 77.3% of current alcohol consumers were binge drinkers, with a higher proportion for males (79.5%) as compared to females (58.6%). There was also a trend for a higher of binge drinking amongst younger age group and of Fijian decent (Cornelius *et al*, 2008). Binge drinking is a risk factor for stroke. A large prospective cohort study of 15,965 Finnish men and women age 25 to 64 years showed binge drinking to be an independent risk factor for total and ischemic strokes (Sundell *et al*, 2008).

In a recent report, which identified the trend of lifestyle diseases among the urban and rural dwellers from four years of Community Health Monthly Consolidated Reports (MCR), authors determined the extent of non-communicable disease in relation to poor diet and the changing lifestyles, and concluded that non-communicable diseases caused premature deaths with high mortality rate of young to middle age persons (Kepa and Makutu, 2008). The authors are of the view that “it is a great concern to the Fiji nurses with the implications of poverty created from loved ones lost to non-communicable diseases becoming a serious threat”.

Number of strokes in Fiji

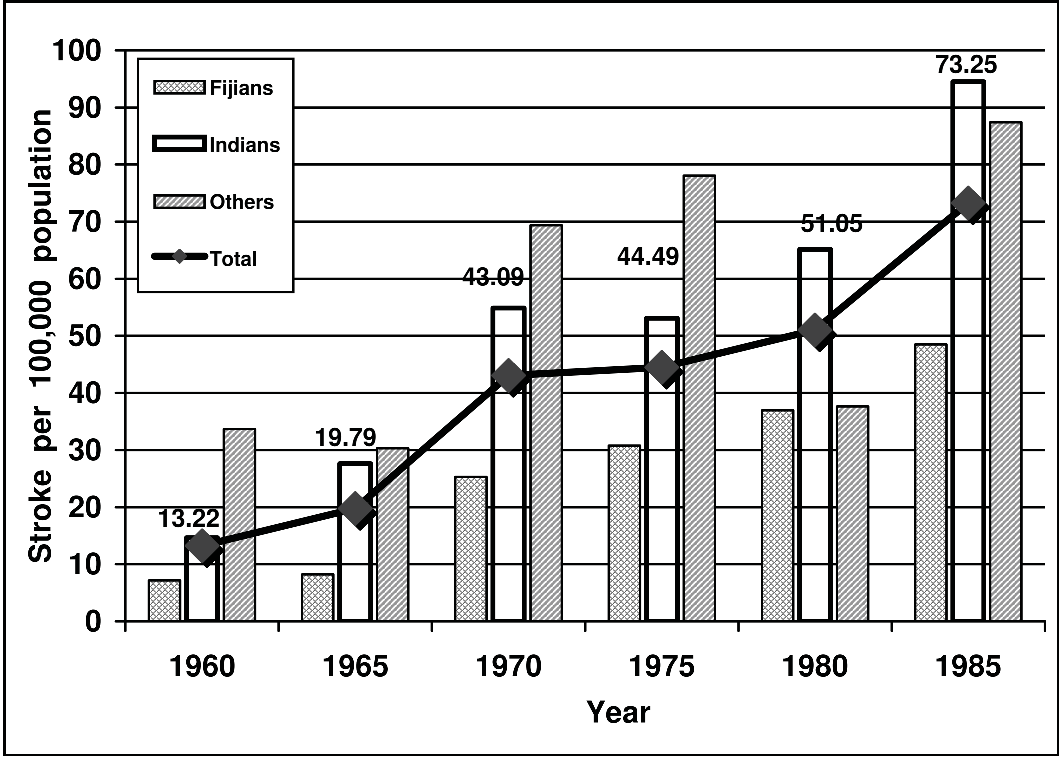
Although the above discussed cardiovascular disease and stroke risk factor profile for Fiji is published, there is scarcity of published data on the trends of stroke incidence, prevalence, mortality and outcome in Fiji. The following two sets of unpublished data obtained from official government reports demonstrate an increasing incidence over the decades since 1960s.

Data obtained from the Ministry of Health Annual Reports over a period of 25 years from 1960 to 1985 adjusted for changes in population and stratified according to ethnicity show an increase from 13.22 per 100,000 to 73.25 per 100,000 population, a 5.5 fold increase over a 25-year period (Maharaj, 1999). This is represented in the

Figure 2 below. The Ministry of Health Annual Reports are Parliamentary documents summarising the Ministry's activities and health statistics for a calendar year. The huge jump in the incidence of stroke over these decades may be explained by changes in lifestyles, increasing prevalence of stroke risk factors in the community as discussed above, ageing of the population, more accurate certification and reporting, and better data collection.

The second set of data is the number of stroke cases, both hospitalised and not hospitalised, available for Fiji (Ministry of Health, 1997) is presented in the Figure 3 below, as raw number of stroke cases per year for 14 years from 1980 to 1994. This also shows an increasing trend. Both these sets of data from the Ministry of Health Annual Reports confirm an increasing trend of stroke in Fiji over the last three decades up to 1994.

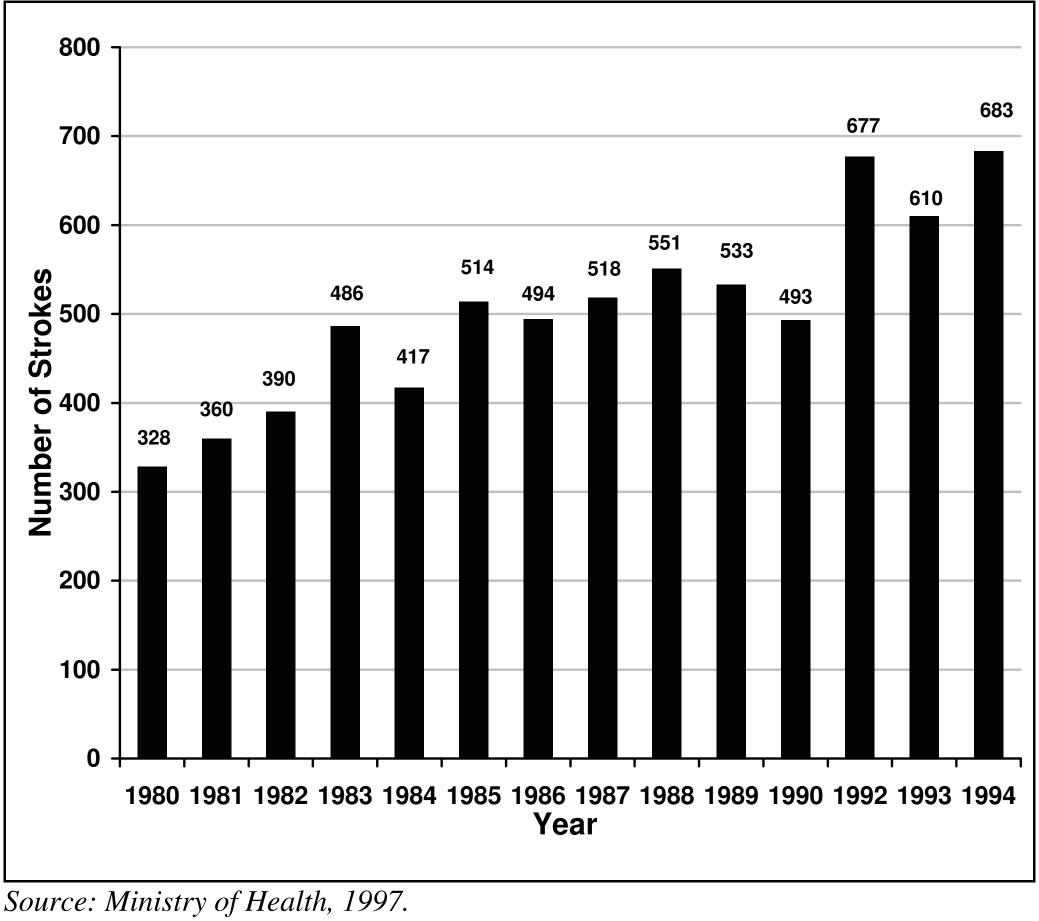
Figure 2: Stroke in Fiji 1960 - 1985 by Ethnicity and Total



Source: Ministry of Health Annual Reports. (Dr JC Maharaj).

The age-standardized sex-specific mortality rate for cerebrovascular diseases in Fiji, for the 35-64 year age group in 1999, was reported to be 71.1 per 100,000 population for men (95% CI 51.9 - 90.2) and 54.8 per 100,000 for women (95% CI 37.3 - 72.3) (Menzies Centre for Population Research, 1999). This figure seems to be understatement, as some of those, who die from stroke, are certified as dying from hypertension. They are thought to be more properly classified as suffering from stroke. In contrast, the age-standardized sex-specific mortality for the 35-64 year age group in Australia was only a quarter of this - 19.3 per 100,000 for men and 12.4 per 100,000 for women. When standardized to an Australian population, the Fijian statistics suggests a stroke incidence of 206 per 100,000 population every year - roughly equivalent to that found in Australian populations. In Fiji, the overall in-hospital death rate was 25.5%, with those returning home from hospital having a much higher mortality rate (Lowe, 2001).

Figure 3: Stroke in Fiji 1980 - 1994 based on Hospital Admissions



Source: Ministry of Health, 1997.

In the 10 year period from 1989-1998, 1801 cases of stroke were recorded in the Nausori/Suva/Lami/Navua region, giving an incidence rate of about 94 cases per 100,000 population per year (Maharaj, 1999). By contrast, in a developed world population, approximately 240 patients per 100,000 population come for medical attention for a stroke every year. About 20% of stroke patients in Western countries will die in the first month after a stroke (Hankey and Warlow, 1999). The cause for this apparent lower incidence of patients with stroke reported in Fiji is probably because of the younger population and also due to certification issues related to the presence of multiple co-morbidities (Maharaj and Ehrlich, 1999).

Lowe (2001) further suggests that the overall picture seen in Fiji portrays that there are roughly equal numbers of patients presenting to the hospital with stroke, but markedly increased death rates. Lowe (2001) went on to hypothesise that Fiji has about one and a half to two times the stroke incidence of Australia (although only half present themselves to hospitals), and the mortality is about two to three times more. This would fit well with some of the other information that is available with regards to health in Fiji. Records show that many people do not present themselves to hospitals even with serious disease. It also depicts that only about half of the total recorded deaths are from strokes which have been treated within hospitals. The records go further to suggest that it is difficult to transport people with major stroke from remote rural communities, and that stroke treatment and rehabilitation are mostly unobtainable in Fiji (Lowe, 2001). Only about 50% of people with stroke presenting to hospitals could be partially due to rural remoteness and lack of treatment facilities, and also attributed to the failure in recognising signs of stroke and resorting to traditional cures, which is a common practice in Fiji (Cornelius *et al*, 2008).

Thus, if stroke incidence and prevalence are higher in Fiji, the main risk factors for stroke are probably hypertension, diabetes mellitus, obesity and hyperlipideamia. Rheumatic heart disease is another condition still fairly common in Fiji and directly accounted for 3.8% of strokes that presented to one of the three base hospitals (Steer *et al*, 2009). Atrial fibrillation and carotid stenosis are other important risk factors for stroke, which are managed differently in Fiji, when compared to Western countries such as Australia.

Data on stroke mortality in Fiji, available from the Ministry of Health (2005), show an increasing trend for all ethnic groups, gender and age-groups 0-39, 40-59 and 60 years and over respectively, from 1998 to 2001. The number of deaths from stroke was 199, 390, 415 and 452 for the years 1998, 1999, 2000 and 2001 respectively. The very large increase of almost 200 deaths between 1998 and 1999 is difficult to explain. Whether there was an under-reporting in 1998 or the certification improved since 1999 has to be ascertained. This was beyond the scope of this study but needs further research. As expected, stroke mortality rapidly increased with increasing age of Fiji's population. This data is shown in Table 7.

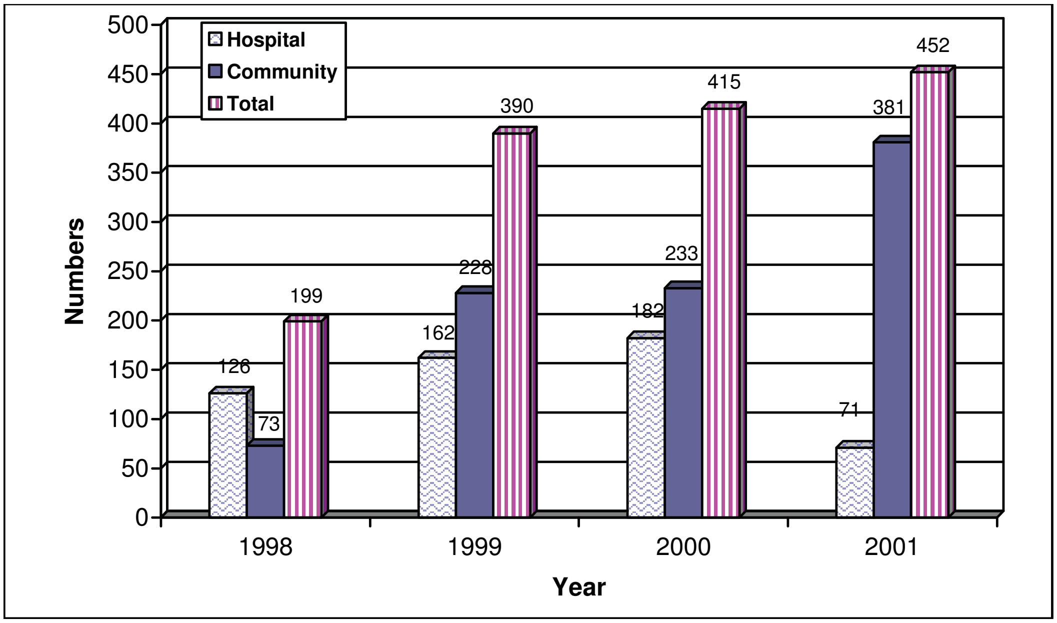
Table 7: Stroke Mortality in Fiji by Race, Gender and Age-group for 1998-2001

Year	**Race**			**Gender**		**Age group**			**Total**
	Fijians	Indians	Others	Male	Female	0-39	40-59	Over 60	
1998	104	87	8	108	91	8	58	133	199
1999	186	189	15	198	192	8	98	284	390
2000	202	203	10	211	204	17	125	273	415
2001	250	186	13	234	218	37	120	295	452

Source: Ministry of Health, 2005.

The Ministry of Health (2005) data provides further information on the place of stroke mortality as either in a hospital or in the community, indicating that, except for 1998, there were always more stroke deaths in the community. This may explain, to some extent, the large disparity, as it appears due to under-certification of mortality from stroke of persons with multiple comorbidities dying in the community. This data is displayed in the Figure 4 below.

Figure 4: Stroke Mortality in Hospital, Community and Total in Fiji for the years 1998 – 2001



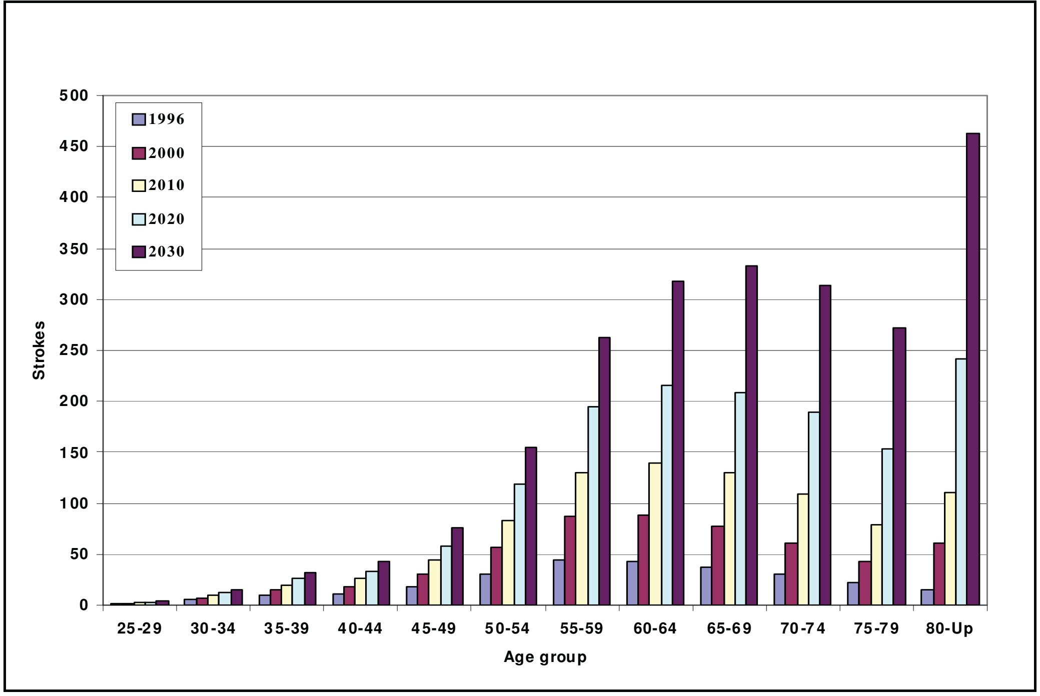
Projected stroke incidence in Fiji

The incidence and burden of stroke in Fiji is projected to increase along with the accelerated ageing of the Fijian population. As more people survive to older ages, the prevalence of stroke will increase, even if the overall risk of stroke remains stable across time. To generate these estimates, Maharaj and Panapasa (2002) first projected the Fiji population from 2000 to 2030, then generated failure rates for 1996, which were applied to these population projections, producing prevalence estimates for the number of stroke victims by five-year age groups from 2000 to 2030.

As shown in Figure 5, the number of strokes increases each decade for all ages, but the greatest increases is seen among the oldest age group. Even with the most conservative estimates, rapid growth in the size of the oldest age group increases the estimated number of strokes per year from 16 strokes among those who are 80 years and over, to an exponential figure of 463 strokes per year for the same age group by the year 2030. Overall, this represents a doubling of the total prevalence of strokes across all ages between 1996 and 2000, with a 50% increase in strokes for each decade between 2000 and 2030. In terms of total prevalence across time, the number of strokes is projected to have an almost 8.5 fold increase from 271 strokes in 1996 to almost 2,300 strokes for the year 2030. This rapid increase shows a significant additional burden to families, medical and health care service providers, and social support networks, who are already straining to meet current demand.

However, the potential influence of various socio-economic factors on stroke in Fiji has not been studied before and is the subject of part of this thesis.

Figure 5: Projected Numbers of Stroke by Age in Fiji 1996 – 2030



Source: Maharaj and Panapasa, 2002.

3.4 Risk factors and probability of stroke

3.4.1 Risk factors for stroke

Our current knowledge recognises that there are many risk factors for stroke and that some are better studied and understood than others. There are various well documented, and some less well-documented, risk factors of stroke. These are traditionally divided into modifiable and non-modifiable risk factors contributing towards stroke incidences. Sacco *et al* (1997) provide an exhaustive list of such risk factors categorised as well-documented risk factors into modifiable, value established, with the inclusion of the following:

- hypertension,
- cardiac disease,
- atrial fibrillation,
- infective endocarditis,
- mitral stenosis,
- recent large myocardial infarction,
- cigarette smoking,
- sickle cell disease,
- transient ischemic attacks, and
- asymptomatic carotid stenosis.

It also includes potentially modifiable risk factors including:

- diabetes mellitus,
- hyperhomocysteinemia, and
- left ventricular hypertrophy;

and nonmodifiable factors such as:

- age,
- gender,
- hereditary/familial factors,
- race/ethnicity, and
- geographic location.

They provide a lengthy list of less well-documented risk factors with potentially modifiable factors being:

- elevated blood cholesterol and lipids,
- cardiac disease,
- cardiomyopathy,
- segmental wall motion abnormalities,
- nonbacterial endocarditis,
- mitral annular calcification,
- mitral valve prolapse,
- valve strands,
- spontaneous echocardiographic contrast,
- aortic stenosis,
- patent foramen ovale,
- atrial septal aneurysm,
- use of oral contraceptives,
- consumption of alcohol,
- use of illicit drugs,
- physical inactivity,
- obesity,
- elevated hematocrit,
- dietary factors,
- hyperinsulinemia and insulin resistance,
- acute triggers (stress),
- migraine,

- hypercoagulability and inflammation**,**
- fibrin formation and fibrinolysis**,**
- fibrinogen**,**
- anticardiolipin antibodies**,**
- genetic and acquired causes**,**
- subclinical diseases**,**
- intimal-medial thickness**,**
- aortic atheroma**,**
- ankle-brachial blood pressure ratio**,**
- infarct like lesions on MRI, and
- socio-economic features;

and nonmodifiable factors being:

- season and climate.

Probably the most effective methods of preventing stroke is prevent the modifiable risk factors or to identify people with existing risk factors and other evidence of vascular disease and to treat or manage them to decrease, control or eliminate the risk factors and vascular disease in order to prevent stroke. As such, the important issue is to accurately recognise the existing or impending risk factors of stroke and the evidence of vascular disease.

The importance of primary prevention of stroke through recognition, control and elimination of modifiable risk factors for stroke is critical in Fiji's situation. As discussed in earlier sections, the medical risk factors for stroke, such as hypertension, diabetes mellitus, hyperlipideamia and obesity are common, and there is a high prevalence of comorbidities in patients admitted to medical wards in Fiji (Maharaj and Ehrlich, 1999). Controlling these will reduce the risk of stroke. One example of the efficacy of control over a medical risk factor for stroke is the Heart Outcome Prevention Evaluation (HOPE) trial, in which patients with any previous vascular event (i.e. stroke, ischaemic heart disease or peripheral vascular disease) were assigned to either an Angiotensin Converting Enzyme (ACE) inhibitor (ramipril) or placebo, which showed a significant reduction in the rates of death, myocardial infarction, and stroke in a broad range of high-risk patients, who were not known to have a low ejection fraction or heart failure (The Heart Outcomes Prevention Evaluation Study Investigators, 2000). According to Gubitz and Sandercock (2000), treatment with the ACE inhibitor resulted in a relative risk reduction of 25% for cardiovascular disease; 20% for myocardial infarction; and 32% for stroke.

The implications of this trial for clinical practice are that if 50% of people in developed countries, and 25% of people in developing countries with vascular disease were to take the ACE inhibitors, 400,000 deaths and 600,000 non-fatal cardiovascular events could be prevented every year, but at a substantial cost. However, particularly in developing countries like Fiji, where resources are limited, this investment, in the longer term, offers large gain through cost-offsets, health expense savings and positive impact on the national economy. The success of these interventions to control one medical risk factor suggests that it should also be possible to decrease morbidity and mortality as a result of cerebrovascular disease in Fiji.

However, now there is debate between epidemiologists about the pros and cons of a targeted screening approach for managing the risk of cardiovascular disease versus policy interventions aimed at reducing risk factors across entire populations. Jackson *et al* (2008) pointed out that the World Health Organization conducted a review comparing high-risk and population-wide interventions to prevent cardiovascular disease globally, which revealed that "treating high-risk patients with aspirin, off-patent statins, and blood pressure lowering drugs was not only cost effective but would avert more DALYs worldwide than population based interventions." However, Capewell *et al* (2008) noted that such targeted programs focussing on individuals can often result in the less affluent and less educated people being disadvantaged leading to an increase in social inequalities. "Disadvantage can occur at every stage in the process, from the person's health beliefs and health behaviour, through presentation, negotiation, participation, and adherence with treatment". Unfortunately, each of these interventions will be expensive for Fiji, and further research is required to analyse their cost-effectiveness, particularly amongst Fiji's population, as there is no such study to demonstrate its effectiveness on this population.

3.4.2 Socio-economic status and health

It has been postulated that the correlation of socio-economic status to health is not linear in nature. That is, just the number of years of education or level of income does not explain all the correlation. There is a more complex association of socio-economic status with a broader spectrum of health conditions. The way, in which socio-economic status persistently predicts correlation with health condition, even when other factors are controlled, suggest more than "gradient" relationship. Thus, Young (2004) proposed a new sociological theory in an attempt to explain the correlation of socio-economic status to health, and stated that the biomedical model alone does not provide the full explanation of wellness. He proposed an alternative social "structural" model, while leaving the "biomedical" model to explain for curative medicine and epidemics. Thus, strengthening the sociological rationale for public health and positive health initiatives.

Growing socio-economic disparities in health for both younger and older populations have also been reported across time. Martin *et al* (2007) analysed a large data-set from self-reported general health status of 1982 – 2003 National Health Interview Surveys conducted in the United States, and found that although there was a small decline in the proportion of disability, there was a widening health disparity by income, and narrowing of the race/ethnicity and education gap. Falling health status of a population in a "transitional economy" with falling living standards and widening income inequalities is also recognised (Petrovici and Ritson, 2006), and the economic changes in the Central and Eastern European Countries reported age, income, and health motivation as significant socio-economic factors.

Socio-economic status not only produces disparities in prevalence of health conditions, but has considerable impacts on mortality. In one of the broadest international studies to date, Mackenbach *et al* (2008) compared the magnitude of inequalities in mortality and self-assessed health among 22 countries in all parts of

Europe. They obtained data on mortality according to education level and occupational class. In almost all countries, the rates of death and poorer self-assessments of health were substantially higher in groups of lower socio-economic status, but the magnitude of the inequalities between groups of higher and lower socio-economic status was much larger in some countries when compared with others.

The magnitude of risk for a particular condition varies substantially across countries amongst lower socio-economic class to produce differing epidemiological picture. As for example, in the United States, socio-economic conditions are usually most strongly related to the risk of cardiovascular disease, yet in countries such as France and Italy, socio-economic conditions are more strongly related to the risk of cancer, than to the risk of cardiovascular disease (Berkman and Epstein, 2008). These authors further report that the socio-economic status, as it relates to differences in rates of smoking, also does not appear to explain differences in mortality from causes generally attributable to smoking (e.g., chronic obstructive pulmonary disease and various cancers). For example, in Hungary, differences in the rates of smoking according to socio-economic status are very small, whereas differences in mortality according to socio-economic status for conditions related to smoking are large.

Socio-economic determinants being relevant to both the communicable and non-communicable disease alike produces the excess mortality amongst the lower socio-economic status by shortening their life expectancy. The gross inequalities in health that is seen within and between countries, present a spread of life expectancy of 48 years among countries and 20 years or more within countries (Marmot, 2005). Improving socio-economic status and extending life expectancy adds to national economy, as according to World Health Organisation, increasing life expectancy at birth by 10% increases economic growth by 0.35% each year (Hunter and Richards, 2008).

It is of paramount importance to have a clearer understanding of the degree of impact which various socio-economic factors may have on the causation of cerebrovascular disease and the incidence of stroke morbidity and mortality. This concept is subject of this study and is further discussed in the methodology section of this thesis and detailed in the Chapter 6 – Impact of Socio-economic variables on Stroke Likelihood: A Probability Modeling.

3.5 Psychological well-being after stroke

Stroke brings sudden and unexpected change for the victim and his or her family members. After a stroke, many people continue to live in the community with their residual impairments, activity limitations and participation restrictions (Parker *et al*, 1996; Lofgren *et al*, 1998; Nichols-Larsen *et al*, 2005; Salter *et al*, 2008), which can pose significant distress and ill health not only to stroke survivors, but to their spouses (Nilsson *et al*, 2001; Wilz and Kalytta, 2008) and carers (Parag *et al*, 2008).

Good health is defined as a “state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity" (World Health Organisation, 1948). Following stroke a person’s global health can be adversely affected. Several studies in the literature describe poor quality of life or life dissatisfaction after stroke due to limited activity, impaired social network, gender, extent of infarct and depression in comparison to controls (Astrom *et al*, 1992; King, 1996; Kwa *et al*, 1996; Wyller *et al*, 1997; Gray *et al*, 2007; de Ridder *et al*, 2008; Gargano *et al*, 2008).

There is no consensus on the exact definition of “quality of life”. It has been suggested that quality of life is the measure of the gap between the person’s perceived expectations and achievements (Calman, 1984). The term “quality of life” has been used in different fields and with different meanings (Bulpitt and Fletcher, 1990) including “psychological well-being” and “morale”. James and Potter (1993) suggest that exclusive definition of quality of life is impossible due to its subjective nature and individual complexities that are influenced by a multitude of factors. Since it is difficult to define, quality of life is also tedious to measure in a standardised scientific manner.

There are many different definition of quality of life, but the World Health Organisation (1995) proposed the definition below:

> *"An individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the persons' physical health, psychological state, level of independence, social relationships, and their relationship to salient features of their environment."*

Comprehensive stroke outcome is not easy to measure because of the heterogeneity of stroke signs, symptoms, and the board definition of quality of life. Assessments have shifted from traditional biological and physical measurements, such as evaluation of physical limitation, functional impairment, and mortality, to parameters that are generated from the patients own perception (Kranciukaite and Rastenyte, 2006). The patient-centred outcomes incorporate individual patient's own subjective perception about their quality of life (Prueksaritanond *et al*, 2008). Although these can be more difficult to quantify, these functional status and health-related quality of life measures are often more clinically relevant, thus, are increasingly being pursued as outcome measures in clinical research (Williams, 1998).

Life satisfaction is thought of as an individual's own comprehensive life assessment using their own criteria, perception and judgement. Literature abounds with conflicting results on association between life satisfaction and quality of life, with some researchers believing that life satisfaction is a cognitive element, which explains the subjective nature of quality of life (Pippalla *et al*, 1997), while others equate life satisfaction to quality of life, even calibrating their quality of life instruments using satisfaction scales (Ferrans and Powers, 1992). Furthermore, studies have reported either high correlations or even weak associations between life satisfaction and quality of life (Kreitler *et al*, 1993). Hackett and Anderson (2006) indentified the multifactorial and complex nature of mood disturbance after stroke and from their study reported the key baseline predictors of abnormal mood after stroke to be disability and history of depression.

In terms of health related quality of life (HRQoL), a large number of generic and condition specific instruments, mainly questionnaire-based, are in use. As the objective of this study is to measure psychological well-being of community dwelling stroke survivors and matched controls, appropriate measurement instruments are discussed in the chapter on methodology.

Chronic illness in a family member, apart from causing emotional distress of the spouse (Nilsson *et al*, 2001; Wilz and Kalytta, 2008), can also cause distress throughout the family, and may impair the family's dynamics and ability to support the person (King *et al*, 2002; Holmes and Deb, 2003). Some of the related findings from studies in the literature are discussed below.

In New Zealand, Anderson *et al* (2004) determined survival and health status at 21-year follow-up of patients, who participated in a population-based stroke incidence study undertaken in Auckland, during the twelve months beginning March 1st, 1981. Half of all residents of Auckland with acute first-ever or recurrent stroke (n=680) were assessed during this period and followed up prospectively during the next two decades. In 2002, their vital status and health-related quality of life (HRQoL) using the 36-item short-form questionnaire (SF-36) was determined by telephone interviews. The SF-36 profile of 21-year stroke survivors was compared with a standardized New Zealand population. Overall, 626 of the original cohort had died and four were lost to follow-up, leaving 50 (7%) individuals (57% male; mean age 70 years) available in 2002, of whom 12% were residents of an institutional care facility and 19% required help with everyday activities. The stroke cohort had nearly twice the mortality rate of the New Zealand population, but the SF-36 profile of very long-term stroke survivors was broadly similar to the general population. Because stroke is generally a disease of older people and has a high case fatality, it is not surprising that only 1 in 10 people survive two decades after onset. However, of those who do, their HRQoL profile suggests that they settled relatively successfully within the general population, despite ongoing disability and a higher mortality risk. Of course, local community characteristics of care and support available to the stroke survivors would have had an influence on the outcome.

Hafsteinsdottir and Grypdonck (1997) reviewed four qualitative studies from the research literature on the patient's experience of stroke and reported that stroke patients often have clear goals for themselves in relation to functional abilities, against which they measure all success and forward progress in their rehabilitation. However, studies show that the psychological impact of stroke experience is immense (Paul *et al*, 2005) and that stroke patients experience stress on a variety of levels with depression and anxiety (Sturm *et al*, 2004a) and handicap independently of physical impairment and disability (Sturm *et al*, 2004b) existing in a large portion of the stroke population. The impact of stroke also influences the patient's social existence, as studies have shown that stroke patients do manifest diminished social function (Lo *et al*, 2008).

Lofgren *et al* (1999) assessed 47 community dwelling stroke survivors, three years after discharge and interviewed them regarding their psychological well-being with the Philadelphia Geriatric Center Morale Scale (PGCMS). They found that more than half of the stroke subjects were classified as having levels of psychological well-being that were good or fairly good. However, Clarke *et al* (2002) using secondary analysis on data from the second wave of the Canadian Study of Health and Aging (CSHA-2), investigated patterns of well-being in community dwelling stroke survivors to identify those factors that restrict or enhance well-being. They compared stroke survivors with senior community dwellers, who had not experienced a stroke. Stroke survivors reported a lower sense of well-being and were more likely to be restricted in their physical and cognitive function, to report worse mental health, and to be living with a greater number of co-morbid health conditions. They concluded that mental health and physical and cognitive disabilities are associated with a reduced sense of well-being in stroke survivors, but social supports and educational resources moderated the impact of functional status on well-being.

Studies predicting functional outcomes of stroke have mainly used clinical and demographic measures. Johnston *et al* (2004) examined the additional predictive value of psychological predictors in a cohort of patients, who were assessed on six occasions between admission to hospital and three years post-stroke, with 40 of the original sample of 101 being available at the final assessment. In this study of demographic variables, clinical indices and psychological measures were used to predict survival to three years and three-year functional recovery was assessed using measures derived from the Barthel Index, which took account of initial levels of performance. For functional recovery, multiple regression analyses showed that fixed clinical and demographic indices explained only 16% to 40% of the variance in recovery, whereas important perceptions of control six months after discharge added significantly to the predictive equations.

Psychological well-being can be influenced by many different factors. While there is no one-to-one correlation with the severity of disease (Chassany *et al*, 2004), numerous other factors can influence psychological well-being including individual adaptability (Clarke and Black, 2005), leisure activities (Sveen *et al*, 2004), level of IADL functionality (Lalu, 2003), co-morbidities (Maddigan *et al*, 2005), hospital discharge planning (Hoffmann *et al*, 2003), family support (Jaracz and Kozbski, 2003), and social support and social-related activities (Kim *et al*, 1999; Lundgren *et al*, 2000).

The assessment of psychological well-being of community dwelling stroke survivors and matched controls in Fiji was one of the objectives of this study and the details of the methodology and finding are presented later in this thesis.

Besides psychological impact, stroke causes economic impact and hardship at various levels for the patients, families, carers, the society and the nation. This is the subject of next theme of this thesis.

3.6 Economic analysis of stroke

Stroke has been reported to be a major cause of death (World Health Organisation, 2005) and chronic disability; and as such, is costly. The economic analysis of stroke, in literature, mainly report on cost of resource utilisation after stroke, which are categorised as either directly or indirectly related to the care of the stroke survivor, at acute, sub-acute rehabilitation and long-term care in the community or residential facility. While the direct and indirect costs related to stroke care are very important aspects of economic burden of stroke, the economic analysis of stroke, in this study, calculated the human capital loss for Fiji from stroke mortality only. This is an additional aspect of economic burden of stroke that is not well reported in literature.

Various country specific economic burdens of stroke studies are discussed and cited here. In the United States of America, Morgenstern (2005) conducted a comprehensive cost analysis of all the important aspects of all sub-types of strokes, including cost of therapy, professional fee for providing therapy, cost of complications, administrative fee for giving therapy, e.g., pharmacy, nursing, extra tests needed for patients receiving therapy (e.g., extra CT Scan), length of hospital stay, cost of rehabilitation, cost of nursing home, loss of wages and productivity (indirect costs), stroke recurrence rate, post-stroke life expectancy, ability of patients to recover and leave the nursing home, cost of setting up 'stroke teams'; and thus, concluded that the cost of stroke in the United States of America was US$3,040 billion a year.

In the United States of America, the average healthcare costs including inpatient and outpatient per stroke for different stroke sub-types has also been estimated as for cerebral infarction to be between US$8,000 and US$16,500; for intracerebral haemorrhage between US$11,100 and US$12,881; and, for subarachnoid haemorrhage between US$27,000 and US$32,911. Although these numbers are impressive, they do not include the additional costs associated with the residual morbidity after stroke, that is, lost work, additional nursing care, etc (Sacco *et al*, 1997). The estimated direct and indirect cost of stroke was US$65.5 billion with the mean lifetime cost of ischaemic stoke in the United States estimated at US$140,000 (American Heart Association, 2008).

The cost of stroke care may be a measure of stroke severity, with more extensive strokes resulting in greater medical costs. Lo *et al* (2008) examined costs for poststroke care in a paediatric population in Ohio, United States during the first year after diagnosis and compared these costs with the volume of the cerebral infarct and the level of neurological and functional outcome. The median cost for poststroke care during the year after diagnosis was US$42,338. The cost for stroke care was higher for hemorrhagic stroke, than for ischemic stroke. Cost had a significant positive correlation with neurological impairment. However, the median cost of post-stroke care per year for older patients can be expected to be higher due to associated comorbidities.

A prevalence-based study measuring disease-related costs carried out in Ontario, Canada in 1994/95 incurred by people with stroke, looked at direct costs including expenditures on hospital and other institutional care, services of physicians and other health professionals, drugs, research, home care, emergency health services, assistive devices and community support and indirect costs using the human-capital approach, which examined lost productivity due to premature death and disability. The total cost of stroke in Ontario alone was estimated to be US$857 million per year, with a low of US$719 and a high of US$964 million (Chan and Hayes, 1998). The direct costs were 60% of total costs. Stroke accounted for 3.9% of acute care hospital costs, 5.0% of rehabilitation, chronic care and other institutional costs, and 6.0% of home care costs. It accounted for a relatively minor proportion of physician costs (1.0%), and drug expenditures (0.3%).

Ghatnekar *et al* (2004), utilising incidence approach for estimating the present value of both direct and indirect costs, estimated the excess cost of stroke in Sweden and the potential costs that could be avoided by preventing first-ever strokes. They reported that the present value of direct cost for an average stroke patient was SEK513,800 (US$56,024) and the corresponding indirect cost was SEK125,110 (US$13,640). Almost 45% of the direct costs were attributable to social services. Women had higher costs than men, and costs for survivors increased with age due to higher social services. They estimated that in Sweden, with an incidence of 213 first-ever strokes per 100,000 individuals, the total excess direct and indirect cost of stroke would be SEK12.3 billion (approximately US$1.3 billion).

In another incidence-based study from the third-party payer's perspective, incorporating 10-year survival data and 5-year resource use data from the Erlangen Stroke Registry with discounted lifetime year 2004 costs per case and applied to the expected age and sex evolution of the German resident population in the period 2006 to 2025, the overall cost per first-year survivor of first-ever ischemic stroke was estimated to be 18,517 EUR (US$24,000) (Kolominsky-Rabas *et al*, 2006). The authors further reported that rehabilitation accounted for 37% of the cost, whereas in subsequent years outpatient care was the major cost driver. Discounted lifetime cost per case was 43,129 EUR (US$57,000) overall, and was higher in men (45,549 EUR) (US$) than in women (41,304 EUR) (US$54,000). National projections for the period 2006 to 2025 showed 1.5 million and 1.9 million new cases of ischemic stroke in men and women, at a present value of 51.5 (US$68 billion) and 57.1 billion EUR (US$75.7 billion), respectively. The mean cost of hospitalization of a stroke patient in Israel in 2007 was US$5000 and the total annual cost of hospitalization of stroke patient is estimated at US$65 million (Koton *et al*, 2008).

In Australia, it has been shown that hospital and nursing home costs contributed most to the total cost of stroke (excluding SAH) (Dewey *et al*, 2001). An incidence-based cost-of-illness model incorporating data obtained from the North East Melbourne Stroke Incidence Study (NEMESIS) analysed the costs of stroke during the first year after stroke and the value of total lifetime costs of stroke were estimated. The total first-year costs of all first-ever-in-a-lifetime strokes that occurred in Australia during 1997 were estimated to be A$555 million (US$420 million), and the value of lifetime costs was estimated to be A$1.3 billion (US$985 million). The average cost per case during the first 12 months and over a lifetime was A$18,956 (US$14,361) and A$44,428 (US$33,658), respectively. The most important categories of cost during the first year were acute hospitalisation (A$154 million or US$117 million), inpatient rehabilitation (A$150 million or US$114 million), and nursing home care (A$63 million or US$48 million).

Stroke survivors, with a chronically disabling condition, represent unique economic and healthcare burdens to individuals, families, caregivers, healthcare systems, and the national support services. Particularly with an under-resourced rehabilitative care facilities and governmental support for caregivers, there are inherent challenges faced in caring for community dwelling stroke survivors in Fiji. The Maharaj and Panapasa (2002) study found that family support was available to only about half of all stroke survivors living in the community; thus, there is need for further provision of care and support in the community.

The reports from various studies cited above are presented in the Table 8. These are from different countries, from varying reference years and alternative methodologies have been used to calculate the economic burden of stroke, thus the findings cannot really be compared to each other. However, the main intention for this review was to show that there are substantial direct and indirect costs related to stroke morbidity, even prior to stroke mortality and further productivity losses. The cost drivers for direct and indirect economic burden to individuals, families, caregivers, and the nations could have many similarities between them.

Table 8: Economic Burden of Stroke Studies

Country	Study	Type of Analysis	Value in US$
Australia	Dewey *et al*, 2001	Direct & Indirect - Incidence-based	$420 million/year total Lifetime est. $985 million
Canada	Chan & Hayes, 1998	Direct, Indirect & Human Capital	$857 million/year total
Germany	Kolominsky-Rabas *et al*, 2006	Direct & Indirect discounted value	$24,000/year per case $57,000 lifetime per case
Israel	Koton *et al*, 2008	Hospitalisation	$5,000 hospital per case $65 million/year total
United States	Sacco *et al*, 1997	Direct & Indirect	$65.5 billion/year total
United States	Morgestern, 2005	Comprehensive, including productivity loss	$3,040 billion/year total
United States	Lo *et al*, 2008	Direct & Indirect for Paediatric	$42,338/year per case
Sweden	Ghatnekar *et al*, 2004	Direct & Indirect	$56,024/year per case $1.3 billion/year total

There is no economic burden of stroke study available for Fiji. This study performed an economic analysis of burden of stroke mortality in Fiji, in terms of annual national human capital resource loss. This is an aspect of the economic burden of stroke, which is over and above the usually reported direct and indirect costs of stroke care. Detailed methodology and findings are presented in later chapters of this thesis.

3.7 Summary and Conclusion

Stroke usually occurs suddenly and unexpectedly, often with devastating impact on the individual and the family members. Many stroke survivors live in the community with long-term impairments, activity limitations and restricted participation with cognitive, psychological, physical and/or social sequelae.

There are many risk factors for stroke – some well documented, while others not so well documented, and these can be categorised into modifiable and non-modifiable risk factors. Cardiovascular diseases and stroke share many common risk factors. The socio-economic risk factors contributing to stroke, although increasingly being recognised in the literature, are still not well understood or quantified.

In many countries, stroke is regarded as a common cause of mortality and morbidity after cardiac and cancer causes. Stroke incidence and morality rapidly increases with increasing age. The incidence is also higher in people of Asian, Pacific and African American backgrounds compared to whites. While stroke incidence has declined or declining in most developed countries it is increasing in developing countries. It is predicted from the World Health Organisation STEPwise surveillance that stroke will become the primary cause of mortality and morbidity by the year 2020, with the majority of disease burden being in developing countries.

In the past, outcomes of diseases and interventions have largely been measured using biological and physical parameters. However, there is a shift towards assessing outcomes beyond just the traditional biological and physical parameters to including more meaningful quality of life and psychological well-being measures to assess outcomes of stroke. These outcome measures reflect perceived health and psychological status and the needs of stroke survivors, and can be regarded as a meaningful addition to the armamentarium of biological and physical outcome measures.

Beyond the physical and emotional sufferings caused by stroke, the economic burden of stroke is also a very real and important concern for stroke survivors, their families, society and nations. Stroke deaths create a burden beyond resource utilisation. Although various aspects of economic burden of stroke, mainly resource utilisation, are being more and more recognised in published literature, the annual national human capital resource loss from stroke mortality is not extensively reported.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter addresses the design and rigour of the study. It describes the population studied, method of random subject selection and control recruitment in the community. The logistics of preparation for the study, Research Assistant training, fieldwork, data collection and handling are discussed. Control of bias, statistical analysis and ethical concerns are also addressed.

4.2 Subjects

Due to the usage of a population-based case control research design, this study comprised data collection from a randomly selected sample of stroke survivors living in the community for six or more months and household or neighbourhood controls to ascertain their demographic, socio-economic and psychological status, and to evaluate other medical, health and physical functional related data. Given that some other conditions like epilepsy and brain tumours can mimic stroke; only persons with stable medical condition and stroke based on their clinical presentation defined according to the standard criteria, as discussed earlier, were included in the study.

For study power calculation and sample size estimation, it was assumed that the prevalence of adverse psychological well-being amongst community dwelling stroke survivors in Fiji would be in the range of 25% to 33%. In order to detect a relative risk difference of 1.5 for this rate of exposure, in a case control design, using Epi Info Version 6 Statcalc calculator (Dean *et al*, 1996), a total of 74 cases (and 74 controls) were required for an $\alpha = 0.05$, a power of 95% Confidence Interval (CI), and a two-tailed test of significance.

In Fiji, most of the stroke survivors are identified and entered into the CounterStroke Fiji National Stroke Register maintained since 1989. The background of the CounterStroke Fiji has been discussed in Chapter 2. Counterstroke Fiji has a high profile in the community and receives direct referrals of all cases of stroke through its network, whether they were hospitalised or remained in the community.

The actual incidence or prevalence of stroke has not been established in Fiji. During the year 2001 Ministry of Health (2005) reported 593 stroke admissions to hospitals in Fiji and, as stated in the previous Chapter, 452 stroke deaths – 71 in hospital and 381 in the community. However, the statistics available does not differentiate first-time-ever stroke admission or how long after stroke the victim passed away. Thus, it is not possible to calculate the incidence of stroke in Fiji from the available statistics. I believe there is research project under way now to ascertain that (Fiji School of Medicine, 2007; Ministry of Health, 2007).

In view of lack of accurate information regarding incidence and prevalence o stroke in Fiji and incompleteness of CounterStroke Register the following is presented. During the year 2001, there were 593 stroke admissions and 452 stroke deaths (Ministry of Health, 2005), assuming they were all first-time-ever strokes, it gives a balance of 141 stroke survivors. During the same year CounterStroke enrolled 98 new stroke survivors in the Register. This, hypothetically gives a deficit of 43 (30%) stroke survivors not being registered by CounterStroke for that year.

However, 1,175 “current” stroke survivors were entered in the Register for the year 2001 and 2002. From this population of 1,175 stroke survivors, 200, that is, 17% of the study population was randomly selected by drawing their numbers out of “a hat”. Research Assistants conducted this procedure in the presence of the Rehabilitation Hospital staff and myself at Tamavua Hospital. To control confounding and to allow for missing data, a larger sample size than that calculated was selected. The first 102 community dwelling stroke survivors contactable were interviewed. The Research Manager contacted the selected stroke survivors via telephone either directly or through the next of kin's telephone contact. Those who did not have a telephone contact were traced via the local Community Nurse. Thus, the population of community dwelling stroke survivors obtained from the CounterStroke Fiji National Stroke Register served as a suitable group for sampling for the study.

Community dwelling stroke survivors of any ages entered in the Stroke Register between 1st January 2001 to 31st December 2002 inclusive and living in the community for more than six months were included in the study. More than six months period post stroke was used because this gave ample time for stroke survivors to overcome their acute stage, settle back into the community, and realise the difficulties arising out of their acquired impairments, leading to activity limitations and restricted participation with impact on their psychological well-being, if any. One of the objectives of this study was to evaluate this particular aspect.

The Research Assistants approached stroke survivors in the community and provided a written information sheet and gave verbal explanation about the study, prior to obtaining a signed consent from participants or their nominees before conducting the interviews.

Stroke survivors with severe speech dyspraxia, aphasia or severe dysphasia, who presented with severe communication difficulties, were excluded from the study. There was only one stroke survivor with severe dysphasia who was excluded from the study. In addition, cases and controls that refused to participate were excluded from the study as well. However, there was only one case and one control who did not agree to provide full information and were accordingly excluded from the study.

Individuals with no history of stroke recruited from household or neighbourhood were used as a source of control data. The Research Assistants, after interviewing the case (stroke survivor), requested whether a family member would like to be interviewed as control and if no one was available or willing the Research Assistant approached and recruited a control from the local area. Controls were matched to cases (1 case: 1 control) according to 10-year age strata (<50, 50-59, 60-69, 70-79, 80+), gender and geographical area of residence. The same number of 102 controls were recruited and interviewed.

4.3 Study Instruments

To achieve the study objectives, various study instruments were reviewed and the appropriate ones selected for the purpose of this study. The questionnaire and instruments utilised in this study are tabulated at the end of the chapter. It is important to note that none of the instruments or scales discussed and utilised for this study are routinely used in the clinical setting in Fiji.

4.3.1 Demographic and socio-economic data

After a review of relevant literature, a questionnaire was specially designed for this study to gather required information on demographic and socio-economic variables, including mental and physical functional status, cardiovascular risk factors (cigarette/tobacco smoking, alcohol use, Kava consumption, lifetime physical activity, existence of obesity), medical and physical health status (presence or absence of diabetes, cardiac disease and hypertension, and current use of regular medications), use of health services, self-reported health status, and combined household income prior to having the stroke for stroke survivors and extra expenses only for stroke survivors, if any, since their stroke. There were two sets of questionnaires to accommodate for the stroke specific questions in the questionnaire for "Cases". These stroke specific questions were left out of the questionnaire for "Controls". Both these questionnaires are attached as Appendix 1 and 2 respectively.

All stroke survivors and their matched controls were interviewed concurrently over a 12-month period from April 2003 to March 2004. Thus, all questionnaires and instruments employed were finalised in early 2003, before the Research Assistants' training and commencement of fieldwork and data collection. All interviews took place at the stroke survivor's place of residence in the community. The collection of data for this population-based case control study by four Research Assistants covering a large geographical area of Viti Levu, required this lengthy period of time to complete.

4.3.2 Probability of stroke event analysis

This section describes the theoretical model for probability of stroke analysis.
As stated in the previous chapter, there are various well-documented and some less well-documented stroke risk factors, which are traditionally divided into modifiable and non-modifiable risk factors of stroke (Sacco *et al*, 1997). Numerous studies document socio-economic features as contributing to stroke incidence and/or mortality (Hart *et al*, 2000; Engstrom *et al,* 2001; Arrich *et al*, 2004; Bravata *et al*, 2005; Avendano *et al*, 2006; Hinkle *et al*, 2006; Song *et al*, 2006; Thrift *et al*, 2006).

There are various simple and easy to apply cardiovascular risk and/or stroke risk assessment calculation methods, some of which are computer/software based and some paper based, for prediction of the probability of a cardiovascular or cerebrovascular event. These prediction equations mostly emphasize better understood traditional biological risk factors, and not behavioural (Wilson, 1994) or socio-economic risk factors. The National Stroke Foundation of Australia (2006) Strokesafe test contains a mix of eleven medical and socio-economic risk factors. The Brain Foundation of Australia (2003) contains ten, Stanford Stroke Center Stroke Risk Assessment Test based on the Framingham study (D'Agostino *et al*, 1994) contains eight, and the widely recommended New Zealand Cardiovascular Risk Calculator (National Health Committee, 1995; Dyslipidaemia Advisory Group, 1996; Jackson, 2000) contains six.

Based on current knowledge, and some stroke medical risk factors nature of the acuteness of stroke onset, almost all existing calculators are heavily weighted towards medical risk factors and include a limited number of socio-economic indices. The literature search did not reveal any risk assessment method or calculator that took into account socio-economic factors to calculate their individual and/or combined impact, or quantify the degree of risk profile for stroke.

In this study, based on a theoretical model, a quantitative relationship between an individual's socio-economic indices and the likelihood of having a stroke event was modelled and analysed. Utilising the **Probit Model** and imputing the pre-stroke factors gathered during the population-based study, a postulation of the likelihood of having a stroke event amongst the stroke cases was mapped. This econometric technique has been utilised by many authors to determine the quantitative relationship between various variables (McCulloch *et al*, 1994; Geweke, 1996; Geweke *et al*, 1997; Keane, 1997; Allenby *et al*, 1998; Paap, 2000). Such quantitative relationship modeling allowed us to test and determine the quantitative significance of various socio-economic indices for the probability of stroke.

The results of this quantitative modeling provides policy makers with new important information on the degree of impact of different socio-economic indices towards the probability of stroke, thus, providing them with objective directions in designing strategies for health promotion and stroke prevention campaigns to counter stroke.

To calculate the quantitative relationship of the independent variable, the following theoretical model was utilised:

$$Y_i = \alpha + \beta X_i + \varepsilon_i$$

Where Y_i = 1 if risk factor is present, 0 if risk factor is not present;
X_i = vector of explanatory variables; and
ε_i = random error term.

The details of this econometric technique utilising socio-economic variables to determine the probability of stroke event is presented in more detail in this thesis in Chapter 6 - Impact of Socio-economic variables on stroke likelihood: A probability modeling.

4.3.3 Mental status examination

Strokes variably affect people's physical and mental states with the possibility of a spectrum of sequelae from complete recovery to minor or major impairments, activity limitations and restricted participation, to death. In this study, all stroke survivors and the controls were assessed for their mental and physical status.

There are various validated methods of assessing mental status.

Abbreviated Mental Test Score

The Abbreviated Mental Test Score (AMTS) was introduced by Hodkinson (1972) to quickly assess elderly patients for the possibility of memory loss and dementia. Although it has mainly been validated in the elderly, its use in medicine has become much wider to assess for confusion in adults. The test has utility across a range of acute and outpatient settings. The test can differentiate normal from cognitively impaired, and has been tested on an Australian sample of patients (Flicker *et al*, 1997). The test takes only about 5 minutes and includes 10 questions. The maximum score is 10. A score of less than 7 suggests cognitive impairment. A score of less than 6 suggests dementia, although further and more formal tests are necessary to confirm the diagnosis.

An alternative to the AMTS is the 30-point Mini Mental State Examination (MMSE).

Mini Mental State Examination

The Mini Mental State Exam (MMSE) is the most widely used cognitive test for mental state or dementia in clinical practice. The examination takes approximately seven to ten minutes to complete. It tests a broad range of cognitive functions including orientation, recall, attention, calculation, language manipulation, and constructional praxis (Folstein *et al*, 1975), but age and education of the subject have an influence on the results of MMSE (Tangalos *et al*, 1996).

Mini-Cog

A shorter and brief cognitive assessment, the "Mini-Cog," seems ideal for mental status screening. It is brief and has good performance in populations with different cultural, linguistic, and educational backgrounds. The “Mini-Cog” consists of a clock-drawing task (CDT) and an un-cued recall of three unrelated words. Nevertheless, at this stage, this test lacks validation in clinical and population-based samples (Borson *et al*, 2000).

Saint Louis University Mental Status Examination

Research physicians at St Louis University, led by Drs John Morley and Syed Tariq (Tariq *et al*, 2006) have recently developed another new Screening Test for Alzheimer’s (Dementia and memory loss) called Saint Louis University Mental Status Examination (SLUMS). This is more efficient a test than the MMSE in diagnosing mild neurocognitive disorder (MNCD). SLUMS is a 30-point screening test and its results have been compared with those from the MMSE in the same patients. The test has only recently been introduced and is already in use at many Veterans Administration Hospitals in the USA. It seems a useful tool to detect MNCD as early as possible.

The aim of this study was only to quickly differentiate severe cognitive impairment from normal. The AMTS7, which is the shorter version of AMTS, can differentiate normal from cognitively impaired. It has been validated in the elderly and assesses orientation, memory and attention (Flicker *et al*, 1997). Persons with severe dysphasia or aphasia were not included in the study, as they would not be able to participate in the evaluation. MMSE which assesses orientation, recall, attention, calculation, language manipulation, and constructional praxis is influenced by age and educational level thus was not suitable for this population. Mini-Cog is still to be validated and SLUMS was published after the study was commenced. Thus, it is felt that AMTS7 was the most appropriate cognitive assessment tool to utilise in this study situation.

4.3.4 Physical activity limitation

There are numerous instruments used to measure a stroke survivor's physical activity level and limitations. The two most commonly used scales in stroke that measure disability and activities of daily living (ADL) in a clinical setting are Functional Independence Measure (FIM) (Granger *et al*, 1986; Keith *et al*, 1987, State University of New York, 1993) and Barthel Index (Mahoney and Barthel, 1965). The FIM is an indicator of the severity of disability. The FIM Instrument comprises of 18 items, each of which is assessed against a seven point ordinal scale, where the higher the score for an item, the more independently the patient is able to perform the tasks assessed. Total scores range from 18 to 126. The items are divided into two major groups, the Motor items, of which there are 13, and the Cognitive Items, of which there are 5. The rating scale designates major gradations in behaviour from dependence to independence.

The Department of Rehabilitation Medicine, School of Medicine and Biomedical Sciences at the State University of New York at Buffalo developed the system to document the severity of patient disability and the outcomes of medical rehabilitation, in what later became the Uniform Data Set for Medical Rehabilitation (UDSMR), a minimum data set that requires a rating scale to measure function. The FIM is now widely used around the world, including Australia. The FIM requires special training and can take up to 40 minutes to complete, whereas Barthel Index, which has excellent validity and reliability, is reported not to be sensitive across the entire spectrum of stroke severity (Duncan *et al*, 2003).

The **Rankin Scale** (Rankin, 1957) is a global disability scale, which grades a person with stroke depending on physical status from "No symptoms at all" (0) to "Dead" (6). However, the **Modified Rankin Scale** (mRS) (Bonita and Beaglehole, 1988; van Swieten *et al*, 1988), which ranges from 0 – 5, is easy to use, takes only 5 minutes and has been commonly employed as a measure of functional outcome after stroke. The Rankin score ranges from 0 (No symptoms at all); 1 (No significant disability despite symptoms: able to carry out all usual duties and activities); 2 (Slight disability: unable to carry out all previous activities, but able to look after own affairs without assistance); 3 (Moderate disability: requiring some help, but able to walk without assistance); 4 (Moderately severe disability: unable to walk without assistance, and unable to attend to own bodily needs without assistance); and 5 (Severe disability; and bed ridden, incontinent, and requiring constant nursing care and attention).

The Modified Rankin Scale (mRS) is simple, valid and reliable for measures of stroke outcome when tested after 6 weeks or 6 months, and supports continued use in large-scale multinational stroke studies at different intervals after stroke (Berge *et al*, 2001). It has vary good reliability with the agreement between the raters, as estimated from the intraclass correlation coefficient, being 0.947 for neurologists and 0.963 for nurses and physiotherapists and the reproducibility was also satisfactory with values of 0.865 and 0.871, respectively (Shinohara *et al*, 2006). Banks and Marotta (2007) reviewed medical literature from Medline from 1957 to 2006 that provided information on the structure, validation, scoring, and psychometric properties of the mRS and its use in clinical trials and concluded that multiple types of evidence attest to the validity and reliability of the mRS that support the view that the mRS is a valuable instrument for assessing the impact of stroke. Kwon *et al* (2004) compared Barthel Index, motor component of Functional Independence Measure and the Modified Rankin Scale and found that the three measures were highly correlated. The Modified Rankin Scale (mRS) was utilized in this study.

The instruments to measure mental status (Abbreviated Mental Test Score - AMTS7) and physical activity limitation (Modified Rankin Scale - mRS) were incorporated at the beginning of the general questionnaires for both, stroke survivors and the controls. Please refer to appendices for details of these instruments. None of the instruments described above are routinely used in a clinical setting in Fiji.

4.3.5 Psychological well-being after stroke

Stroke brings a sudden change to victims' and their families' life situation. Outcomes in stroke have been traditionally evaluated primarily by using objective tests that measure physical impairments and functional limitations (Miyai *et al*, 1999; Hourihane and Clark, 1999; Smith *et al*, 1999; Teixeira-Salmela *et al*, 1999; von der Lee *et al*, 1999). These measures lack information about the patient's own perception of the psychological and emotional impacts of the stroke. There has been an increasing interest in the literature in reporting post-stroke health-related quality of life as a key outcome measure now, typically encompassing physical, functional, psychological, cognitive, and social aspects of life. These measures are assumed to reflect an individual's subjective perception of his or her current function and overall health. The patients' subjective perception is a key element in today's patient and healthcare.

Studies describing stroke survivors' life satisfaction or quality of life from a long-term perspective have been conducted (Astrom *et al*, 1992; King, 1996; Kwa *et al*, 1996; Wyller *et al*, 1997; Clarke *et al*, 2000) and it has been shown that stroke survivors are less satisfied than the controls, but comparison among the studies are difficult due to the variance in conceptual basis, varying terminology and different measurements used.

This section of the chapter reviews various instruments available to measure quality of life, with psychological and emotional well-being of stroke survivors. While numerous scales and instruments to assess quality of life of stroke survivors exist in literature, the most commonly used and validated scales are discussed here.

There are generic and stroke specific scales to assess quality of life and psychological well-being.

Generic quality of life scales

A generic quality of life scale is a nonspecific instrument for use with diverse medical conditions. The EuroQol and the Medical Outcomes Short Form Health Survey (SF-36) are two widely utilised generic quality of life measures with reliability and validity specifically established for stroke survivors (Anderson *et al*, 1996; Dorman *et al*, 1997a, Dorman *et al*, 1998).

The other generic scales used in the assessment of quality of life after stroke, but not specifically validated for use with this population, are the Sickness Impact Profile (SIP), the Nottingham Health Profile (NHP), the Quality of Life Index (QLI), and the Reintegration to Normal Living Index (RNLI). These scales are discussed below.

EuroQol

This instrument was developed by the International EuroQol group and is a simple 5-item questionnaire, which addresses five domains. It is designed to serve as a standardised generic measure of health status and has been widely used in diverse populations. The score for each item ranges from one (no problems) to three (extreme problems). The EuroQol also includes a visual analogue scale, which is used to provide an overall assessment of health related quality of life on a scale from zero (worst imaginable health) to 100 (best imaginable health) (Dorman *et al*, 1997a).

Medical Outcomes Short Form Health Survey

The Medical Outcomes Short Form Health Survey (SF-36) is a self-report questionnaire containing 36 items organised into eight domains, which cover a wide range of physical activities and psychosocial perceptions, including global ratings of general health. It was recommended by the Agency for Health Care Policy and Research (AHCPR) in the Post-Stroke Rehabilitation Clinical Practice Guidelines and has been widely used (Agency for Health Care Policy and Research, 1996). Total possible scores range from 0-100 with higher scores indicating better health status.

Sickness Impact Profile

The Sickness Impact Profile (SIP) is a 136-item questionnaire organized into 12 domains or subscales. This scale measures specific behaviors that reflect limitations or recent changes in function, rather than subjective perceptions and emotions. Total scores are expressed as a percentage of maximal dysfunction ranging from zero (absence of dysfunction) to 100 (maximal dysfunction) (Bergner *et al*, 1981).

Nottingham Health Profile

The Nottingham Health Profile (NHP) is a 38-item questionnaire requiring a yes or no response to items organised into six subscales. Scores in each scale range from 100 to zero, with zero indicating optimal health. This scale was initially developed as a measure of perceived health for use in general population surveys.

Quality of Life Index

The Quality of Life Index (QLI) was developed to measure quality of life associated with cancer and other chronic diseases (Ferrans and Powers, 1985), but it has been adapted for use with stroke patients (King, 1996). Communication, self-care, and mobility were added to the original version of 38-item questionnaire, which is divided into 4 subscales to create the QLI-Stroke Version. Each item is rated on a scale of 1-6 with respect to both satisfaction and importance. The total scores range from 0-30 with higher scores indicating a better quality of life.

Reintegration to Normal Living Index

The Reintegration to Normal Living Index (RNLI) assessment scale consists of an 11-item questionnaire, which evaluates patient satisfaction in six domains. It assesses global functional status by documenting the patient's perceptions of their abilities. Similar to other generic measures, a global score and domain specific subscores can be obtained with higher scores indicating a better quality of life (Dorman *et al*, 1998).

The generic quality of life scales are easier to use in a sense that it allows comparison within and between different health conditions. Being less disease-specific, these scales are specifically designed with the aim to compare different groups, in order to determine the relative impact of various diseases on quality of life.

Assessment of Quality of Life

Sturm *et al* (2002) validated **Assessment of Quality of Life** (AQoL), a generic health-related quality of life instrument after stroke, and demonstrated strong psychometric properties, and validity and sensitive between the AQoL and comparator instruments: the Medical Outcomes Short-Form Health Survey (SF-36); London Handicap Scale; Barthel Index; National Institutes of Health Stroke Scale; and Irritability, Depression, Anxiety scale. Sensitivity of the AQoL was assessed by comparing AQoL scores from groups of patients categorized by severity of impairment and disability and with total anterior circulation syndrome (TACS) versus non-TACS. Predictive validity was assessed by examining the relationship between 3-month AQoL scores and outcomes of death or institutionalization 12 months after stroke. The AQoL measures five dimensions: illness, independent living, social relationship, physical senses and psychological wellbeing (Hawthorne *et al*, 1999).

These generic scales are appropriate for comparing quality of life, other outcomes, and cost-benefit analysis across different disease conditions. This particular instrument, AQoL, seems to offer the best of both; it has strong psychometric properties and valid and sensitive generic nature for comparability between different disease conditions.

One particular disadvantage with AQoL is that it lacks the suitability to be used with patients experiencing significant cognitive or language difficulties. Not including these individuals in studies on stroke quality of life would exclude a significant number of stroke survivors.

To overcome this problem, a proxy respondent may be used to answer questions on the patient's behalf, but the responses could be biased as analysis of proxy versus stroke survivor Sickness Impact Profile (Sneeuw *et al*, 1997), EuroQol (Dorman *et al*, 1997b) and the SF-36 (Pierre *et al*, 1998) scores demonstrated significant differences between patient and proxy mean scores on almost all measures. The proxy respondents were found to frequently underestimate a patient's response by rating the patient as having more limitations than the patient perceived (Sneeuw *et al*, 1997; Dorman *et al*, 1997b). As may be expected, the domains, which are more directly observable (i.e., self-care), had the highest similarities, and the lowest agreements were for more subjective domains, which assess psychological, social outcomes and pain (Dorman *et al*, 1997b). In this study, although majority of stroke survivors could participate, proxy respondents were allowed to participate when the stroke survivor needed assistance with interpretation and explanation.

A further disadvantage of the generic quality of life scales is reduced sensitivity producing "floor" and "ceiling" effects. Significant floor or ceiling effects have been reported for various SF-36 subscales (Dorman *et al*, 1999; Gandek *et al*, 1998; O'Mahony *et al*, 1998) and for the EuroQol (Miyai *et al*, 1999). The floor and ceiling effects of an instrument are due to its lack of sensitivity to specific changes. This can be expected of an instrument, if it is not designed to do so. In a recent study, Seymour *et al* (2007) using EQ-5D and SF-36 (converted to SF6D values) instruments with both a baseline and follow up measurement for both study and control groups compared to ordinary least squares methods, a first difference model showing that there was a much lower association between the measures. This suggests that Ordinary Least Squares (OLS) methods may lead to biased estimates of the relationship, as a significant part could be attributed to unobservable patient characteristics and statistically significant floor and ceiling effects. They showed that for people, whose health improved over time, the relationship between instruments was higher for those, who experienced the largest increases in health, whilst for people who deteriorate, the association was higher amongst those with the smallest reduction in health status. Thus, the choice of an instrument should depend on its sensitivity to measure the specific changes being evaluated to minimise the floor and ceiling effects.

In summary, the above discussed generic Quality of Life scales measure different aspect with EuroQol: psychological functioning, mobility, usual activity, pain, own health and selfcare; SF-36: mental health, physical functioning, physical, emotional and social roles, pain, general health and vitality; SIP: emotional and social, mobility, home management, alertness, sleep, body care and communication; NHP: emotional and social aspects, mobility, pain, energy and sleep; QLI: communication, selfcare and mobility; RNLI: relationships, handling life events, mobility, role within family and selfcare and the AQoL: illness, independent living, social relationship, physical senses and psychological wellbeing.

Thus, the different generic scales measure different aspects of quality of life and are ideal for use when the objective of the study is to compare between different health or disease conditions as these scales are designed to capture information, which allows for that comparison. Whereas, when the objective of the study is to evaluate more specific aspects of a health or disease conditions, it is preferable to utilize condition specific measurement scales.

Stroke specific quality of life scales

There are three quality of life assessment scales, which have been recently developed for use specifically with stroke survivors; and two psychological well-being scales, which have been in existence for some time. These are discussed below.

The Stroke Adapted Sickness Impact Profile

The Stroke Adapted Sickness Impact Profile (SA-SIP30) is a modified version of the 136-item SIPS. This instrument was developed to overcome the major disadvantage of the excessive length of the original SIP. The SA-SIP30 is a 30-item scale with eight subscales and was developed through a process of elimination of the least relevant and most unreliable items from the original test. The internal consistency and validity of the scale has been tested using a study sample of 319 post-stroke patients (van Straten, 1997). The correlation between the two scales was generally good; however, the agreement between the scores was lowest for severely impaired patients. The SA-SIP30 was found to be not as sensitive as the SIP to the decline in quality of life reported by the patients, who experienced more severe strokes. While this stroke specific scale has the advantage of being shorter than the original generic SIP, further research is required to fully evaluate the reliability, validity, and sensitivity of the SA-SIP30 for assessments of quality of life following stroke.

Stroke Impact Scale

The next stroke specific quality of life scale is the Version 2.0 of the Stroke Impact Scale (SIS). Unlike the SA-SIP30, which is simply a shorter version of an existing generic scale, this self-report measure including 64 items within 8 domains, was developed to specifically include the domains and items most relevant to stroke survivors. The 4 physical domains (strength, hand function, mobility, and ADL/IADL) can be added up to create one physical domain score, while the others must be scored as individual domains. Each domain score has a range of 0-100. A visual analogue scale at the end of SIS asks the respondent to rate their perception of their recovery. The psychometric properties of the SIS have been evaluated on a sample of 91 mild to moderate stroke subjects. Internal consistency and good test-retest reliability demonstrated that the SIS is a stable and reliable instrument, which could be used to measure change over time. Further analysis revealed that most SIS domains are sensitive to change as recovery progresses. The emotional domain happens to be the least sensitive and reliable to change (Duncan *et al*, 1999).

Stroke Specific Quality of Life Measure

The Stroke Specific Quality of Life Measure (SS-QOL) is the third and most recently developed stroke specific quality of life scale. The 12 domains and 49 items included in this measure were initially obtained from interviews with stroke survivors. Experts in Neurology, Physical Medicine and Rehabilitation, and additional stroke survivors reviewed and modified the scale, which then was pilot tested amongst stroke survivors, who were 1 to 3 months post-acute. The internal consistency and validity of this scale was good in individuals with a moderate response to change during the first 3 months after stroke (Dorman *et al*, 1997b).

This SS-QOL scale has been used to examine the predictors of quality of life in stroke survivors and to compare patient's subjective ratings of the overall quality of life against various scales, one month after stroke using the SF-36, the SS-QOL, the Barthel Index, the Beck Depression Inventory, and the NIH Stroke Scale. The SS-QOL summary scores correlated with the patient's overall subjective quality of life; however, SF-36 scores did not. Thus, data appears to support the hypothesis that generic quality of life scales, such as the SF-36, may be less sensitive to measure meaningful changes after stroke than disease specific scales like the SS-QOL. In addition, the use of just a single scale is not considered highly reliable or valid (William *et al*, 1999).

Like the generic scales, these scales are self-report questionnaires and relatively easy to administer via the use of methods such as on-site patient self-completion, direct personal interview, telephone interview, or via mail distribution. Designed specifically to address the items most relevant to stroke survivors, the SIS and the SS-QOL have unique characteristics, which neither the generic quality of life scales nor the SA-SIP30 have. While these stroke specific scales offer advantages over the generic scales, they are limited by their recent development, and the SS-QOL is restricted by its complexity. Further validation of the SS-QOL with a larger sample is currently underway (William *et al*, 1999) and some of these limitations will hopefully be addressed, as the development of this new instrument continues.

SATIS-Stroke Scale

SATIS-Stroke is a recently developed functional scale specifically to measure satisfaction with activities and participation, providing goal-setting guidelines for treatment planning (Bouffioulx *et al*, 2008). This is a 36-item questionnaire based on the International Classification of Functioning, Disability and Health (ICF) model and existing scales. The patients reported perceptions over a wide range of measurement with high reliability ($r = 0.94$) and good reproducibility over time (intraclass correlation coefficient = 0.98). In the development of this scale 101 patients' responses were analysed separately using RUMM Rasch software to select items presenting an ordered rating scale, sharing the same discrimination, and fitting a unidimensional scale. Its range and measurement precision are appropriate for clinical practice.

Psychological well-being specific measures in stroke

The two specific instruments that have been used to measure psychological well-being after stroke are discussed below. These are generic scales that are suitable for assessment and comparison of psychological well-being across populations and health conditions.

Philadelphia Geriatric Center Morale Scale

The Philadelphia Geriatric Center Morale Scale (PGCMS), developed by Lawton (1975) and recommended for use by the Royal College of Physicians, London, and the British Geriatric Society (Dall, 1992), is a multidimensional measurement instrument to assess morale. By the author's definition, this scale measures "freedom from distressing symptoms and a basic sense of satisfaction with oneself'; "a feeling of having attained something in his life"; "of being useful now, and thinks of himself as an adequate person"; "feeling of harmony between self and environment"; and "ability to strive appropriately, while still accepting the inevitable'. However, this easy to use scale is validated for use only with very old people.

Ryff Measure of Psychological Well-being

The Ryff Measure of Psychological Well-being is constructed to measure six core theoretical dimensions of well-being of autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance and measures both positive and negative aspects of psychological well-being. This instrument was developed and validated by Professor Carol D. Ryff of Institute on Aging, University of Wisconsin, Madison, Wisconsin 53706, United States of America. It has been validated for use in stroke and several studies have employed this instrument in conducting research (Ryff, 1989; Ryff and Essex, 1992; Ryff, 1995; Ryff and Keyes, 1995; Heidrich and Ryff, 1996; Ryff and Heidrich, 1996; Kling *et al*, 1997; Ryff, 1996; Ryff and Singer, 1996; Smider *et al*, 1996; McGregor and Little, 1998; Staudinger *et al*, 1999; Clarke *et al*, 2000; Keyes *et al*, 2002).

Burden of Stroke Scale

The other, rather newer scale, that deserves to be mentioned is the Burden of Stroke Scale (BOSS) (Doyle *et al*, 2003), which is a health-status assessment instrument designed to measure patient-reported difficulty in multiple domains of functioning, psychological distress associated with specific functional limitations, and general well-being in stroke survivors. A new 112-item pilot version of this instrument was developed through a qualitative research method. The BOSS Communication Difficulty (CD) and Communication Associated Distress (CAPD) sub-scales have been found to have good discriminant and construct validity (Doyle *et al*, 2003), thus, being useful amongst stroke survivors with communication difficulties. After pilot, a sixty-four item version was retained, comprising 12 internally consistent unidimensional scales. Principal components analysis revealed three second-order factors of Physical Activity Limitations, Cognitive Activity Limitations, and Psychological Distress. Comparisons between groups revealed that stroke survivors reported greater activity limitations and psychological distress on all scales relative to controls, and that stroke survivors with communication disorders reported greater activity limitations on swallowing, communication, cognition, and social relations scales relative to non-communicatively disordered stroke survivors. This scale was not available at the time at which this study started.

Ideal instrument

The ideal instrument for measuring quality of life after stroke would be a reliable instrument for use by either patients or their proxies; it would have good content validity; and it would be responsive to meaningful patient changes across a wide range of clinical presentations (Saladin, 2000). The ideal instrument currently does not exist and the advantages and limitations of the available measures have been discussed. It is important to consider the study objectives, available resources, and the characteristics of study population, when selecting the best available instrument.

This study utilised the criteria and methodology adopted from the Ryff Measure of Psychological Well-being, which best measures the six core theoretical dimensions of well-being. The details of the psychometric properties and scoring format of this instrument are discussed in this thesis in the Chapter 7 – Psychological Well-being of Stroke Survivors in Fiji.

4.3.6 Economic analysis of stroke

As revealed in the literature, stroke, as a chronic disabling condition can impose substantial economic burdens on individuals, societies and nations. In the literature, the majority of studies on economic analysis and burden of stroke discuss cost of resource utilisation at different stages of care of stroke.

A recently reported approach, which can be applied to evaluate resource utilization with ranking option of intervention, is the Model of Resource Utilization, Costs, and Outcome for Stroke (MORUCOS) (Moodie *et al*, 2004). In the trial with the application of this methodology aspirin, a low-cost intervention applicable to a large number of stroke patients was evaluated against recombinant tissue-type plasminogen activator (rtPA). Analysis of health benefits, in terms of dollars and DALYs, could be produced and the authors concluded that if used to assess interventions across the stroke care continuum, MORUCOS offers enormous capacity to support decision-making in the prioritising of stroke services. Further validation of the methodology suggests that MORUCOS is transparent and flexible in describing Australian stroke care and can effectively be used to systematically evaluate a range of different interventions even adjusting to account for stroke subtypes (Mihalopoulos *et al*, 2005).

The cost of resource utilisation after stroke is a very important health economic issue and is a relatively well studied aspect in some countries. The scope of this thesis was not to evaluate resource utilisation for post-stroke care in Fiji, but to calculate another aspect of economic impact from stroke mortality in Fiji. The objective was to calculate the economic loss in terms of annual national human capital resource loss following stroke mortality. Another method of addressing this issue is the friction-cost method which is further discussed in the Chapter 8 – Economic Analysis of Stroke.

An estimation of the economic burden of stroke in terms of annual national human capital loss due to pre-mature deaths of working age group productive worker can be made with some degree of accuracy. The economic analysis of stroke, taking into account the national stroke mortality, calculated the annual national human capital loss in Fiji for the year 2001. Stroke mortality data for the year 2001 was obtained from the Ministry of Health (2005).

The costs of human capital resource loss may include:

- income and productivity foregone following stroke;
- increased medical and health care costs;
- cost of training, recruitment and replacement of labour force;
- costs of recruiting carer(s); and
- loss of family carers' financial income.

The loss to the economy arising from stroke in a productive worker is given by the discounted value of the output foregone over the period in which the worker is not able to earn an income. The maximum replacement period could be the remaining working lifespan, which is estimated by subtracting the age of the individual at the point of stroke from the average retirement age. The retirement age in Fiji, during the year 2001, was 55 years. The annual income foregone multiplied by the number of work years lost will yield the total income foregone, which must be discounted using a suitable discount rate. This, of course, assumes that the individual's annual income remains the same throughout the remaining period.

A simple formula to compute the present discounted value (PV) of the income foregone is as follows:

$$\text{Output Loss from the Economy} = S\left(\frac{1}{r}\right)\left[1-\frac{1}{(1+r)^t}\right]$$

where S is the annual income foregone; r is the chosen rate of discount and t is the working lifespan lost as the result of stroke. Due to varying levels of income for individuals, the average annual income is proxied by the per capita income.

The details of economic analysis of stroke in terms of the annual national human capital loss for Fiji for the year 2001 are presented in this thesis in the Chapter 8 – Economic Analysis of Stroke.

4.4 Data collection

The questionnaire was designed and developed to collect information on socio-demographic data, stroke risk factors, use of health services, functional and mental status, whereas all the other instruments including Abbreviated Mental Test Score (AMTS7), Modified Rankin Scale (mRS), Probit Model, Ryff Measure of Psychological Well-being, Formula for Output Loss from the Economy were utilised with their original content without any alterations. A summary of all the instruments is listed below in Table 9.

As the Principal Researcher, I appointed and trained one Research Manager and four Research Assistants to support fieldwork and conduct data collection. All these personnel were senior health workers with experiences in recognition and rehabilitation of stroke survivors. Following training and agreement to take part in the fieldwork of this research, they signed a "Research Assistant Agreement", indicating that they had received the training, were willing to participate in the research, and would abide by research ethics of confidentiality. The Research Assistants training included practice and clarifications of the questionnaire, particularly the Ryff Measure of Psychological Well-Being instrument, prior to the fieldwork.

The Research Manager and the Research Assistants conducted all the interviews in the community at the stroke survivors' and controls' homes. They also received ongoing support and guidance from the Research Manager and the Principal Research Officer. Regular meetings were held with the study team to maintain standardised procedures and to follow up on the progress. The Research Manager was directly responsible for the distribution and collection of questionnaires and providing financial re-imbursements to the Research Assistants. Wherever possible, any missing data was followed up by the Research Manager for completion. The Research Manager checked and verified every completed questionnaire prior to submitting them to the Principal Research Officer for data entry into Excel Spreadsheet.

Table 9: Summary of Instruments used in this Study

Area of measure	Instrument used
Socio-demographic data	General questionnaire designed
Stroke risk factors	General questionnaire designed
Use of health services	General questionnaire designed
Functional status (self-reported)	General questionnaire designed
Mental status	Abbreviated Mental Test Score (AMTS7)
Physical status	Modified Rankin Scale (mRS)
Probability of stroke event analysis	Probit Model
Psychological well-being	Ryff Measure of Psychological Well-being
Economic analysis of stroke	Formula for Output Loss from the Economy

4.5 Pre-test

On receiving the completed questionnaires, the Principal Research Officer systematically validated the accuracy of data collection (reliability) from the first two sets of case and control questionnaires completed by each Research Assistant. The review included ascertaining the accuracy of socio-demographic, medical, physical functional and stroke severity information which was already available to me from a combination of sources of CounterStroke National Register and the medical records. The other aspect of the review was to ascertain the ease of Research Assistant and the interviewee with the understanding or interpretation of the questions. The review also looked at the need for any alterations to the questionnaire for clarification and/or addition or subtraction of variables (content validity), as well as looking at the time it took to complete the task. On the average, it took 90 to 120 minutes to complete the interviews. Both the reliability and content validity were found to be satisfactory and the data collection proceeded as planned.

4.6 Statistical considerations

All questionnaires were checked and data entered into Excel spreadsheets in batches as the study progressed, to prevent prolonged data cleaning at the end of the fieldwork. The data checks and verification were performed as an ongoing process during the data entry. The ongoing checks were prior to data entry for accuracy of entry such as ethnicity, gender, if unemployed whether salary was stated, accuracy of coding for data entry and at the next level was data cleaning after data entry to correct any errors in data entry.

Excel Spreadsheet was used to calculate frequency and mode for categorical data; and median and range, and mean and Standard Deviation were calculated for quantitative or continuous data. To assess whether there was any statistically significant association between the two unpaired samples, SPSS statistical software package was used. The Student's *t*-test for significance was applied to all continuous parametric data. Epi Info software was use to calculate Mantel-Haenszel Chi-square (χ^2) for all unpaired categorical data utilizing the contingency tables. Fisher exact test for values less than 5. Wherever appropriate p values for statistical significance, Odd Ratios (OR), 95% Confidence Interval (CI), Standard error and degree of freedom (df) were also obtained.

The Odd Ratio is an alternative way of comparing how 'likely' events are between two groups. Odd ratio value of 1 or unity reflects exactly the same chances, ratio of greater than 1 indicated the chances are greater in the exposed group and a ratio of less than 1 indicates the reverse. Confidence Intervals measure the uncertainty in the measurements in relation to a quoted estimate. A wide estimate can be made with high degree of confidence or a more precise estimate with a lower degree of confidence. The degrees of freedom is an estimate of the number of independent categories in a particular statistical test.

The analysis of socio-economic variables to analyse the maximum likelihood estimates of stroke the probit model were obtained by using the Shazam Econometrics Computer Package (White, 1993). This software package operates as a binary system thus all socio-economic variables utilised in the analysis were converted to 0 and 1. Only the study subjects with full set of socio-economic variables to be analysed in the probability modelling were included in this analysis.

Further details of statistical methods used to analyse the impact of specific socio-economic variables on the probability of stroke – probability modeling; psychological well-being of stroke survivors compared to controls in Fiji and the economic analysis of stroke mortality in terms of annual national human capital loss are respectively outlined in Chapter 6 - Impact of Socio-economic Variables on Stroke Likelihood: A Probability Modeling; Chapter 7 - Psychological Well-being of Stroke Survivors in Fiji; and Chapter 8 - Economic Analysis of Stroke.

4.7 Potential sources of bias

Several sources of bias – selection, which is sampling and response (recall and information), performance, observation bias - are relevant in a study of this type. There was no attrition bias as subjects were not required to be flowed over time. Procedures developed to minimise bias and adherence to these procedures were monitored at regular frequency for quality control. Since the community dwelling stroke survivors were randomly selected from a population sample of stroke survivors recorded in the CounterStroke Fiji National Stroke Register for the years 2001 and 2002 from whole of Viti Levu, which is the main island of Fiji, it is not prone to selection bias. In a population-based study, recruitment of household or neighbourhood control is well accepted. The past information recall required of the study subjects involved only a short past few months of general information recall and not minute details. Thus, the information recalled and provided should be fairly reliable. The observation bias was controlled by Research Assistant training and there was not intervention involved or promised thus no ascertainment bias or Hawthorne effect.

4.8 Ethical issues

To utilise the CounterStroke Fiji National Stroke Register information and clients for research, written permission was obtained from Dr Jona Senilagakali, the President of the CounterStroke Fiji. The sample selection was done in a random manner.

The purpose of the research project was explained to every subject before their informed signed consent was obtained prior to the interviews. Strict confidentiality was maintained of all data collected for the study. The data was de-identified in analysis and publications and no individual or subject was identified in the analysis or reporting of the results by name or identification. Only collective quantitative analysis is performed and reported.

The University of the South Pacific Research and Ethics Committee approved this study. The University of the South Pacific also provided part funding for the research fund code 6D049 – 1492 – 00.

4.9 Summary and Conclusion

Following the literature review, a comprehensive questionnaire was developed to capture all necessary information, and appropriate study scales and instruments were reviewed and selected. The various scales and instruments used were incorporated with the general questionnaire into a yellow booklet for “Cases” and a green booklet for “Controls” for the purpose of fieldwork. The questionnaire booklets were coloured coded to alert appropriate use and to avoid error and confusion in data collection.

This population-based case control study comprised of data collection from a randomly selected sample of 102 stroke survivors living in the community for six or more months and matched 102 "neighbourhood" controls living in the community who never had a stroke.

Three trained Research Assistants, with years of experience in recognition and care of stroke survivors, after receiving training, conducted the fieldwork and data collection. They were supervised by a Research Manager, while the Principal Researcher oversaw the course of the study.

The study, taking into account the given risk factors for stroke, analysed the quantitative relationship between the specific reported socio-economic factors and the probability of having a stroke event. It assessed and analysed psychological well-being status of community dwelling stroke survivors and compared with controls and amongst themselves. The study also conducted an economic analysis of stroke in terms of annual national human capital resource loss from stroke mortality in Fiji.

CHAPTER FIVE

COMPARATIVE ANALYSIS OF STROKE FACTORS

5.1 Introduction

As discussed in the earlier chapters, the existing literature revealed that there are various factors that influence and have impact on stroke survivors' and their families' physical, social and psychological well-being, and functioning. These factors produce either a negative or adverse effect on well-being, or a positive or moderating effect.

This chapter provides a comparative analysis of all the study variables from the primary data of randomly selected stroke survivors living in the community for six or more months against the controls. The influence and impact these variables have on the psychological well-being of community dwelling stroke survivors with significance of the association are discussed separately in Chapter 7 – Psychological Well-being of Stroke Survivors in Fiji.

5.2 Methodology

The primary data was captured by a comprehensive structured interview questionnaire specially designed for this study as Appendix 1 colour-coded yellow for stroke survivors and Appendix 2 colour-coded green for controls. The questionnaire booklets were colour-coded to avoid mix up in data collection. The data included variables for socio-demographic characteristics, mental status, medical risk factors and socio-economic indices for stroke, self-reported health status, utilisation of health service facilities including co-morbidities and medication use, and self-reported physical and social levels of functioning. The collected data also included observer-assessed physical functional status, carers' characteristics, family and social support network, including the study subjects perceived relationships with them and outside organisational assistance received, and the perceived need for more support.

The observer-assessed physical functional status of the participants were based on modified Rankin Scale (mRS), while the mental state examination was based on the Abbreviated Mental Test Score (AMTS), both of which have been explained in detail in the Methodology section of this thesis.

The data was entered into and analysed using the Excel Spreadsheet, SPSS and Epi Info software programs. As stated in the chapter on methodology further analysis for significance was conducted using Student's *t*-test for all continuous parametric data and Mantel-Haenszel Chi-square (χ^2) test was applied to categorical data. Odd Ratios (OR), 95% Confidence Interval (CI), standard error and degrees of freedom (df) were also obtained.

5.3 Results and Discussion

One hundred and two (n=102) stroke survivors and the same number of controls (n=102) participated in the study. From the originally selected sample, nineteen stroke survivors could not be contacted and two were found to have deceased. Only a small number of selected sample were found deceased because the time from entry into the Stroke Register to the time of selection and fieldwork and data collection was within a year.

Of all the stroke survivors in the study, fifty nine percent (59%) (n=60) had left hemiplegia, while forty one percent (41%) (n=42) had right hemiplegia. It is reported in the literature that the percentage of right and left hemiplegia, in hospital populations, are almost similar (Andrews, 1982; Katrak and Peeva, 2008). However, there was a slightly higher percentage of right hemiplegics amongst this sample of community dwelling stroke survivors. Whether this pattern is peculiar to Fiji's or if there is a higher survival of right hemiplegics, is not known. Thus, it could be a subject of further research initiatives.

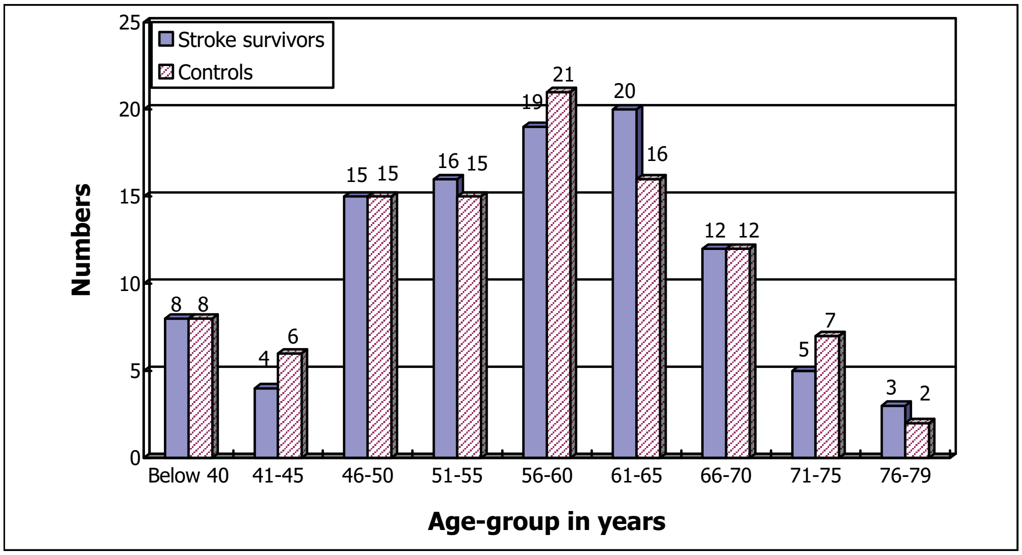
There is a clinical difference in presentation of the right and left strokes or hemiplegics. Apart from the facial and/or limb weakness, paresis or paralysis, the other unilateral clinical presentations of the contra-laterally affected cerebral sides vary with left (dominant) cerebral stroke, that is, right hemiplegia mostly presenting with speech, and right (non-dominant) cerebral stroke with left hemiplegia presenting with visuo-spatial difficulties.

As per case control study protocol, none of the controls recruited ever had suffered a stroke. However, they did have various other medical conditions and co-morbidities, which are compared and discussed later in this chapter.

5.3.1 Socio-demographic data

The average ages of the stroke survivors and the controls were almost fifty-seven years each with stroke survivors 56.9 ± 10.9 years and controls 56.7 ± 10.5 years. There was no statistically significant difference between the stroke survivors and the controls age (p = 0.90, 202df, Standard error 1.50, 95% CI -2.75 – 3.14). The five-year age-group distribution is illustrated in Figure 6.

Figure 6: Age-group distribution of Stroke survivors and Controls



There were 8 of each below the age of 40 years; 4 and 6 in 41-45 year age-group; 15 each in 46-50 year age-group; 16 and 15 in 51-55 year age-group; 20 and 16 in 61-65 year age-group; 12 each in 66-70 year age group; 5 and 7 in 71-75 year age-group; 3 and 2 in 76-79 year age-group of stroke survivors and controls respectively. There was no subject over the age of 79 years. Furthermore, forty two percent (42.2% (n=43) stroke survivors and forty three percent (43.1%) (n=44) controls were below the retirement age of 55 years in Fiji at the time of the study. Stroke incidence increases rapidly with increasing age (World Health Organisation, 2005; Australian Institute of Health and Welfare and the National Stroke Foundation, 2006; Frost, 2007; American Heart Foundation, 2008), including that projected for Fiji (Maharaj and Panapasa, 2002).

With respect to gender, male stroke survivors made up almost sixty six percent (65.7%) (n=67), while females just over thirty four percent (34.3%) (n=35). Whereas males made up only thirty seven percent (37.3%) (n=38) of the control group, females accounted for almost sixty three percent (62.7%) (n=64). There was a statistically significant difference in the gender composition between stroke survivors and controls ($\chi^2 = 16.42$, $p < 0.001$, OR = 3.22, 95% CI 1.75 – 5.96). The disparity seems to have come about due to the recruitment process of including spouses of stroke survivors as household controls. This could be seen as a weakness of the study. However, as reported in the literature, the effect of chronic illness on the spouse (Nilsson *et al*, 2001) and family members (King *et al*, 2002; Holmes and Deb, 2003) can be equally adverse when compared to the person with the chronic illness. Although this selection of gender disparity in the control group is an obvious limitation of this study, it should not heavily bias the results. The results must be interpreted with this difference in mind.

The geographical distribution of the study sample is given below according to their "current" district of residence. Fifty five percent (54.9%) (n=56) stroke survivors and forty five percent (45.1%) (n=46) controls were from Suva; twenty seven percent (26.5%) (n=27) stroke survivors and thirty eight percent (38.2%) (n=39) controls resided in Nasinu; six percent (5.9%) (n=6) stroke survivors and eight percent (7.8%) (n=8) controls were from Nausori; three percent (2.9%) (n=3) stroke survivors and one percent (1.0%) (n=1) control were from Tailevu; four percent (3.9%) (n=4) stroke survivors and five percent (4.9%) (n=5) controls of Lami; two percent (2.0%) (n=2) stroke survivors and two percent (2.0%) (n=2) controls were from Navua; one percent (1.0%) (n=1) stroke survivor and none of the control were from Nadi; two percent (2.0%) (n=2) stroke survivors and one percent (1.0%) (n=1) control were from Lautoka; and one percent (1.0%) (n=1) stroke survivors and none of the control were from Rakiraki. It is of note that Nasinu, which lies between Suva and Nausori, is a new municipality created in 1991. Prior to this, part of it was in Suva and part in Nausori municipalities.

When dichotomised into either currently living in the Suva/Nasinu area, which is close to the specialised medical rehabilitation services, or not from Suva/Nasinu area; eighty one percent (81.4%) (n=83) stroke survivors and eighty three percent (83.3%) (n=85) controls came from this area, while the rest were from other parts of Viti Levu. There was no statistically significant difference by place of residence of stroke survivors and controls ($\chi^2 = 2.78$, $p = 0.10$, OR = 0.53, 95% CI 0.23 – 1.19). This data is shown in the Table 10.

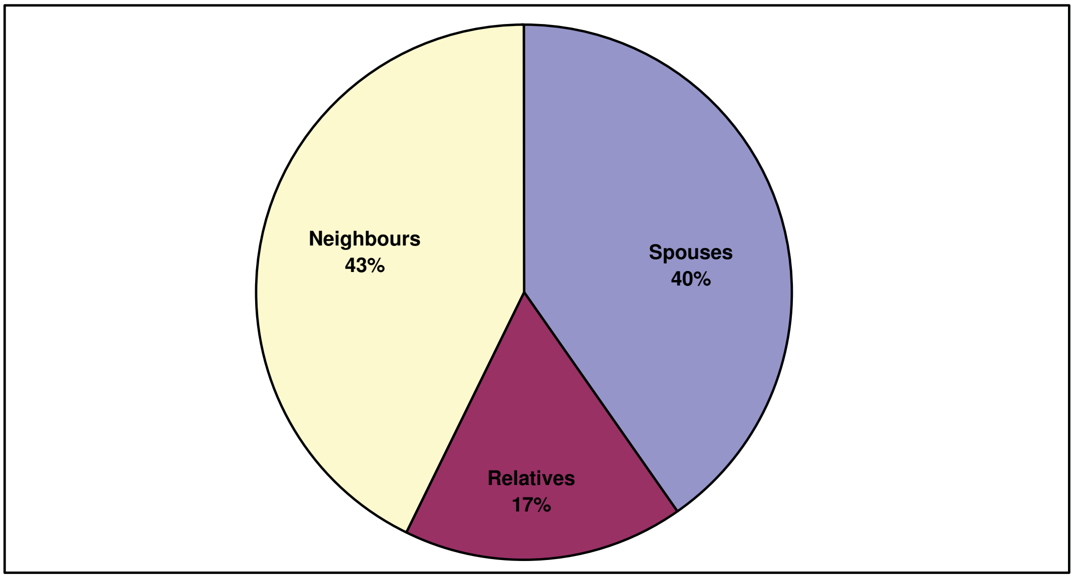
Table 10: Place of residence of Stroke survivors and Controls

District of residence	**Stroke survivors**		**Control**	
	n	%	n	%
Suva	56	54.9	46	45.1
Nasinu	27	26.5	39	38.2
Nausori	6	5.9	8	7.8
Tailevu	3	2.9	1	1.0
Lami	4	3.9	5	4.9
Navua	2	2.0	2	2.0
Nadi	1	1.0	0	0.0
Lautoka	2	2.0	1	1.0
Rakiraki	1	1.0	0	0.0
Total	**102**	**100.0**	**102**	**100.0**

Reports in literature show that nativity or place of birth (Lackland *et al*, 1999), as well as place of dwelling related to socio-economic status (van Rossum *et al*, 1999; Avendano *et al*, 2006) have been shown to correlate with stroke incidence and mortality as a result of stroke. Variation in this trend was not examined in the course of this study and could be subject of further study.

The characteristics of the control group are presented below. In this population-based study, immediate household relatives or neighbours were recruited as neighbourhood controls. Thus, the controls can be categorised as spouses, other relatives or neighbours. Forty percent (40%) (n=41) of spouses of stroke survivors; seventeen percent (17%) (n=17) other relatives of stroke survivors; and forty three percent (43%) (n=44) other persons from the neighbourhood community agreed to be the controls. This is displayed in the Figure 7 below.

Figure 7: Categories of Controls



According to ethnic distribution, just over seventy percent (71.6%) (n=73) of stroke survivors were Fijians, and nearly thirty percent (28.4%) (n=29) were Indians. Thus, it is evident that marginally higher 73.5% (n=75) Fijians, than 26.5% (n=27) Indians made up the control group. There was no statistically significant difference by ethnicity ($\chi^2 = 0.10$, $p = 0.75$, OR = 0.91, 95% CI 0.47 – 1.76) between stroke survivors and controls. Although international reports describe geographical and ethnic variations in the distribution and incidence of stroke (Thorvaldsen *et al*, 1995; Bonita *et al*, 1997; Anderson *et al*, 2006), the distribution pattern of stroke is not known in Fiji.

The level of education, for the whole sample, was assessed as either being primary school level or below and secondary school level or higher. Almost sixty three percent (62.7%) (n=64) of stroke survivors and fifty six percent (55.9%) (n=57) controls reported an education level of primary or less, whereas almost thirty seven percent (37.3%) (n=38) of stroke survivors and forty four percent (44.1%) (n=45) of controls had attained an education level of secondary or higher. In this study there was no statistically significant difference in education levels of primary or less and secondary or more between stroke survivors and controls ($\chi^2 = 0.99$, $p = 0.32$, OR = 1.33, 95% CI 0.73 – 2.42). A lower education level has been reported to be associated with a higher incidence of stroke and associated mortality. Educational level seems to be an important correlate of stroke mortality. In a large study, involving ten European countries (Avendano *et al*, 2004), an association between education and stroke mortality was shown to persist at all ages, in all populations.

The employment status, at the time of interview, was taken as either currently employed, retired, or unemployed. Under ten precent (9.8%) (n=10) of stroke survivors and over thirty six percent (36.2%) (n=37) of controls were ‘currently’ formally employed; almost similar percentages of 15.7% (n=16) stroke survivors and 16.7% (n=17) controls had retired; while almost three quarters (74.5%) (n=76) of stroke survivors and less than half (47.1%) (n=48) of the controls were unemployed. There was a statistically highly significant difference in employment status at interview between stroke survivors and controls ($\chi^2 = 21.86$, $p < 0.001$, 2df), with controls more likely to be employed. Although stroke survivors ‘employment status’ was that of post-stroke, employment and occupational status seems to go hand in hand with educational and socio-economic status prior to stroke, and have been shown to be related to stroke incidence and mortality probably associated with health awareness and healthcare utilisation (Avendano *et al*, 2004).

The participants' occupation was grouped into either professional or others (non-professional). The occupational group of stroke survivors was that of prior to the stroke. The occupational groups were almost equally distributed between stroke survivors and controls, with almost twenty one percent (20.6%) (n=21) professionals amongst stroke survivors and just over twenty five percent (25.5%) (n=26) amongst the controls. In the 'others' (non-professional) group, there were just over seventy nine percent (79.4%) (n=81) stroke survivors and nearly seventy five percent (74.5%) (n=76) controls. There was no statistically significant difference in occupational groups being either professional or others between stroke survivors and controls ($\chi^2 = 0.69$, $p = 0.41$, OR = 0.76, 95% CI 0.37 – 1.53).

Marital status was recorded as either married, never married, widowed or separated, but for analysis purposes these were collapsed into either 'married' or 'not married' groups. Almost seventy four percent (73.5%) (n=75) stroke survivors and over eighty percent (81.4%) (n=83) controls were married, while the rest were categorised as 'not married' at the time of data collection. There was no statistically significant difference of marital status between stroke survivors and controls ($\chi^2 = 1.79$, $p = 0.18$, OR = 0.64, 95% CI 0.31 – 1.30).

Both the Fijian and Indian ethnic groups are amongst the very 'traditional' cultures, and for this reason, the hierarchical position of a person in the household is important. The household position held by the stroke survivors and the controls was grouped into either 'head' of the household, 'spouse' or 'others'. Almost fifty six percent (55.9%) (n=57) of stroke survivors and forty three percent (43.1%) (n=44) of controls were heads of their households; just over thirty percent (30.4%) (n=31) stroke survivors and fifty percent (50.0%) (n=51) of controls were spouses; while the rest were categorised as 'others', with almost fourteen percent (13.7%) (n=14) accounting for stroke survivors and seven percent (6.9%) (n=7) as controls. There was a statistically significant difference seen by household position between stroke survivors and controls ($\chi^2 = 8.88$, $p = 0.01$, 2df) with stroke survivors more likely to be 'head' of the household. There were no studies found, which reported on the influence of a person's hierarchical position in the household on stroke. This finding may be artificial due to high proportion of female spouse in the control group. This will need further study and analysis.

The average number of persons living in a household was just greater than five for both stroke survivors (5.24) and the controls (5.17). There was no significant difference (p = 0.80) in household size. The number of persons living in a household could indicate the size of a family or extended nature of the family unit, with the average family size in Fiji being 3.5 members per family. There was no study found in the literature describing an influence of family size on the occurrence of stroke.

Household income has been used as an indicator of social capital for the family, and is known to influence stroke incidence and mortality. The annual household income including wage and salaries of everyone in the household was assessed. There were 14 stroke survivors and 6 controls who did not provided response to this question and have been excluded from the analysis. The combined household income for stroke survivors was the income that they received prior to having the stroke. This data allowed for comparison with controls and with the change or loss of income after the stroke. The average annual household income for the stroke survivors was F$8,470.13 (US$5,082.08) and for control was F$9,022.84 (US$5,413.70). There was no significant difference (p = 0.61, 182df, Standard error 1072.81, 95% CI $-2.67 - $1564.02) in household income of stroke survivors and controls.

Only the stroke survivors were asked whether they had any change in their household income since stroke and if so by how much. They were asked whether they had any extra expenses pertaining specifically to medical and health costs related to stroke. The research Assistants clarified this to them. Over a third (35.3%) (n=36) of stroke survivors reported change in their household income since stroke, with an average annual loss of F$5,611.54 (US$3,366.92). Almost three quarters (73.5%) (n=75) of stroke survivors reported having extra expenses of an average of F$947.00 (US$568.20) per year specifically due to the stroke. All the results of the socio-demographic characteristics are presented in the Table 11.

Table: 11 Socio-demographic Data for Stroke survivors and Controls

Socio-demographic Characteristic	Stroke survivors	Control	(χ^2)	p value
Region - Suva	78.4% (n=80)	87.3% (n=89)	2.78	0.10
- Outside Suva	21.6% (n=22)	12.7% (n=13)		
Ethnicity - Fijian	71.6% (n=73)	73.5% (n=75)	0.10	0.75
- Indian	28.4% (n=29)	26.5% (n=27)		
Gender - Male	65.7% (n=67)	37.3% (n=38)	16.42	< 0.001
- Female	34.3% (n=35)	62.7% (n=64)		
Age (years ± S.D.)	56.9 ± 10.9	56.7 ± 10.5		0.89
Education - Primary or less	62.7% (n=64)	55.9% (n=57)	0.99	0.32
- Secondary or more	37.3% (n=38)	44.1% (n=45)		
Occupation - Professional	20.6% (n=21)	25.5% (n=26)	0.69	0.41
- Others	79.4% (n=81)	74.5% (n=76)		
Employment - Employed	9.8% (n=10)	36.2% (n=37)	21.86	< 0.001
- Retired	15.7% (n=16)	16.7% (n=17)		
- Unemployed	74.5% (n=76)	47.1% (n=48)		
Marital status - Married	73.5% (n=75)	81.4% (n=83)	1.79	0.18
- Not married	26.5% (n=27)	18.6% (n=19)		
Household position - Head	55.9% (n=57)	43.1% (n=44)	8.88	0.01
- Spouse	30.4% (n=31)	50.0% (n=51)		
- Others	13.7% (n=14)	6.9% (n=7)		
No. of persons in the house	5.24	5.17		0.80
Annual household income	F$8,470.13 (n=88) US$5,082.08)	F$9,022.84 (n=96) US$5413.70)		0.61
Income change since stroke	35.3% (n=36)	-		
Average income loss per year	F$5611,54 (US$3366.92)	-		
Extra expenses since stroke	73.5% (n=75)	-		
Average extra expenses per year since stroke	F$947.00 (US$568.20)	-		

5.3.2 Medical risk factors for stroke

All the respondents were asked to state about their five most important existing medical risk factors for stroke, including high blood pressure, diabetes mellitus, heart disease, family history of stroke, and previous transient ischaemic attack or stroke. They were also asked whether any of these conditions were diagnosed for the first time after the stroke, and whether they have any other co-morbidities apart from the five mentioned above. Two-thirds (66.7%) (n=68) of stroke survivors and only a fifth (20.6%) (n=21) of controls reported having high blood pressure. There was a statistically highly significant difference in the presence of blood pressure between stroke survivors and controls ($\chi^2 = 43.81$, $p < 0.001$, OR = 7.71, 95% CI 3.93 – 15.31). Almost a third (30.4%) (n=31) of stroke survivors and half that proportion (15.7%) (n=16) of controls also had diabetes mellitus. There was a statistically significant difference in the presence of diabetes mellitus between stroke survivors and controls ($\chi^2 = 6.19$, $p = 0.01$, OR = 2.35, 95% CI 1.13 – 4.97). Seventeen percent (16.7%) (n=17) of stroke survivors and only six percent (5.9%) (n=6) of controls reported having concomitant heart disease. There was a highly significant difference in the presence of heart disease between stroke survivors and controls ($\chi^2 = 5.90$, $p = 0.01$, OR = 3.20, 95% CI 1.13 – 10.32). Family history of stroke was present amongst over a quarter (26.5%) (n=27) of stroke survivors and thirty percent (30.4%) (n=31) of the controls. There was no statistically significant difference in the presence of family history of stroke between stroke survivors and controls ($\chi^2 = 0.38$, $p = 0.54$, OR = 0.82, 95% CI 0.43 – 1.59). However, it seems that a higher percentage of controls than stroke survivors reported a “family history” of stroke, that is, they reported that a family member had previously suffered from stroke because they were controls recruited from the household of a stroke survivor. Just under fourteen percent (13.7%) (n=14) of stroke survivors had a previous transient ischaemic attack or a stroke, whereas none of the controls did. As expected, stroke survivors had a significantly higher prevalence of high blood pressure, diabetes mellitus and heart disease compared to controls. This is tabulated below in the Table 12 below.

Table: 12 Medical Risk Factors amongst Stroke survivors and Controls

Medical Risk Factors	Stroke survivors	Control	(χ^2)	p value
High blood pressure	66.7% (n=68)	20.6% (n=21)	43.81	< 0.001
Diabetes Mellitus	30.4% (n=31)	15.7% (n=16)	6.19	0.01
Heart disease	16.7% (n=17)	5.9% (n=6)	5.90	0.01
Family stroke history	26.5% (n=27)	30.4% (n=31)	0.38	0.54
Previous stroke	13.7% (n=14)	0		

Almost half (44.1%) (n=45) of stroke survivors reported having been diagnosed with at least one medical risk factor for stroke, including high blood pressure, diabetes mellitus or heart disease following their stroke, whereas less than seven percent (6.9%) (n=7) controls were recently diagnosed with any of the conditions. Stroke survivors were highly significantly more likely to be diagnosed with a new medical co-morbidity in the recent past compared to controls ($\chi^2 = 37.09$, $p < 0.001$, OR = 10.71, 95% CI 4.36 – 29.74).

This indicates that a high proportion of the population have an undiagnosed medical condition, which is a high medical risk factor for stroke. More than twenty percent (20.6%) (n=21) of stroke survivors and sixteen percent (15.7%) (n=16) of controls reported having another co-morbidity, other than high blood pressure, diabetes mellitus or heart disease. A high proportion of the population being diagnosed with a new medical condition following their stroke indicates that a high proportion of an “at risk” population live in the community unaware of “carrying” the risk with impending danger of stroke. This prevalence of risk factors has been shown in previous studies in Fiji and discussed in detail in Chapter 3 Stroke – An Overview. Co-morbid diseases have been shown to be common among patients after stroke and having a negative correlation with functional outcome (Karatepe *et al*, 2008). General population education to raise the awareness of their personal health is very important in controlling or eliminating medical risk factors for stroke by early detection and management, before it progresses to actual stroke.

5.3.3 Mental status

The result of the Abbreviated Mental Test Score (AMTS7) shows that controls performed much better than the stroke survivors. Amongst the controls, ninety seven percent (97.1%) (n=99) had the highest possible or a normal score of 7 and only three percent (2.9%) (n=3) scored 6, whereas amongst the stroke survivors, although majority of fifty eight percent (57.9%) (n=59) scored 7, forty two percent (42.1%) (n=44) scored 6 or below on this mental test. This forty two percent of stroke survivors comprised of eighteen percent (17.6%) (n=18) with a score of 6; four percent (3.9%) (n=4) score of 5; nine percent (8.8%) (n=9) score of 4; seven percent (6.9%) (n=7) score of 3; four percent (3.9%) (n=4) score 2; and none with a score 1 but one percent (1.0%) (n=1) had a score of zero. This is shown in the Table 8 below. To assess the difference between the two groups the AMTS7 score was dichotomised into 0-6 and 7, as score of 6 or below is regarded as abnormal. There was a highly significant difference ($\chi^2 = 44.69$, $p < 0.001$, OR = 24.05, 95% CI 7.10 – 124.74) between the controls and stroke survivors on the AMTS7 mental test scores indicating that community dwelling stroke survivors were significantly more likely to suffer from cognitive difficulties when compared to controls. This is shown in Table 13 below.

Table: 13 Abbreviated Mental Test Score for Stroke survivors and Controls

AMTS7 Score	Stroke survivors	Control	(χ^2)	p value
0 - 6	42.1% (n=43)	2.9% (n=3)	44.69	< 0.001
7	57.9% (n=59)	97.1% (n=99)		

5.3.4 Socio-economic risk factors for stroke

As lifestyle risk factors such as being overweight or obese, dietary practices, smoking, indulgence in excess alcohol and Kava, lack of exercise and sedentary life style are cardiovascular and stroke risk factors, all the participants were asked to provide information in relation to these. These variables, which were pre-stroke for stroke survivors, were also used to calculate the probability of stroke, as discussed in detail in the Chapter 6 – Impact of Socio-economic Variables on Stroke Likelihood: A Probability Modeling of this thesis.

The questions relating to weight, dietary practice, and exercise were purely based on the interviewee's self-perception of these issue rather than quantified and defined levels by the interviewer. The participants were asked, "According to you, were you overweight or 'fat'?" Thirty four percent (34.3%) (n=35) of the stroke survivors and twenty percent (19.6%) (n=20) of the controls reported being overweight. There was a statistically significant difference between stroke survivors and controls with stroke survivors more likely to report being overweight prior to stroke ($\chi^2 = 5.57$, $p = 0.02$, OR = 2.14, 95% CI 1.08 – 4.29). They were asked about their dietary practice by "Did you avoid salty and fatty foods?", to which thirty three percent (33.3%) (n=34) of the stroke survivors and forty four percent (44.1%) (n=45) of the controls reported that they avoided salty and fatty foods. There was no statistically significant difference between the controls and stroke survivors ($\chi^2 = 2.49$, $p = 0.12$, OR = 0.63, 95% CI 0.34 – 1.16). To the question "Did you smoke?", thirty three percent (33.3%) (n=34) of the stroke survivors and twenty three percent (22.5%) (n=23) of the controls reported smoking. Again there was no statistically significant difference between the groups ($\chi^2 = 2.93$, $p = 0.09$, OR = 1.72, 95% CI 0.88 – 3.36). When asked, "Did you take alcohol?", thirty one percent (31.4%) (n=32) of the stroke survivors and seventeen percent (16.8%) (n=17) of the controls said that they consumed alcohol. Only one control did not answer this question and was excluded from analysis. There was a statistically significant difference when consumption of alcohol was compared between stroke survivors and controls ($\chi^2 = 6.01$, $p = 0.01$, OR = 2.29, 95% CI 1.12 – 4.76).To the Kava question, "Did you take Kava?", fifty six percent (55.9%) (n=57) of the stroke survivors and only thirty eight percent (38.2%) (n=39) of the controls consumed Kava. There was a similar statistically significant difference when consumption of Kava was compared between stroke survivors and controls ($\chi^2 = 6.34$, $p = 0.01$, OR = 2.05, 95% CI 1.13 – 3.72). Both alcohol and Kava showed similar significance in this sample most likely due to the pattern of consumers' lifestyles of indulging in both.

When asked, “Did you exercise?”, twenty two (22.5%) (n=23) of the stroke survivors and sixteen percent (15.7%) (n=16) of the controls reported that they participated in any form of regular exercise. There was no statistically significant difference between stroke survivors and controls in terms of participation in regular exercise ($\chi^2 = 1.55$, p = 0.21, OR = 1.56, 95% CI 0.73 – 3.41). The participants were also asked, “What type of work did you do most of your life?”, to which twenty one percent (20.6%) (n=21) of the stroke survivors and twenty five (24.5%) (n=25) of the controls stated that they were “office-workers”, whereas the rest did “manual labour work”. Again there was no significant difference between stroke survivors and controls in terms of type of work ($\chi^2 = 0.45$, p = 0.50, OR = 0.80, 95% CI 0.39 – 1.63).

The results show that overall the stroke survivors generally had higher risk lifestyle activities compared to controls. Whilst accepting that stroke survivors are more likely to have such lifestyle risk factors (as being overweight, eating salty foods and excessive indulgence in alcohol and Kava) it may be that they are more conscious and realistic in reporting such factors given that they already have had a stroke thus amplifying the difference between them and the controls. However, only “reported being overweight”, “consumed alcohol” and “consumed Kava” showed any statistically significant difference between the two groups. This data is as presented in Table 14 below.

5.3.5 Self- Reported Health Status of Stroke survivors and Controls

Self-reported health status has been shown to be a valid measure of a person’s health (Dorman *et al*, 2000; Bugge *et al*, 2001; Miller and Wolinsky, 2007), but caution should be exercised in the form of questioning (Hillen *et al*, 2003). To the simple question “How is your health these days?”, the participants were asked to respond as either “Very Good”, “Good”, “Fair”, “Poor”, or “Very Poor”.

Table: 14 Socio-economic Risk Factors amongst Stroke survivors and Controls

Socio-economic Risk Factors	Stroke survivors	Control	(χ^2)	p value
Reported being overweight	34.3% (n=35)	19.6% (n=20)	5.57	0.02
Diet				
-avoided salty & fatty foods	33.3% (n=34)	44.1% (n=45)	2.49	0.12
Smoked	33.3% (n=34)	22.5% (n=23)	2.93	0.09
Consumed alcohol	31.4% (n=32)	16.8% (n=17)	6.01	0.01
Consumed Kava	55.9% (n=57)	38.2% (n=39)	6.34	0.01
Participated in regular exercise	22.5% (n=23)	15.7% (n=16)	1.55	0.21
Type of work				
- Office	20.6% (n=21)	24.5% (n=25)	0.45	0.05
- Labour	79.4% (n=81)	75.5% (n=77)		

Only seven percent (6.9%) (n=7) of the stroke survivors and almost eighteen percent (17.7%) (n=18) of the controls reported being in 'very good' health status. Thirty eight percent (38.2%) (n=39) of the stroke survivors reported being in 'good' health status, when as compared to almost double over sixty one percent (61.8%) (n=63) of the controls. Forty three percent (43.2%) (n=44) of the stroke survivors reported being in 'fair' health status, compared to only eighteen percent (18.6%) (n=19) of the controls. Almost nine percent (8.8%) (n=9) of the stroke survivors reported 'poor' health status, compared to only one percent (0.9%) (n=1) of the controls. Against none of the controls, three percent (2.9%) (n=3) of the stroke survivors reported being in a 'very poor' state of health. There was a statistically highly significant difference in their self-reported health between stroke survivors and controls (χ^2 = 29.80, $p < 0.001$, 4df) with stroke survivors more likely report fair to very poor health. This is shown in Table 15 below.

Table: 15 Self-reported Health Status of Stroke survivors and Controls

Self-reported Health Status	Stroke survivors	Control	(χ^2)	p value
- Very good	6.9% (n=7)	17.7% (n=18)	29.80	< 0.001
- Good	38.2% (n=39)	61.8% (n=63)		
- Fair	43.2% (n=44)	18.6% (n=19)		
- Poor	8.8% (n=9)	0.9% (n=1)		
- Very poor	2.9% (n=3)	0		

5.3.6 Uses of Health Services by Stroke survivors and Controls

The following information on admissions to a hospital after stroke, length of stay in acute and rehabilitation hospitals, outpatient therapy and alternative treatment/therapy/cure only deals with stroke survivors. The reasons for a stroke survivor to present or not present to a health service facility in acute or in chronic stage could be many and varied. Although this was beyond the scope of this study, these could include from lack of recognition of stroke by the victim and the family, preference for traditional cures before Western medicine, geographical isolation, lack of referral by primary health practitioner and lack of resources to get to health care facility. This is an important area for further research in Fiji. Data on how soon after the stroke a stroke survivor was admitted to hospital was not collected as that was not in the scope of this study but this information may be available through acute hospital admission process or could be ascertained from stroke survivors and their family or relatives of those who passed away from stroke.

A high proportion of (91.1%) (n=93) of the stroke survivors in this study were admitted to acute hospitals following their stroke. Of these, stroke survivors twenty eight percent (28.0%) (n=26) had a length of stay (LOS) in acute hospitals of less than a week; fifty two percent (51.6%) (n=48) stayed in the acute hospital from a week up to less than a month; and only twenty percent (20.4%) (n=19) had longer than one month LOS in the acute hospital. For analysis, the hospital LOS of less than three months and more than three months were collapsed into one variable of more than a month.

Only twenty nine percent (29.4%) (n=30) stroke survivors reported admission to the Rehabilitation Hospital. The geographical place of residence seems to have had an impact on the stroke survivor being admitted to Rehabilitation Hospital. Sub-group analysis of the 30 stroke survivors who were admitted for rehabilitation show that majority of eighty seven percent (87%) (n=26) lived within 10 kilometre radius of the Rehabilitation Hospital in Suva (n=16) and Nasinu (n=10) areas. There were only one each from Nausori and Tailevu areas and two from the Western side of the island of Viti Levu. Thirteen percent (13.3%) (n=4) of stroke survivors length of stay (LOS) in the Rehabilitation Hospital was less than a week and fifty percent (50%) stayed in rehabilitation from one week to less than a month, while more than thirty six percent (36.7%) need rehabilitation for more than a month.

Forty one percent (41.2%) (n=42) of stroke survivors reported utilising outpatient therapy services and seventy three percent (73.0%) (n=73), who answered the question, said that they resorted to one or other kinds of alternative treatment/therapy/cure, which are widely practiced amongst almost all cultures in Fiji.

Visits to a doctor or use of health facility, regular medication use, and the number of health issues in the last six months included both the stroke survivors and the controls. In this area, both groups had a similar trend. Almost equal numbers of stroke survivors (51.5%) (n=52) and controls (54.2%) (n=52) visited a doctor/health facility within the month; almost a quarter of the stroke survivors (24.7%) (n=25) and a fifth of controls (20.8%) (n=20) visited doctor/health facility from a month to three months, while just over a quarter of both the stroke survivors (23.8%) (n=24) and the controls (25.0%) (n=24) visited doctor/health facility in over three months. There was no significant difference between stroke survivors and controls in terms visit to a doctor /health facility ($\chi^2 = 0.13$, $p = 0.81$, 2df).

Sixty three percent (62.7%) (n=64) of the stroke survivors and only thirty three percent (33.3%) (n=34) of the controls reported being on any regular medication. There was a statistically highly significant difference between the two groups ($\chi^2 =$

17.67, $p < 0.001$, OR = 3.37, 95% CI 1.82 – 6.24) with, expectedly, stroke survivors more likely to be on regular medication.

The number of health issues encountered by stroke survivors and controls within the past six months was assessed. Similar percentages of both groups, 16.7% (n=17) of stroke survivors and 18.6% (n=19) of controls, reported not having any health issues in the previous six months, whereas only half the number of stroke survivors (5.9%) (n=6) compared to controls (11.8%) (n=12) reported having at least one health issue in the previous six months, but a slightly higher number of stroke survivors (77.4%) (n=79) reported having more than two health issues, when compared to controls (69.6%) (n=71). There was no statistically significant difference in the number of health issues in the past six months reported by the two groups ($\chi^2 = 2.54$, $p = 0.28$, 2df). The findings indicate that the stroke survivors and the controls both had similar pattern of visits to doctors or a health care facility. All the above data on the use of health services by stroke survivors and controls is tabulated in Table 16.

It is also of note that nine of the stroke survivors from the sample were neither admitted to acute hospital or rehabilitation facility except one who was admitted only to Rehabilitation Hospital directly from the community.

5.3.7 Functional and Social Status of Stroke survivors and Controls

The respondents were asked to state about their self perceived physical functional status as ‘activity limitation’ and social status as ‘social activities’ graded as either ‘no restrictions’, ‘some restrictions’ or ‘completely restricted’. This is probably, where the biggest difference between the two groups surfaced. For physical functional status as ‘activity limitation’ only a small proportion of less than a tenth (8.9%) (n=9) of stroke survivors compared to almost seventy percent (69.6%) (n=71) of the controls, reported having ‘no’ activity limitations; twice the proportion stroke survivors (62.4%) (n=64) compared to controls (29.4%) (n=30) reported having ‘some’ activity limitations; whereas, almost thirty times more stroke survivors (28.7%) (n=29) compared to controls (1.0%) (n=1) reported having ‘complete’ activity limitations. There was a statistically highly significant difference of “Activity limitation" ($\chi^2 = 85.89$, $p < 0.001$, 2df) between stroke survivors and controls with stroke survivors highly likely to encounter some or complete activity restrictions.

Table: 16 Use of Health Services by Stroke survivors and Controls

Health Service		Stroke survivors	Control	(χ^2)	p value
Admitted for stroke	Yes	91.2% (n=93)	-		
Length of stay (n=93)	< 1 week	28.0% (n=26)	-		
	< 1 month	51.6% (n=48)	-		
	> 1 months	20.4% (n=19)	-		
Rehabilitation	Yes	32.3% (n=30)	-		
Length of stay in Rehab (n=30)	< 1 week	13.3% (n=4)	-		
	< 1 month	50.0% (n=15)	-		
	> 1 months	36.7% (n=11)	-		
Outpatient therapy (n=102)	Yes	41.2% (n=42)	-		
Alternative cure/ therapy (n=100)	Yes	73% (n=73)	-		
Visit doctor /health facility	Within 1 month	51.5% (n=52)	54.2% (n=52)	0.13	0.81
	1 to 3 months	24.7% (n=25)	20.8% (n=20)		
	> 3 months	23.8% (n=24)	25.0% (n=24)		
Medications	Yes	62.7% (n=64)	33.3% (n=34)	17.67	< 0.001
Health issues in last six months	None	16.7% (n=17)	18.6% (n=19)	2.54	0.28
	One	5.9% (n=6)	11.8% (n=12)		
	> Two	77.4% (n=79)	69.6% (n=71)		

The social status situation assessed, as 'social activities' produced similar results to physical functional status assessed as 'activity limitation'. Thirteen percent (13.0%) (n=13) of stroke survivors and seventy three percent (73.5%) (n=75) of the controls reported having 'no' restrictions in social activities; fifty six percent (56.0%) (n=58) of stroke survivors compared to twenty five percent (25.5%) (n=26) controls reported 'some' restrictions in social activities; whereas thirty one percent (31.0%) (n=31) of stroke survivors compared only one percent (1.0%) (n=1) of controls reported having 'complete' restriction in social activities. There was a statistically highly significant difference in "Social activities" ($\chi^2 = 82.77$, $p < 0.001$, 2df) between stroke survivors and controls with stroke survivors more likely to have restrictions.

Due to the nature of disabilities from stroke, significantly higher proportion of stroke survivors compared to controls had both physical functional activity limitations, which likely affected their social activities. This indicates that the community situation in which the study was conducted, when stroke survivors have restricted physical function, their social activities were equally adversely affected; thus, indicating a relationship between the two – physical functioning and social activities. Gall *et al* (2008) examined handicap 5-years after stroke using London Handicap Scale and found that the greatest handicap was present for physical independence and occupation/leisure items. They reported that handicap was also associated with older age, manual occupation, smoking, initial stroke severity, recurrent stroke and mood disorders. However, this study was not set up to test this hypothesis and is an area for further research in Fiji. This data is presented in Table 17.

Table: 17 Functional and Social Status of Stroke survivors and Controls

Level of Limitation	Stroke survivors	Control	(χ^2)	p value
Activity limitation				
- No restrictions	8.9% (n=9)	69.6% (n=71)	85.89	< 0.001
- Some restrictions	62.4% (n=64)	29.4% (n=30)		
- Completely restricted	28.7% (n=29)	1.0% (n=1)		
Social activities				
- No restrictions	13.0% (n=13)	73.5% (n=75)	82.77	< 0.001
- Some restrictions	56.0% (n=58)	25.5% (n=26)		
- Completely restricted	31.0% (n=31)	1.0% (n=1)		

The study groups' physical status was also observer-assessed using the Rankin Scale described in the methodology section. The stroke survivors had grades over the whole spectrum ranging from 0 – 5 on the Rankin Scale, whereas almost all the controls were graded as 0, except two, where each were graded as 1 and 4 respectively. There was a statistically highly significant difference (χ^2 = 181.10, $p < 0.001$, 5df) in the Rankin scores between the two groups with stroke survivors more likely to have greater restrictions. This result correlates well with the self-reported physical activity limitation, as almost twenty two percent (21.6%) of stroke survivors (n=22) were graded as having moderately severe disability (Grade 4) to severe disability (Grade 5) on observer-assessed Rankin Scale, compared to almost twenty nine percent (28.7%) of stroke survivors (n=29), who self-reported as being "completely restricted" in their physical functional activities. In the literature, it has been reported that patients who are more functionally dependent in self-care are likely to experience a greater number of complications than those who are less dependent (Sackley *et al*, 2008). This result is presented in the Table 18.

Table: 18 Rankin Status of Stroke survivors and Controls

Rankin grade	Stroke survivors	Controls	(χ^2)	p value
0	3.9% (n=4)	98.0% (n=100)	181.10	< 0.001
1	13.7% (n=14)	1.0% (n=1)		
2	33.3% (n=34)	0.0% (n=0)		
3	27.5% (n=28)	0.0% (n=0)		
4	16.7% (n=17)	1.0% (n=1)		
5	4.9% (n=5)	0.0% (n=0)		

Stroke survivors' functional status six months after an ischaemic stroke has been reported to be associated with long-term survival. In a combined analysis of the Oxfordshire and Lothian cohorts, subsequent median survival fell progressively from 12.9 years (10.0 to 15.9) for patients with a Rankin score of 0-1 at six months after the stroke to 2.5 years (1.4 to 3.5) for patients with a Rankin score of 5 (Slot *et al*, 2008). Thus, early interventions that reduce dependency at six months might have positive effects on long-term survival.

5.3.8 Carer and Relationship with Stroke survivors and Controls

The respondents were asked whether they had a carer, and if so, who was the main carer – spouse, child, parent, paid carer or others. The “carer” was described to the participants as anyone providing care needs for them at whatever level. This was a subjective assessment and any instrumental objective assessment of carer needs was not evaluated. However, as reported above, participants’ physical functional status was assessed by modified Rankin Scale and self-reported activity limitation.

For analysis, the carer categories were collapsed into ‘spouse’ or ‘others’. As expected, five times more stroke survivors (80.4%) (n=82) compared to controls (17.3%) (n=17), reported having carers with a statistically highly significant difference between the two groups ($\chi^2 = 82.51$, $p < 0.001$, OR = 20.50, 95% CI 9.51 – 44.72).

Although stroke survivors had significantly more carers, there were a higher proportion of spouses caring for the control group (61.8%) (n=21), when compared to that for stroke survivors (48.8%) (n=40). There was no statistically significant difference between the two groups ($\chi^2 = 1.61$, $p = 0.20$, OR = 0.59, 95% CI 0.24 – 1.43).

In addition, stroke survivors had more paid carers (7.2%) compared to controls (3.5%), but there was no statistically significant difference ($\chi^2 = 0.86$, $p = 0.35$, OR = 2.14, 95% CI 0.36 – 22.37).

More carers of stroke survivors (16.9%) (n=14) reported income loss compared to those of controls (5.3%) (n=3) with a statistically significant difference between the two groups ($\chi^2 = 4.23$, $p = 0.04$, OR = 3.65, 95% CI 0.94 – 20.65).

If the respondents had carers, they were asked to report on the relationship with their carer as either ‘very good’, ‘good’, ‘fair’, ‘poor’ or ‘very poor’. There was no significant differences reported in the relationships with carers by the two groups ($\chi^2 = 0.12$, $p = 0.73$, OR = 1.12, 95% CI 0.37 – 3.95) with the majority reporting either ‘very good’ or ‘good’ relationship. There could be bias in this response especially when there interview is conducted with both the carer and the cared present together. Another area for further investigation. This data is presented in the Table 19.

Table: 19 Carer and Relationship with Stroke survivors and Controls

Carer Characteristics	Stroke survivors	Control	(χ^2)	p value
Carer - Yes	80.2% (n=82) (n=102)	17.3% (n=17) (n=98)	82.51	< 0.001
Main carer				
- Spouse	48.8% (n=40)	61.8% (n=21)	1.61	0.20
- Others	51.2% (n=42)	38.2% (n=13)		
Carer paid - Yes	7.2% (n=6) (n=83)	3.5% (n=2) (n=57)	0.86	0.35
Carer income loss - Yes	16.9% (n=14) (n=83)	5.3% (n=3) (n=57)	4.23	0.04
Relationship with carer				
- Very good	51.7% (n=45)	47.1% (n=8)	0.12	0.73
- Good	45.9% (n=40)	47.1% (n=8)		
- Fair	2.4% (n=2)	5.8% (n=1)		
- Poor	0	0		
- Very poor	0	0		
	(n=87)	(n=17)		

A review of 20 published stroke caregiving research articles by Han and Haley (1999) found that the effect of stroke care-giving, at both acute and chronic phase of stroke, produced elevated levels of depression on the caregiver and that health-related care tasks are most stressful to caregivers, with around 40% of the family caregivers reporting somatic symptoms (Sit *et al*, 2004). This could strain the relationship between the family caregiver and the stroke survivors.

5.3.9 Social Network & Relationship with Stroke survivors & Controls

To assess the social network and family relationship, the respondents were asked about the number of visits by family members and outside visitors, as well as the relationships with the family members.

Almost four percent (3.9%) (n=4) of both the stroke survivors and the controls reported no visits from family members, and for those who had visits, controls report statistically significantly ($p < 0.01$, 181df, Standard error 0.86, 95% CI – 4.38 - 0.98) more average number of visits per month (7.3) compared to that reported by stroke survivors (4.6). As mentioned in Section 5.3.2, there was no difference in the average family size of stroke survivors (5.24) compared to that of controls (5.17) which could have influence the average number of visits.

Similarly, for "outside visitors", there were almost five percent (4.9%) (n=5) of stroke survivors and almost six percent (5.9%) (n=6) of the controls, who had no visitors. For those who did have "outside visitors", the average number of visitors per month was similar in proportion to family members visits and statistically highly significant ($p < 0.001$, 182df, Standard error 0.79, 95% CI – 4.17 - 1.03), with an average of 4.3 visits per month for the stroke survivors and 7.1 for the controls.

For family relationship, a lesser percentage of stroke survivors (38.3%) (n=39) compared to controls (60.9%) (n=62) had 'very good' relationship with family members. More stroke survivors (55.9%) (n=57) compared to controls (34.3%) (n=35) reported 'good' relationship, rather than 'very good'. There was statistically significant difference in the relationships with family between the two groups ($\chi^2 = 13.50$, $p < 0.01$, OR = 0.82, 95% CI 0.19 – 3.37) with stroke survivors more likely to have 'good' rather than 'very good' relationship.

Similar to the carer relationship question there could be bias in this response especially when there interview is conducted with both the family member and the interviewee present together. To adjust for this possibly anomaly separate interviews will have to be conducted which could be more time consuming and require special arrangements. This data is presented in Table 20.

Table: 20 Social Network and Relationship with Stroke survivors and Controls

Social Network and Relationship	Stroke survivors	Control	(χ^2)	p value
Visits from family				
- No	3.9% (n=4)	3.9% (n=4)		
- Yes (average no. of visits)	4.6	7.1		< 0.01
Relationship with family				
- Very good	38.3% (n=39)	60.9% (n=62)	13.50	< 0.01
- Good	55.9% (n=57)	34.3% (n=35)		
- Fair	3.9% (n=4)	1.9% (n=2)		
- Poor	0.0% (n=0)	1.9% (n=2)		
- Very poor	1.9% (n=2)	0.9% (n=1)		
Other visitors				
- No	4.9% (n=5)	5.9% (n=6)		
- Yes (average no. of visits)	4.3	7.1		< 0.001

5.3.10 Perceived Needs by Stroke survivors and Controls

Prior to asking about their perceived needs, the respondents were first asked, “Do you receive any regular assistance from outside organisations?”. More than a third of stroke survivors (36.3%) (n=37) reported receiving regular assistance from outside organisations, compared to only a tenth of controls (10.8%) (n=11). The stroke survivors perception for need of more “Organisational help” was statistically highly significantly different compared to controls ((χ^2 = 18.33, p < 0.001, OR = 0.21, 95% CI 0.09 – 0.47).

When asked, “Do you feel you need more support from family?”, almost similar percentages of both groups of stroke survivors (8.8%) (n=9) and controls (10.8%)

(n=11) stated that they “never” needed any extra help from the family. Forty eight percent of stroke survivors (48%) (n=49) and almost sixty seven percent of the controls (66.7%) (n=68) stated that they “sometimes” needed extra help from the family, however, more stroke survivors (43.2%) (n=44) stated that they felt they “often” needed more help from the family compared to controls (22.5%) (n=23). The stroke survivors perception that they needed more help from family was statistically significantly different compared to controls ($\chi^2 = 9.87$, $p < 0.01$, 2df).

Concerning their perceived needs for more support from outside the family, the respondents were asked, “Do you feel you need more support from outside?” More controls (22.5%) (n=23) and (59.8%) (n=61) thought that they “never” and “sometimes” needed more help from outside compared to stroke survivors (14.7%) (n=15) and (36.3%) (n=37) respectively. However, more stroke survivors (49%) (n=50) compared to the controls (17.7%) (n=18) perceived that they needed for more help from outside. The stroke survivors perception for need for more help from outside was statistically highly significantly different compared to controls ($\chi^2 = 22.62$, $p < 0.001$, 2df). This data is illustrated in the Table 21.

Table: 21 Perceived Needs by Stroke survivors and Controls

Perceived Needs	Stroke survivors	Control	(χ^2)	p value
Organisational help				
- No	63.7% (n=65)	89.2% (n=91)	18.33	< 0.001
- Yes	36.3% (n=37)	10.8% (n=11)		
More help from family				
- Never	8.8% (n=9)	10.8% (n=11)	9.87	< 0.01
- Sometimes	48.0% (n=49)	66.7% (n=68)		
- Often	43.2% (n=44)	22.5% (n=23)		
More help from outside				
- Never	14.7% (n=15)	22.5% (n=23)	22.62	< 0.001
- Sometimes	36.3% (n=37)	59.8% (n=61)		
- Often	49.0% (n=50)	17.7% (n=18)		

In all cases, compared to controls the stroke survivors perceived that they had need for statistically significantly more assistance. Existing literature reveals a mismatch of expected and real needs between the stroke survivor and caregivers. Often the caregivers perceive that the support provided is more than the actual amount of support rendered (Sit *et al*, 2004), thus, could underestimate the real needs.

5.4 Summary and Conclusion

This chapter provided a comparative analysis of all the variables studied within the scope of this research, which can influence the outcome of stroke survivors living in the community, compared with controls. This population-based case control study involved structured interviews of one hundred and two (n=102) stroke survivors living in the community for six or more months and same number of household and neighbourhood controls. There has been a gender disparity in the matching process but it is felt that the bias could be minimal due to effect of chronic condition on the well-being of the whole family.

Although in literature slightly higher percentage of left cerebral strokes (right hemiplegic) are identified at the acute stage, there were more right cerebral strokes survivors (left hemiplegic) living in the community in Fiji at the time of the study, implying a higher mortality of left cerebral strokes (right hemiplegics) or possibly a dissimilar pattern to that reported in literature. Further study is needed to understand this trend.

Almost a third of the community dwelling stroke survivors had some degree of mental difficulty on AMTS, and a much higher percentage had functional physical and corresponding social restrictions. Further community support and interventional studies may be needed to clarify and find appropriate methods of overcoming these issues.

Stroke survivors had multiple medical stroke risk factors, and almost fifty percent of them had at least one of these risk factors diagnosed following their stroke. They generally had higher lifestyle risk profile, but tended to participate in more regular exercise program than controls.

A high percentage of stroke survivors reported being admitted to acute hospital following stroke, but only thirty percent were admitted to rehabilitation. Almost seventy five percent of stroke survivors reported resorting to alternative treatment/therapy/cure for stroke. Although twice the number of stroke survivors reported being on regular medications and having poorer health, there was no difference in the utilisation of heath services.

Compared to controls, a very high proportion of stroke survivors had greater physical functional, as well as social activity restrictions. Stroke survivors had carers, who sacrificed their income to care and they had more paid carers. Both the stroke survivors and controls reported good relationships with their carers.

Stroke survivors reported, on the average, significantly fewer visits from both their own family members and outsiders, and their relationship with the family members was perceived to be less satisfactory when compared to controls.

Although the stroke survivors reported receiving more assistance, they also perceived that the assistance received was not sufficient when compared to the controls.

Some important differences and similarities between stroke survivors living in the community for six or more months and their controls have been demonstrated in the comparative analysis in this chapter.

Thus, in summary, the comparative analysis shows that statistically significant difference between stroke survivors and controls were gender ($p < 0.001$), current employment status ($p < 0.001$), household position ($p = 0.01$), high blood pressure ($p < 0.001$), diabetes mellitus ($p = 0.01$), heart disease ($p = 0.01$), mental test score ($p < 0.001$), report of being overweight ($p = 0.02$), consumption of alcohol ($p = 0.01$), consumption of Kava ($p = 0.01$), self-reported health status ($p < 0.001$), current use of regular medication ($p < 0.001$), restriction in activity limitation ($p < 0.001$), restriction in social activity ($p < 0.001$), modified Rankin Scale grade ($p < 0.001$), having carer ($p < 0.001$), carer's income loss ($p = 0.04$), good relationship with family ($p < 0.01$), had lesser average number of family visits ($p < 0.01$), lesser average number of visits from others ($p < 0.001$), perceived need for organisation help ($p < 0.001$), perceived need for more help from family ($P < 0.01$) and perceived need for more help from outside ($p < 0.001$).

The quantitative relationship between individual socio-economic factors and the likelihood of having a stroke is presented in the Chapter 6 – Impact of Socio-economic variables on Stroke likelihood: A Probability Modeling. The differences in psychological well-being between stroke survivors and controls, and amongst stroke survivors are presented and addressed in the Chapter 7 – Psychological Well-being of Stroke Survivors in Fiji.

CHAPTER SIX

IMPACT OF SOCIO-ECONOMIC VARIABLES ON STROKE LIKELIHOOD:

A PROBABILITY MODELING

6.1 Introduction

The literature reviewed and presented in the early chapters reveal that socio-economic factors are associated with the incidence and mortality of stroke. This chapter aims to utilize the econometric Probit modeling technique to quantify the likelihood of a socio-economic variable causing stroke. The literature reveals that apart from some well-documented medical risk factors for stroke, such as hypertension, heart disease, diabetes mellitus and other risk factors such as ethnicity, gender, increasing age, there are stroke risk determinants, for example lack of physical activity, consumption of excessive alcohol and smoking that increase the likelihood of having a stroke. Apart from the medical risk factors the literature singles out advancing age and gender as factors which could have an impact on the likelihood of suffering from a stroke. It is important that any study on this aspect must also examine the country or society-specific socio-economic factors and their degree of influence on the probability of stroke.

Several studies document socio-economic features, such as education, income, and access to health services as contributing to stroke incidence and mortality (Hart *et al*, 2000; Engstrom *et al,* 2001; Arrich *et al*, 2004; Bravata *et al*, 2005; Avendano *et al*, 2006; Cox *et al*, 2006; Hinkle *et al*, 2006; Song *et al*, 2006; Thrift *et al*, 2006). These socio-economic features have been categorized by Sacco *et al* (1997) as “less” well-documented risk factors for stroke and the actual mechanism, through which socio-economic status contributes to stroke risk and outcome, are unclear apart from the increased risk factor prevalence (Cox *et al*, 2006).

Brown *et al* (2005) tried to address the debate in relation to the association between individual socio-economic status and community socio-economic status and health. They examined individual data from a case-control study of 3,489 stroke survivors in Auckland, New Zealand and sought to identify whether or not individual socio-economic status (as measured by income from lifetime occupation) and community socio-economic status (measured in a number of ways) predicts the onset of stroke both independently and after controlling for individual risk factors (for example, smoking, obesity and hypertension). They concluded that individual socio-economic status and all of the community socio-economic status measures predict the onset of stroke before controlling for individual risk factors. However, there was a high correlation between the various measures of community socio-economic status. The results suggest that average household income is the measure of community-level socio-economic status with the greatest predictive power and that individual income and average household income are significant predictors of onset of stroke, both independently and after controlling for the behavioural and medical risk factors. Their further analysis suggests that individual income is a significant predictor of smoking and obesity, and that community socio-economic status is a significant predictor of heart disease, heavy drinking, diabetes mellitus, smoking and obesity.

Socio-economic status seems also to be associated with place of care and outcome. In a large Canadian study of 25,228 patients with ischemic stroke categorized according to income level quintiles found that patients from high-income areas were more likely to be admitted to high-volume hospitals and the fatality at 7 days was 8.4%, 8.2%, 7.7%, 7.1%, and 6.6% (χ^2=0.002) for income quintiles 1 (lowest) to 5 (highest), respectively (Saposnik *et al*, 2008). The low-income patients admitted to low-volume hospitals had the highest risk-adjusted stroke fatality.

While various studies in the literature report on socio-economic risk factors for stroke, none actually quantify the impact of these individual socio-economic variables on the probability of stroke occurrence. There are various computer and paper based cardiovascular and stroke risk assessment calculators in clinical and general use for prediction of the degree of the risk of vascular events. All of these are heavily weighted towards medical risk factors (for the reasons that they are currently better studied and understood as well as some being amenable to current medical management). Some of these cardiovascular and stroke risk assessment tools do include some socio-economic variables. These have been detailed in the Chapter 4 on Methodology.

As stated earlier, the existing prediction equations emphasize traditional biological and not behavioural factors (Wilson, 1994) or, for that matter, socio-economic factors. Based on Framingham Study, a health risk appraisal function has been developed for the prediction of stroke (Wolf *et al*, 1991). The risk factors of stroke included in this profile are age, systolic blood pressure, the use of antihypertensive therapy, diabetes mellitus, cigarette smoking, prior cardiovascular disease, atrial fibrillation, and left ventricular hypertrophy assessed by electrocardiogram. This tool helps relate an individual's risk to the average risk of stroke for persons of the same age and sex and provides information for targeted risk factor identification and control.

The literature search did not reveal any study undertaken to examine the degree of the impact, or the quantitative relationship of socio-economic specific variables, on the likelihood of stroke occurrence. Therefore, the first objective of this study was to examine, in a quantifiable manner, using econometric tools, the quantitative relationship between given specific socio-economic variables for the prediction of the likelihood of stroke occurring in a person living in the community within Fiji.

6.2 Methodology

The power of the study and sample size estimation was based on population-based case control study design and assumption of a 25% to 33% prevalence of adverse psychological well-being amongst community dwelling stroke survivors living in the community for six or more months in Fiji. Epi Info Version 6 Software Statcalc calculator (Dean *et al*, 1996) was utilized to estimate the sample size. This has previously been discussed in Chapter 4 on Methodology. The socio-economic variables obtained from the sample were then coded and analysed to quantify their likelihood of causing a stroke.

The study was conducted on the main Island of Viti Levu, which is home to 76.7% of Fiji's national population (Bureau of Statistics, 1998). A specially developed structured questionnaire was used to collect data on socio-economic variables from randomly selected stroke survivors living in the community and their matched household or neighbourhood controls. The socio-economic variable included in this particular analysis were ethnicity - being Fijian or Indo-Fijian, gender, age, education - being primary level or below or secondary level and above, household income, smoking/alcohol/Kava as a composite variable, exercise - being participation in regular exercise or not and whether there was history of previous stroke or not. The survey was administered by trained Research Assistants over a twelve-month period from April 2003 to March 2004.

A total of 102 stroke survivors and 102 controls were interviewed in the community. Of the total of 204 subjects interviewed, only 183 (89.7%), who had complete data on the all variables to be analysed in this exercise, were included in this analysis. There were 14 stroke survivors and 6 controls that did not provide responses to the question on household income and only one control that did not provide answer to the question on alcohol intake. Thus, a total of 21 of these subjects were excluded from this analysis. This constitutes only two of all the socio-economic variables affected by the missing data. Of the missing variables 95% of the variable was related to household income and 5% to alcohol consumption. There was 100% response for all the other variables. The mean and the variance of these socio-economic variables are illustrated in Table 22 below.

The econometric technique of Probit modeling, also known as Logit or Nested Logit, is used to model the relationship between a dependent and one or more of independent variables. This type of modeling is also used in other types of statistical analyses, for example, it is the basis of logistic regression. As reported in literature, this technique has been previously applied in a variety of situations. In the health industry, this technique has been used to examine and quantify the impact of cardiovascular risk factors on employment in the United States of America (Sullivan and Ghushchyan, 2007), to quantify the effect of inappropriate drug use on patients' self-perceived health status (Fu *et al*, 2004) and also to test whether multiple aliquots of extracted DNA increased the sensitivity and reproducibility of Chlamydia pneumoniae detection by Polymerase Chain Reaction (PCR) (Smieja *et al*, 2001).

There are a number of studies in the literature, which have utilized this model to explain the probability of, for example, adoption or acceptance by decision makers (Masuo and Reddy, 1997; Yanagida and Reddy, 1997; Reddy *et al,* 1999). This type of behavioural model accounts for a dichotomous dependent variable such as the likelihood of adopting or not adopting a modern crop variety, decision to open or not to open a bank account, determining whether an individual is in poverty or not, or at the risk of having a stroke or not having a stroke. This study utilized this concept and adopted the Probit probability model (which utilizes the cumulative normal probability function) for estimation.

Table: 22 Mean and Variance of Key Variables

Variable	Mean	St. Dev	Minimum	Maximum
Ethnicity	0.706	0.457	0.0	1.0
Gender	0.516	0.501	0.0	1.0
Age	56.55	10.42	32.00	79.00
Education	1.478	0.626	0.0	3.0
Income	8758.50	7254.70	600.00	59000.00
Smoke/Alcohol/Kava	0.500	0.501	0.0	1.0
Exercise	0.804	0.397	0.0	1.0
Stroke Index	0.475	0.501	0.0	1.0
(n = 183)				

In the area of stroke, it has been used to address the issue of statistical selection bias in multivariate models of functional gain estimated from observational studies (Vogel *et al,* 2002), and to compare utilization and outcome following stroke in Medicare Health Maintenance Organisation (HMO) and Fee-For-Service (FFS) (Smith *et al*, 2005).

However, it does not seem to have been used to quantify the impact of socio-economic factors on the probability of having a stroke event. In the following section, econometric techniques will be utilized to assess whether there is a quantitative relationship between various socio-economic specific variables and the probability of having a stroke event. Such quantitative relationship modeling would allow researchers to test and determine the significance of any socio-economic factors to causation of stroke or any other condition of interest in a given population. Furthermore, quantitative modeling would allow decision-makers to measure and understand the impact of individual or collective policy response on the direction and magnitude of change in different independent variables of interest following general or specific targeted risk factor control, health promotion and preventative campaigns.

To do so, the following theoretical model is specified:

$$\boxed{Y_i = \alpha + \beta X_i + \varepsilon_i}$$

Where Y_i = 1 (if an option is chosen) and 0 (if the option is not chosen);

X_i = vector of explanatory variables; and

ε_i = random error term.

Application of Ordinary Least Squares (OLS) techniques to estimate the above model will result in inefficient estimates since the error term is heteroscedastic where random variables have different variances. Heteroscedastic (also know as Heteroskedastic) is a measure in statistics that refers to the variance of the errors over the sample. Most financial instruments, such as stocks, follow a heteroscedastic error pattern. For example, in regression, a mathematical relationship between stock and some other type of measure is to be discovered over a period of time. The error found between the line of best fit and the actual data point will vary - for instance, as each variable gets larger, the error may increase. When two-samples have equal variance it is known as being homoscedastic.

Moreover, the parameter estimates will be inefficient (Goldberger, 1964; Pindyck and Rubinfeld, 1983). In addition, due to a non-normal error structure, classical hypothesis tests, such as the Student t-test statistics, are no longer appropriate in this instance (Shakya and Flinn, 1985). Given this problem, a commonly used approach in the econometrics literature is to transform the original model using a cumulative probability function in such a way that the predictions (P) of the probability will lie in the zero to one (0, 1) interval for all Xs.

Thus, this econometric technique utilized is based on the binary system of 1 (if an option is chosen) and 0 (if the option is not chosen). In this analysis the symbol SI_i was used as stroke index measure where 0 was for did not have stroke and 1 had a stroke; AGE_i was used for age of the respondent in years; GEN_i was used for gender of the respondent where 0 was for female and 1 for male; ETH_i was used for ethnicity of the respondent where 0 was for Indo-Fijian and 1 for Fijian; SAK_i was a dummy variable for whether a person either smoked, took alcohol or Kava, where 0 was for did engage in either smoke, or alcohol or Kava drinking and 1 was did not engage in any of these practices; EDU_i was for education level of the respondent measured in terms of number of years of formal education (that is, either primary or below or secondary and above); and Ex_i was the dummy variable for whether a person did regular exercise with 0 for no regular exercise and 1 for did regular exercise. The equation symbols with explanation are presented below.

As a priori or assumption, it is expected that advancing age variable may have a deleterious effect and show a positive sign indicating that older people may have a higher probability of having stroke. The education variable is expected to have a beneficial effect and a negative sign implying that a higher education level can reduce the likelihood of stroke via other practices undertaken by literate individuals. Although international literature points to some ethnic and gender based differences in stroke incidence and mortality, with respect to ethnic Fijian race, there is no prior study to confirm what is to be expected. The exercise variable is expected to have a negative sign signifying that regular exercise can have a beneficial effect and reduce the likelihood of the occurrence of stroke.

The Probit model can be shown as follows:

$$\boxed{P_i = F(Z_i) = F(\alpha + \beta X_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\alpha+\beta X_i} e^{-x^2/2ds}}$$

Where P_i = probability that the event occurs;

e = base of natural logarithm;

s_i = random variable with mean zero and unit variance.

The empirical model for this study can be written as follows:

$$SI_i = \beta_0 + \beta_1 AGE_i + \beta_2 GEN_i + \beta_3 ETH_i + \beta_4 SAK_i + \beta_5 EDU_i + \beta_6 Ex_i + \beta_7 Y_i$$

SI_i = Stroke Index measures, 0 = Does not have stroke, and 1 = have stroke;

AGE_i = Age of the respondent (in years);

GEN_i = Gender of the respondent, 0= Female,1= Male;

ETH_i = Ethnicity of the respondent, 0=Indo-Fijian, 1= Fijian;

SAK_i = Dummy variable for whether a person either smokes, takes alcohol or Kava, 0 = Does engage in either smoke, or alcohol or Kava drinking; 1 = Does not engage in any of these practices;

EDU_i = Education level of the respondent measured in terms of number of years of formal education; and

Ex_i = Dummy variable on whether a person does regular exercise, 0 = No exercise; 1= Does exercise.

and where "i" refers to the "ith" respondent.

All the socio-economic variables from 183 subjects were coded as 0 or 1, based on priori assumption, depending on whether the variable was reported to be present or not present in stroke survivors and controls. The maximum likelihood estimates of the Probit model were obtained by using the Shazam Econometrics Computer Package (White, 1993). This Shazam Econometrics Computer Package is a statistical software package designed to analyse Probit model after data entry and generate appropriate results.

6.3 Results and Discussion

The influence of socio-economic status on health has been discussed in Chapter 3 – Stroke – An Overview in the section 3.4.2 Socio-economic status and health. Socio-economic status is known to produce considerable disparities in prevalence of health conditions, morbidity and mortality being relevant to both communicable and non-communicable diseases alike. However, the exact quantitative association of individual socio-economic variable on health condition, morbidity and mortality is yet to be ascertained.

In this analysis the model had a fit, a McFadden R^2 of 0.116 or when expressed as percentage - 11.6%, implying that 11.6% of the variation in the dependent variable is explained by the explanatory variables defined in the model. While R^2 is quite low, binary dependent variable model of this nature normally have low R^2. The density function was utilized to convert the coefficients to slope. The signs of the coefficients concur with expectations.

The results from the Probit analysis presented in Table 23 below indicates that there are two key socio-economic variables that significantly affect the likelihood of having a stroke in this study population. These two variables are gender and whether the person engages in a combination of smoking and drinking alcohol and Kava (SAK). The gender variable is significant and indicates that males have a significantly higher probability (25.2%) of having a stroke in comparison to the female counterpart in this study population. The other variable is the lifestyle of a person, which also has relevant policy ramifications. It implies that a person consuming a combination of smoking, alcohol and Kava has a 21.3% higher probability of having a stroke compared to someone who does not indulge in this combination.

Table 23: Maximum Likelihood Estimates of the Probit Model

Variable	Coefficient	Slope
AGE_i	0.001	0.0005
GEN_i	0.604*	0.252
ETH_i	-0.057	-0.022
Ex_i	-0.288	-0.114
EDU_i	-0.180	-0.072
Y	-0.001	-0.00004
SAK_i	-0.535*	-0.213
Constant	0.425	
$F(\beta'x)$	0.397	
McFadden R^2 (%)	11.6	
N	183	

Note: "*" denotes significance at 5% level.

The result of this Probit modeling is in congruent with the current knowledge that male gender and cigarette smoking are high cardiovascular risks factors. It also provides quantitative values for these socio-economic risks factors for gender and composite of smoking, alcohol and Kava consumption for the likelihood of having a stroke.

Smoking, alcohol intake and Kava consumption were used as composite variable after single variables did not show a positive effect in the initial analysis. However, the probability of the combination of variables of being a male who smokes, takes alcohol and consumes Kava of having a stroke was not analyzed. This combination variable (male, smoking, and consuming alcohol and Kava) is very important and would have a higher probability than either of the single probabilities. This could be a subjected for further research and analysis.

This finding has important policy implications. One of these implications requires that a message be sent out to the public portraying that according to the research males have a 25.2% higher probability of suffering a stroke compared to females. Therefore, they must re-examine their lifestyle and control various risk factors to ensure that they minimize the probability of stroke. This information can provide the impetus for targeted risk factor modification in individuals and in the general population. In this sample, all the other socio-economic variables analyzed did not statistically significantly affect the probability of having a stroke.

This provides specific information for policy makers as to who and what should be the target for any preventative campaign to reduce socio-economic risk factors in the community in Fiji. Thus this type of data is useful for policy development and guidance and for clinicians for counseling of patients and family members as prevention of stroke is very important.

6.4 Summary and Conclusion

Given the nature of the dependent variable a Probit model was estimated. The analysis in this chapter assessed the quantitative relationship of selected socio-economic variables and a combination of the variables in Fiji's population on the likelihood of a person having stroke.

Results of the study indicate that, of all the factors quantified the gender of a person being male and whether the person smoked and consumed alcohol and Kava in combination were two key factors that raise the likelihood of a person having a stroke. In case of both of these variables, further research is needed to delineate the reasons for the increased risk. In the case of gender, further research is needed to identify the specific habits and activities of males, which raise their likelihood of having a stroke, taking into account the probably biological factors that may increase the risk of stroke in males.

With respect to the composite SAK variable, there is a large body of literature on the relationship between smoking and cardiovascular risk. Alcohol consumption in moderation is reported to be protective for cardiovascular diseases but the influence of Kava consumption to stroke has not been studied in the past. Also how the combinations of these variables operate at individual level to increase the likelihood of stroke has not been researched.

More country specific research should be undertaken, not only to examine quantitative impact of different socio-economic factors but also to show how the negative impact could be minimised or eliminated and the beneficial effects enhance to prevent stroke.

Better understanding of all risk factors for stroke will enable better stroke prevention as when stroke does happen it not only affects the individual, medically, psychologically and financially, it also affects the wider family, the healthcare system and the nation. Subsequent chapters address these other concerns of psychological and economic impact of stroke.

CHAPTER SEVEN

PSYCHOLOGICAL WELL-BEING OF STROKE SURVIVORS IN FIJI

7.1 Introduction

Stroke survivors have sudden, overwhelming transformation into loss, uncertainty and social isolation (Salter *et al*, 2008). They continue to live in the community with their residual impairments, activity limitations and participation restrictions, which can pose significant problems for their well-being. The literature reviewed in the early chapters reveal that, when compared to non-stroke controls, stroke survivors' quality of life and psychological well-being are adversely affected. There are several factors that can worsen this trend including increased age (Hackett *et al*, 2000), supratentorial location of the lesion (de Haan *et al*, 1995; Sneeuw *et al*, 1997), impaired cognition (Kwa *et al*, 1996; Clarke, 2003) severity of the paralysis and impairments (de Haan *et al*, 1993; Niemi *et al*, 1988), comorbidities (O'Mahony *et al*, 1998), depression (Jaracz and Kozubski, 2003; Lofgren *et al*, 1999), inability to return to work (Neau *et al*, 1998; Niemi *et al*, 1988) and perceived lack of social network and support (King, 1996); or improve psychological well-being as with proper discharge planning (Hoffmann *et al*, 2003), education and counselling (Clark *et al*, 2003), and adequate social resources (Clarke *et al*, 2002).

In addition, chronic illness such as stroke not only affects the victim but also members of their family and the functions within the family (Clark *et al*, 2003; King *et al*, 2002). Holmes and Deb (2003) examined the impact of a person's chronic illness on the psychological health of all persons in their family and identified both individual and family-level risk factors associated with psychological disturbances. They identified that chronic illness in a family member can cause emotional distress throughout the family, and may even impair the family's ability to support the person.

Understanding the functioning and relationship between the self (individual) and the society has been the core theoretical preoccupation of sociologists throughout history.

However, there was no study found which has examined psychological well-being and its related characteristics amongst stroke survivors in a Fijian setting.

Various factors that influence the extent to which stroke affects the well-being of an individual, family and the society, operate through processes at the self, individual or micro level (Becker, 1993; Atchley, 1998). It also operates through processes at the society or macro level through the influences from individual and family dynamics, social structures, resources and limitations including ageing, illness and existence of chronic disabling condition (Oliver, 1990), socio-economic status (George, 1996) and social support (Glass *et al*, 1993; Kim *et al*, 1999).

While stroke rapidly increases with advancing age (Maharaj and Panapasa, 2002; World Health Organisation, 2005; Australian Institute of Health and Welfare and the National Stroke Foundation, 2006; Frost, 2007; American Heart Foundation, 2008), physical and cognitive functions have been shown to decline. The population aged 65 and older is often analysed in three categories: young-old (65–74), middle-old (75–84), and oldest-old (preferably called most elderly) (≥85). Using a large data set of 193,463 resident, Fries *et al* (2000) computed the prevalence, by age, of selected conditions: physical and cognitive function, diseases, problem behaviour, mood disturbance, restraint use, falls, weight loss, eating less, body mass index, chewing and swallowing problems, incontinence (bowel and bladder), catheter use, and selected diagnoses. They reported prevalence of all measures of physical and cognitive dysfunction increased most rapidly with each year of age among the very 'oldest-old'. Most of the slope changes occurred from 95 to 100 years of age.

In old age, quality of life is mostly adversely affected with emotional and social loneliness coming with dependence in environmental activities of daily living and dependence in toileting and transfers respectively (Bondevik and Skogstad, 1998). The sudden, overwhelming transformation of stroke forms a background for loss, uncertainty and social isolation (Salter *et al*, 2008).

This study evaluated and compared the self, individual or micro level perception of psychological well-being and functioning of community dwelling stroke survivors living in the community for six or more months against various influencing characteristics and against persons living in the neighbourhood, who never suffered a stroke. A theoretical concept of psychological well-being that encompasses six distinct dimensions of wellness (autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance) (Ryff, 1989) formed the basis of the model for this study.

7.2 Methodology

The study utilised the criteria and methods adopted from the Ryff Measure of Psychological Well-Being. This instrument was developed by Professor Carol Ryff (Ryff, 1989) and tested by Ryff and Keyes (1995). It proved to be more superior in fit over single-factor and other artifactual models (positive and negative affects and life satisfaction), which generally neglect key aspects of positive functioning emphasised in theories of health and well-being.

In this model, self-report questionnaire assesses six core theoretical dimensions of well-being that are common to the mental health, clinical, and life span developmental theories of positive psychological functioning. These six dimensions are as follows: self-acceptance, or positive attitudes toward oneself; autonomy, including qualities of self-determination and independence; environmental mastery, which is the individual's ability to engage in and manage activities in one's surrounding world; purpose in life, including the feeling that there is purpose in and meaning to life; personal growth, which represents one's continual development and striving to realise one's potential; and positive relations with others, which includes the ability to engage in close relationships with others.

The original version of this instrument consisted of 120-items (Ryff, 1989), but due to time and cost constraints of national surveys, it has been shortened to an 84-item, and yet another even shorter 18-item version mostly for use in telephone interviews. This 18-item version, which includes three items for each of the six dimensions of well-being (Ryff and Keyes, 1995), was included in Canadian Study of Health and Aging (CSHA-2) (Clarke *et al*, 2001). The Ryff Measure of Psychological well-being has been validated and used in several national surveys in the United States of America and found to have strong construct and concurrent validity in samples of older adults (Ryff, 1989; Ryff and Keyes, 1995).

The psychometric analyses of both the shortened 18-item and 84-item versions indicated that it performs similarly to the original 120-item version of the measure (Ryff, 1989; Ryff and Keyes, 1995). Each item correlates strongly and positively only with its own scale, and scale intercorrelations are generally low (ranging from 0.13 for purpose in life and autonomy to 0.46 for self-acceptance and environmental mastery). This indicates that the six dimensions do not demonstrate excessive construct overlap and, as intended, measure different dimensions of psychological well-being. However, while the internal consistency reliability of the larger 120-item version scale is high (Ryff, 1989) (α coefficients ranging from 0.86 to 0.93), estimates of internal consistency reliability in the shorter 18-item version are low to modest (α coefficients range from 0.33 [purpose in life] to 0.56 [positive relations]). This is so because of the small number of indicators per scale (Ryff and Keyes, 1995). Additional psychometric analyses with the 18-item version Ryff Measure of Psychological Well-being in CSHA (Clarke *et al*, 2000; Clarke *et al*, 2001) reinforced its construct validity. However, similar to the findings in the United States data, (Ryff and Keyes, 1995) the reliability of each of the six dimensions was not found to be high, with α coefficients ranging from 0.26 (purpose in life) to 0.52 (self-acceptance) (Clarke *et al*, 2000; Clarke *et al*, 2001).

Of the three version of the Ryff Measure of Psychological Well-Being described above, this study utilised the 84-item version. This instrument was incorporated into the questionnaire booklets for cases and controls, and is attached as Appendix 1 and Appendix 2, respectively. Although the Ryff Measure of Psychological Well-Being can be used as a self-reported instrument, in this study the Research Assistants provided interpretations for the respondents whose English was second language. The Research Assistants had practice and clarifications of the questionnaire during their training sessions prior to the commencing fieldwork.

Respondents rated themselves on each item using a Likert scale with 6 items: strongly disagree (1), moderately disagree (2), slightly disagree (3), slightly agree (4), moderately agree (5), and strongly agree (6). Responses to negatively phrased items (-) are reversed in the final scoring procedures so that high scores indicate high self-ratings on the dimension assessed. Items from the separate scales are mixed (by taking one item from each scale successively into one continuous self-report or interviewer administrated instrument). That is, 1 item assessing the dimension of autonomy reads, "I have confidence in my own opinions, even if they are contrary to the general consensus"; another, assessing personal growth, reads, "For me, life has been a continuous process of learning, changing, and growth." Items are divided between positively and negatively phrased items, with reverse scoring performed for the negatively phrased items so that greater agreement with items results in a higher score. Total scores for each of the six dimensions were calculated by summing scores of the 14 items within each dimension in the 84-item version (14 x 6 = 84-item version). The lowest possible overall score for the entire six dimensions combined is 14, indicating lowest well-being, and the highest is 84, indicating greatest well-being.

In this study, apart from the data collection using the Ryff Measure of Psychological Well-being, information on demographic, medical, mental, functional and social status, and socio-economic factors were also collected. Information on how the respondents perceived their health status was also accumulated through the question: “How is your health these days?” with one of the following responses: Very good, Good, Fair, Poor, Very poor. This type of self-reported health status has been found to be valid in community surveys, (O’Mahony *et al*, 1995; Engstad *et al*, 2000) demonstrating high sensitivity and specificity. All the demographic, medical, mental, functional status, social status, socio-economic factors and perceived health status of the stroke survivors were compared with lower and higher Psychological Well-Being. Not due to the sample size but due to some missing data amongst some of these variables and multiple sub-categorisation resulted in a few small numbers needing combined sub-category analysis. These are discussed below for those particular variables. As described in more detail in the chapter on methodology, the study was powered sufficiently.

Analysis of the primary data gathered from the respondents of this population-based study was conducted according to the methods adopted from the Ryff Measure of Psychological Well-Being (Ryff, 1989), described above, using Excel Spreadsheet software. Further analysis was conducted using Student's *t*-test for significance for all continuous unpaired parametric data using SPSS software. Epi Info software was used to calculate Mantel-Haenszel Chi-square (χ^2) for all unpaired categorical data. Odd Ratios (OR), p values for statistical significance, 95% Confidence Intervals (CI), standard error and degrees of freedom (df) wherever appropriate were obtained. One each of a case and a control were excluded from this analysis due to missing data from the 84-item Ryff Measure of Psychological Well-Being.

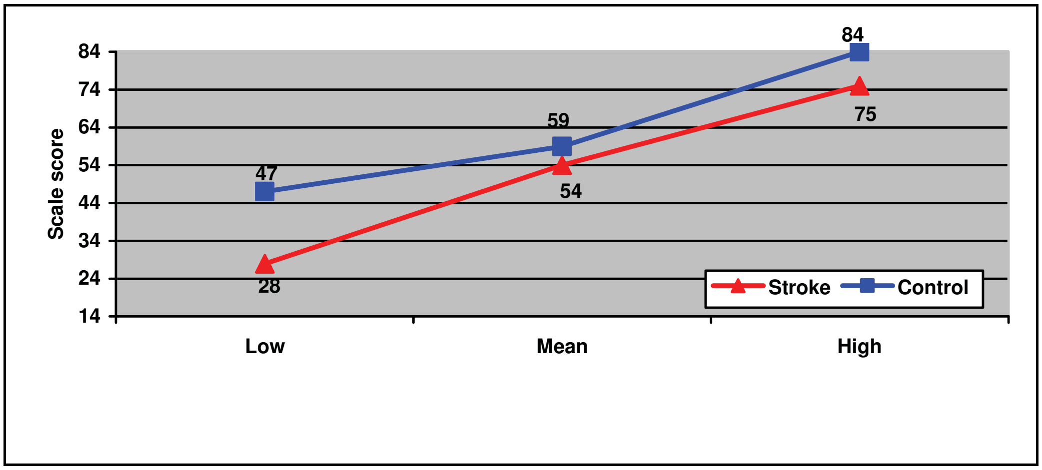
7.3 Results and Discussion

A total of 102 community dwelling stroke survivors and 102 controls were interviewed in the community. As one of each did not provided information on the Ryff Measure of Psychological Well-Being 101 of each were included in the final analysis of Ryff Measure of Psychological Well-Being. The detailed scores are tabulated below and results depicted graphically in the following figures for each core six dimensions.

7.3.1 Autonomy

Compared to controls, stroke survivors living in the community scored lower on the 14-item autonomy scale, indicating that they were less capable of self-determination and were dependent on others. There was a statistically highly significant difference ($p < 0.001$, 99df, Standard error 1.15, 95% CI - 13.27 - 8.72). See Figure 8.

Figure: 8 Autonomy of Stroke survivors and Controls

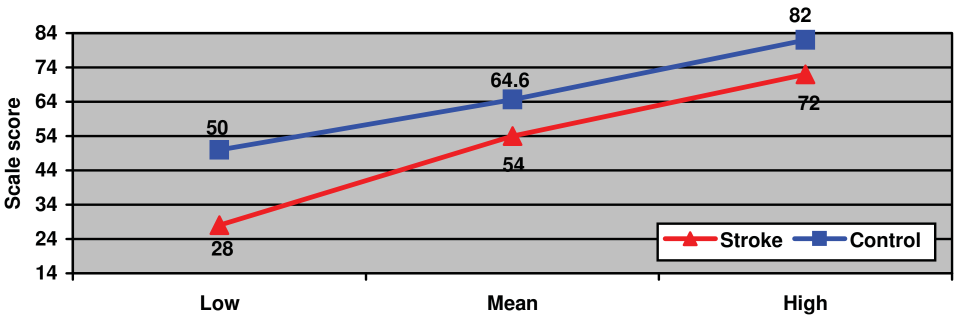


Persons with higher scores indicate higher sense self-determination with higher ability to resist social pressures to think and act in certain ways, and higher ability to regulate their behaviour from within and evaluate self by personal standards. Lower scores show concern about expectations and important decisions, with yielding to social pressures to think, act and reliance on judgements of others to make certain decisions.

7.3.2 Environmental Mastery

Compared to their controls, stroke survivors living in the community scored lower on the 14-item environmental mastery scale showing that they had decreased control over their environment. There was a statistically highly significant difference ($p < 0.001$, 99df, Standard error 1.13, 95% CI – 16.86 - 11.66). See Figure 9.

Figure: 9 Environmental Mastery of Stroke survivors and Controls

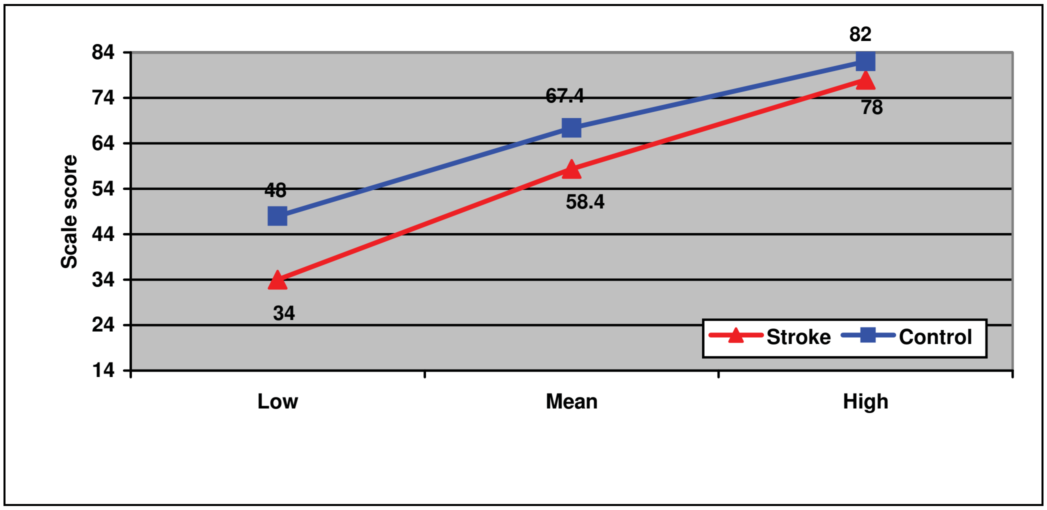


Persons with higher scores have a sense of mastery and competence in managing the environment; controlling a complex array of external activities; making effective use of surrounding opportunities; and are able to choose or create contexts suitable to personal needs and values. In contrast, the low scorers encounter difficulties in managing everyday affairs; are unable to change or improve surrounding context; are unaware of surrounding opportunities; and lack a sense of control over the external world.

7.3.3 Personal Growth

Compared to their controls, stroke survivors living within the community scored lower on the 14-item personal growth scale indicating that they had fewer opportunities for development and reported being uninterested with life and feeling unable to develop new attitudes or behaviours. There was a statistically highly significant difference ($p < 0.001$, 99df, Standard error 1.09, 95% CI – 15.79 - 11.43). See Figure 10.

Figure: 10 Personal Growth of Stroke survivors and Controls

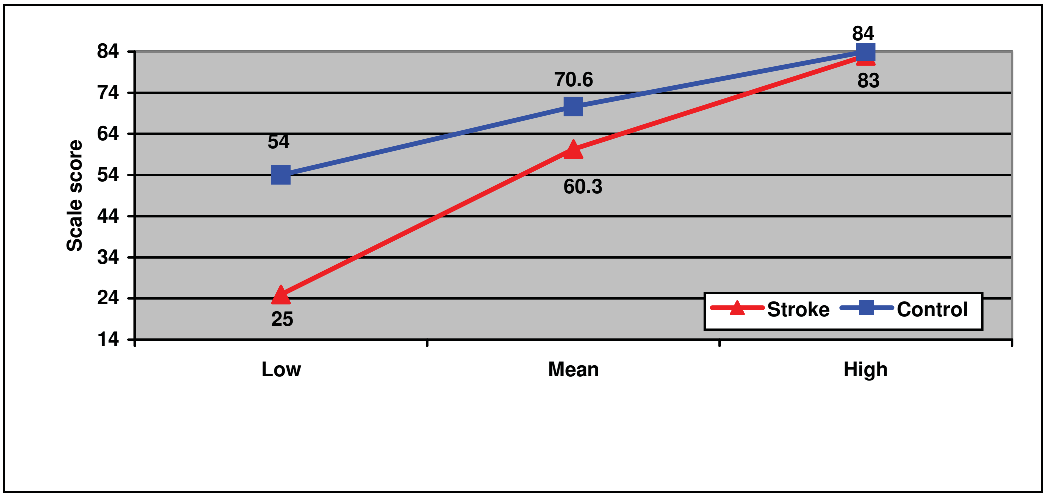


Persons who score higher have a feeling of continued development; see self as growing and expanding; are open to new experiences; have a sense of realising one's potential' see improvement in self and behaviour over time; and are changing in ways that reflect more self knowledge and effectiveness, while low scorers have a sense of personal stagnation, lack a sense of improvement or expansion over time, feel bored and uninterested with life and feel unable to develop new attitudes or behaviours.

7.3.4 Positive Relations with Others

In comparison to controls, stroke survivors living in the community scored lower for positive relationship with others on the 14-item scale showing difficulties in interpersonal relationship following stroke. However, the lower end of the range has greater disparity between the stroke survivors and controls, whereas the upper end shows similarities. There was a statistically highly significant difference ($p < 0.001$, 99df, Standard error 1.48, 95% CI – 17.79 - 11.93). Refer to Figure 11. This finding needs further study to explain the trend.

Figure: 11 Positive Relationship with Others for Stroke survivors and Controls



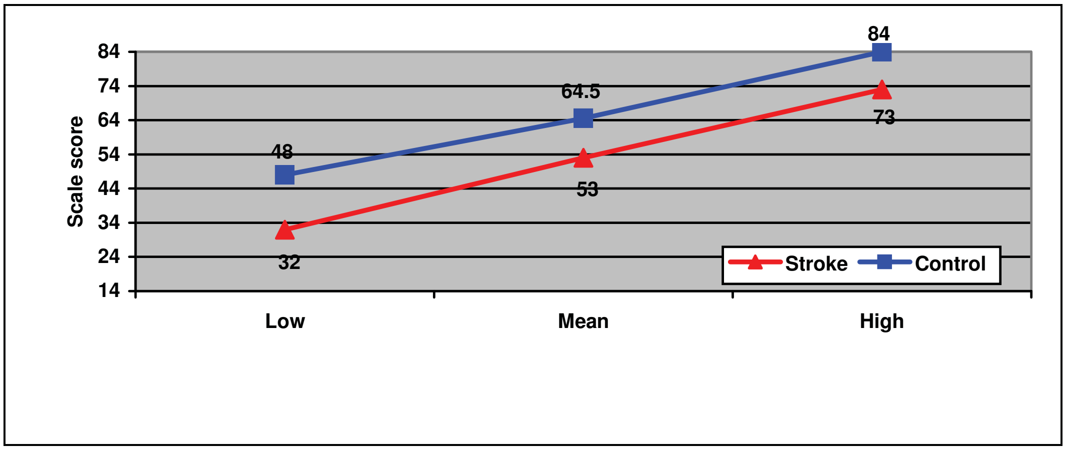
Higher scoring persons have warm, satisfying, trusting relationships with others; are concerned about the welfare of others; are capable of strong empathy, affection, and intimacy; and understand the give and take of human relationships, whereas low scorers have few close, trusting relationships with others; are isolated and frustrated in interpersonal relationships; and are not willing to make compromises to sustain important ties with others.

7.3.5 Purpose in Life

Compared to controls, stroke survivors living in the community scored lower on the 14-item purpose in life scale showing that they felt less direction and lost the sense of meaning in life. Again, the lower end of the range shows greater disparity between stroke survivors and controls, while the upper end shows similarities. There was a statistically highly significant difference ($p < 0.001$, 99df, Standard error 1.22, 95% CI – 15.21 - 10.38). See Figure 12.

Persons with higher scores have goals in life and a sense of directedness; feel that there is a meaning to present and past life; hold beliefs that life gives purpose; and have aims and objectives for living. On the other hand, low scorers lack a sense of meaning in life; have few goals or aims; lack direction; do not see purpose of past life; and have no beliefs or outlook that give meaning to life.

Figure: 12 Purpose in Life for Stroke survivors and Controls

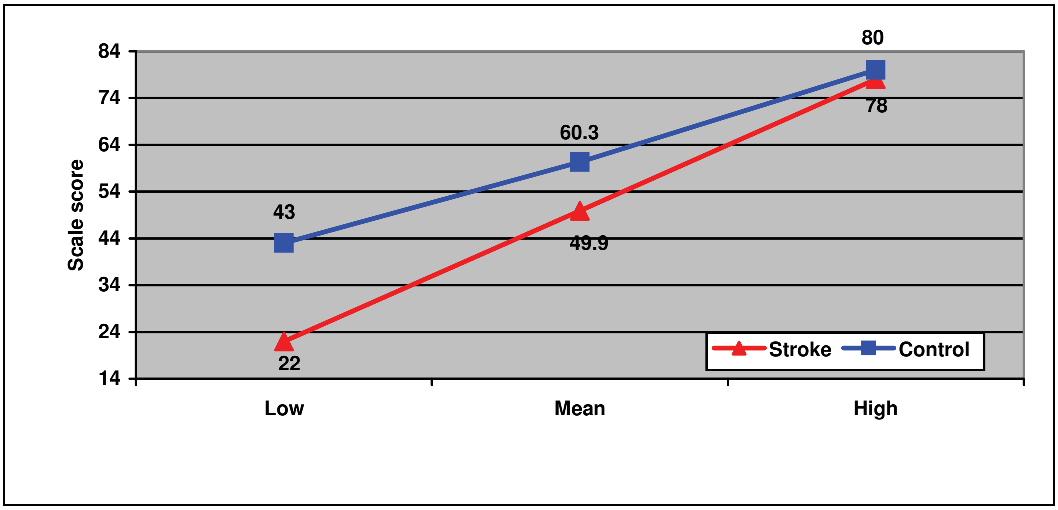


7.3.6 Self-acceptance

Again compared to controls, stroke survivors scored lower for self-acceptance on the 14-item scale showing dissatisfaction with self and disappointment with past life. However, there was greater disparity at the lower end of the range, while the upper end of the range showed similarities between the two groups. There was a statistically significant difference between the stroke survivors and controls ($p < 0.001$, 99df, Standard error 1.43, 95% CI – 16.18 - 10.51). See Figure 13. This trend needs further study.

Persons with higher scores possess a positive attitude towards the self; acknowledge and accept multiple aspects of self including good and bad qualities; and feel positive about past life, whereas low scorers feel dissatisfied with self; are disappointed with what has occurred in past life; are troubled about certain personal qualities; and wish to be different.

Figure: 13 Self-acceptance for Stroke survivors and Controls



The results of psychological well-being of all the six dimensions are presented in Table 24 below as a mean ± standard deviation (SD) score with the range in parenthesis and statistical significance.

Table: 24 Scores for the Dimensions of Psychological Well-being

Psychological Dimension	Stroke survivors	Controls
Autonomy	54.0 ± 8.0 (28-75)***	59.0 ± 6.2 (47-84)
Environmental mastery	54.0 ± 9.7 (28-72)***	64.4 ± 7.4 (43-82)
Personal growth	58.0 ± 8.8 (34-78)***	67.3 ± 7.0 (48-82)
Positive relations with others	60.0 ± 10.5 (25-83)***	70.4 ± 6.9 (51-84)
Purpose in life	53.0 ± 8.9 (32-73)***	64.4 ± 7.6 (48-84)
Self-acceptance	50.0 ± 9.8 (22-78)***	59.9 ± 8.1 (20-80)

Note: "***" denotes statistically highly significant difference at $p < 0.001$***

In summary, Ryff Measure of Psychological Well-Being instrument is a technique utilized to capture both negative and positive of psychological well-being. The results indicate that although the "high scoring" stroke survivors scored higher than the "low scoring" controls, there was a consistent statistically significant association (p <

0.001) between all the six core areas of psychological well-being of autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance of stroke survivors living in the community compared with the controls. Although the high scoring stroke survivors did better then low scoring controls they were statistically highly significantly more likely to be adversely psychologically affected compared to controls.

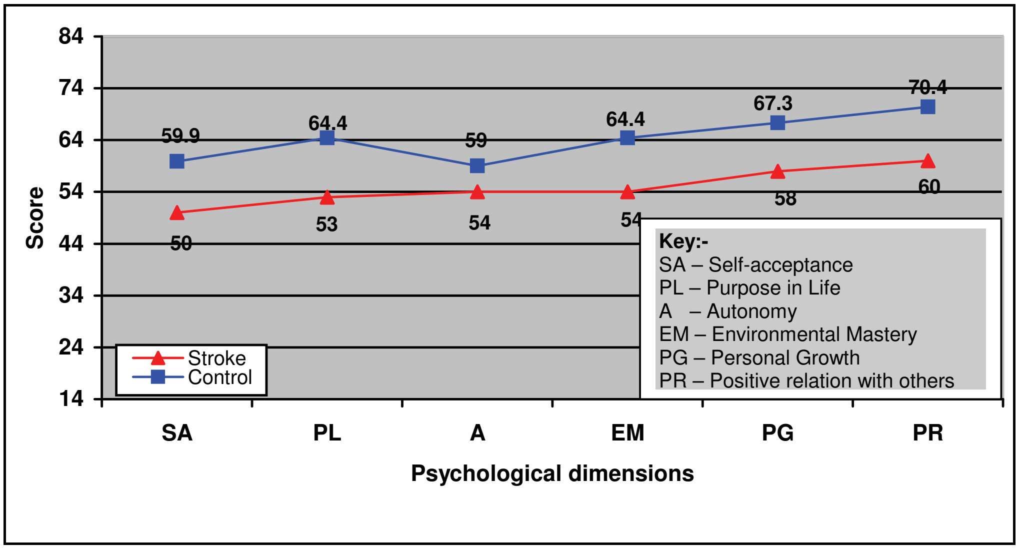
As the Ryff Measure of Psychological Well-Being instrument assesses six different core domains of psychological well-being including autonomy, environmental mastery, personal growth, positive relations with others, purpose in life stroke and self-acceptance and the results generated from this measure are as per single domains. It is felt and proposed below that a composite of the six core domains can be generated to express the findings as a single index - the Psychological Well-being Index (PWI).

7.3.7 Psychological Well-being Index

A new index, the Psychological Well-being Index (PWI) is proposed. This is the mean of the mean scores of all six core dimensions. This PWI provides a composite or cumulative psychological well-being status taking into account the six core dimensions of psychological well-being of an individual or the study sample population. In this study, the results show that the gradient between the different dimensions is minimal or the plot is almost flat, as depicted in the Figure 14 below, thus, easily allowing the production of a cumulative indicator, the PWI, without distorting the dimension-specific picture with the overall index.

The average ± S.D. PWI of stroke survivors was 54.9 ± 8.1 with a range of 36.2 to 72.5, whereas that of controls was 64.2 ± 6.0 with a range of 44.7 to 80.3. There were 41 people with right, and 60 people with left hemiplegia with no statistically significant difference ($\chi^2 = 3.00$, $p = 0.08$, OR = 2.04, 95% CI 0.85 – 4.98) between their PWI.

Figure: 14 Gradient between Six Dimensions of Well-being (mean scores)



The stroke survivors with a higher PWI demonstrate a higher psychological well-being. They are better able to adjust to their stroke compared with those with lower PWI. The stroke survivors with a higher PWI seem to have a "protective", while those with the lower PWI have an "adverse" effect presumably due to a factor or a combination of factors from within the self or from the surrounding environment, family and society. Thus, there are factors that can be protective and provide a moderating effect, and also factors that produce an adverse effect on stroke survivors PWI. To be able to enhance stroke survivors' PWI and subsequently their quality of life and well-being, rehabilitating, assisting and supporting adequately a thorough understanding of the protective or moderating factors is essential.

As shown earlier in this chapter, stroke survivors consistently performed statistically significantly worse than the controls on the entire six core theoretical dimensions of psychological well-being. The following sections of this chapter compares stroke survivors within their own group based on the level of cumulative score of PWI. The stroke survivors were stratified into two according to the level PWI score at the median point of 55.3. As there were 101 stroke survivors, who provided complete data on the Ryff Measure of Psychological Well-being, this gave fifty (n=50) on the higher PWI arm and fifty one (n=51) on lower PWI arm.

Comparative proportions, as percentages, were calculated for all variables in each arm and analysis for any statistical significant between the variables and lower and higher PWI groups was conducted as described in the methodology section.

7.3.7.1 Mental status and PWI

The Abbreviated Mental Test Score (AMTS7) 0 - 6 indicating adverse mental status were collapsed into one category and compared against the score of 7 as shown in the Table 25 below. The results show that the majority of stroke survivors, who performed better on this mental status examination, also had a higher PWI, while the majority of those, who did not perform well, had a lower PWI. There was a statistically highly significant association ($\chi^2 = 12.48$, $p < 0.001$, OR = 4.52, 95% CI 1.78 – 11.72) between the AMTS7 and PWI scores. This type of relationship between impaired cognition and low psychological well-being has been demonstrated in previous studies (Kwa *et al*, 1996; Clarke, 2003).

Table: 25 Abbreviated Mental Test Score and PWI for Stroke survivors

AMTS7 Score	Lower PWI	Higher PWI	(χ^2)	p value
0 – 6	71.4% (n=30)	28.6% (n=12)	12.48	< 0.001
7	35.6% (n=21)	64.4% (n=38)		

7.3.7.2 Socio-demographic Characteristic and PWI

It has been previously reported in the literature that living in a village or small/medium town had increased life satisfaction when compared to living in a big city as perceived by the individuals (Peterson *et al*, 2005; Hudson, 2006; McGrath and Susser, 2009), however, a recent study from Thailand (Manimmanakorn *et al*, 2008) reported that there was no statistically significant difference in psychological condition between urban and rural stroke survivors after rehabilitation. Although there was no statistical difference ($\chi^2 = 1.02$, $p = 0.31$, OR = 1.64, 95% CI 0.57 – 4.87) according to their area of residence the majority of stroke survivors living outside of the city of Suva area (59.1%) had higher PWI in comparison to those living within the Suva area (48.1%). Thus this study showed a similar trend to that reported in the literature, that living in a village or small/medium town had increased life satisfaction when compared to living in a big city as perceived by the individuals (Peterson *et al*, 2005; Hudson, 2006), but it was not possible to confirm this in the current study ($p = 0.31$).

Amongst the two major ethnic groups in Fiji, there were similar proportions in both arms of the study with no statistically significant difference ($\chi^2 = 0.15$, $p = 0.70$, OR = 0.84, 95% CI 0.32 – 2.21) in ethnicity compared to lower or higher PWI. However, there are many comparative reports in literature that show disparities amongst different ethnic groups with Whites happier than African Americans (Alesina *et al*, 2004; Lee and Bulanda, 2005; Graham and Felton, 2006), native Swiss happier than non-Swiss 'foreigners" (Stutzer, 2004).

Although the stroke survivors, who did better on PWI, on the average, were 3.5 years younger, there was no statistically significant difference ($p = 0.11$, 99df, Standard error 2.15, 95% CI – 0.77 – 7.75)) between the age of those who did well and those who did not being 55.06 ± 9.98 years and 58.55 ± 11.52 years respectively. Most studies that considered non linear models suggest there is a U-Shaped age curve with minimum satisfaction being in the range of 35 - 45 year age group (Blanchflower and Oswald, 2004; Fahey and Smyth, 2004; Blanchflower and Oswald, 2005; Hudson, 2006; Lelkes, 2006).

There was also no statistically significant differences ($\chi^2 = 0.94$, $p = 0.33$, OR = 0.66, 95% CI 0.27 – 1.64) between the gender and PWI. In this sample more male stroke survivors performed slightly better than females on PWI. Reports in literature are equivocal about which gender shows greater psychological well-being from there being no difference in life satisfaction as a function of gender (Stutzer, 2004), to women having higher happiness and life satisfaction than men (Haller and Hadler, 2006; Hudson, 2006), while men show higher well-being and happiness than women (Blanchflower and Oswald, 2004; Brown *et al*, 2005).

The majority of those with secondary or more education level performed better on PWI with a statistically significant difference ($\chi^2 = 5.98$, $p = 0.01$, OR = 2.81, 95% CI 1.13 – 7.11) from those with primary or less level of education. This is supported by the reports that years of schooling (Hudson, 2006), better education and counselling (Clark *et al*, 2003) and post secondary and tertiary education (Lelkes, 2006) increases life satisfaction and psychological well-being.

According to the participants' occupational group, the "professional group" performed slightly better than the "other" with no statistically significant association ($\chi^2 = 2.91$, $p = 0.09$, OR = 0.42, 95% CI 0.13 – 1.27) between the lower and higher PWI groups. The PWI according to the current employment status produced interesting results with the "currently" employed group performing only slightly better on PWI. The majority of the "retired" group performing poorly and 100% of the "unemployed" group performing better. There was a statistically highly significant difference ($\chi^2 = 59.17$, $p < 0.001$, 2df) between employment status and level of PWI with unemployment associated with higher PWI. The results imply that being an "unemployed" community dwelling stroke survivors in Fiji is better for psychological well-being compared to those employed or retired. Although this is counterintuitive this could be due to difficulties of sustaining an employment for persons with a disability and issues of accessibility and employment in Fiji. To investigate the exact reasons for this there is need for further study. As will be expected, opposed to this finding are numerous studies in literature that report being unemployed reduces overall happiness (Blanchflower and Oswald, 2004; Blanchflower and Oswald, 2005; Graham and Felton, 2006; Hudson, 2006, Pichler, 2006).

As for the marital status, slightly more stroke survivors in the "married" category performed better than the "not married". This is probably easily explained by the fact that having a partner to provide emotional and physical support provides better psychological well-being. However, this study sample did not show statistically significant difference ($\chi^2 = 1.25$, $p = 0.26$, OR = 0.60, 95% CI 0.22 – 1.60). In the literature, being married and having a partner has been shown to have positive effect on happiness and psychological well-being (Alesina *et al*, 2004; Lee and Bulanda, 2005; Graham and Felton, 2006; Hudson, 2006, Pichler, 2006) and life satisfaction is negatively affected in both partners (Carlsson *et al*, 2007) after stroke.

Stroke survivors' household position was assessed as either "head". "spouse" or "others". The majority of "head" of the household performed better than the other categories but there was no statistically significant association ($\chi^2 = 4.85$, p = 0.09, 2df). The average number of persons living in a household was almost similar for both groups, with no statistically significant difference (p = 0.78, 99df, Standard error 0.05, 95% CI – 0.78 – 1.00) between number of persons living in a household and PWI. No comparative study was found in the literature that assessed "household position" and "number of persons living in a household" against PWI.

Although the stroke survivors who did better, had on the average, a higher household annual income by F$1,519.69 (US$915.48) per annum. There was no statistically significant difference (p = 0.31, 99df, Standard error $1,582.82, 95% CI $-4.78 - $1,522.20) with PWI. Greater numbers of stroke survivors with income change since stroke performed better, however there was no statistically significant association ($\chi^2 = 2.98$, p = 0.08, OR = 0.48, 95% CI 0.19 – 1.19). There were similar numbers in both the groups for those with extra expenses since stroke with no statistically significant association ($\chi^2 = 0.16$, p = 0.69, OR = 0.83, 95% CI 0.31 – 2.24).

Reports indicate that income inequalities are correlated with happiness and life satisfaction (Alesina *et al*, 2004; Fahey and Smyth, 2004; Graham and Felton, 2006; Haller and Hadler, 2006) with higher income associated with happiness. Some of the international literature cited in relation to psychological well-being and ethnicity, gender and age, education are not specific for stroke survivors but are related to and compare general and chronic health status of the populations. However, it is extrapolated to apply to stroke survivors as well due to their chronic nature of the health condition. The results of the socio-demographic characteristics of stroke survivors stratified according to lower and higher PWI is presented in the Table 26.

Table: 26 Socio-demographic Characteristic & PWI for Stroke survivors

Socio-demographic Characteristic	Lower PWI	Higher PWI	(χ^2)	p value
Region - Suva	51.9% (n=42)	48.1% (n=37)	1.02	0.31
- Outside Suva	40.1% (n=9)	59.1% (n=13)		
Ethnicity - Fijian	49.3% (n=36)	50.7% (n=37)	0.15	0.70
- Indian	53.6% (n=15)	46.4% (n=13)		
Age (years ± S.D.)	58.55 ± 11.52	55.06 ± 9.98		0.11
Gender - Male	47.0% (n=31)	53.0% (n=35)	0.94	0.33
- Female	57.1% (n=20)	42.9% (n=15)		
Education				
- Primary or less	59.4% (n=38)	40.6% (n=26)	51.17	< 0.001
- Secondary or more	34.2% (n=13)	65.8% (n=24)		
Occupation				
- Professional	33.3% (n=7)	66.7% (n=14)	2.91	0.09
- Others	54.3% (n=44)	45.7% (n=36)		
E**mployment** - Employed	43.7% (n=7)	56.3% (n=9)	5.98	0.01
- Retired	84.6% (n=44)	15.4% (n=8)		
- Unemployed	0.0% (n=0)	100.00% (n=33)		
Marital status - Married	46.7% (n=35)	53.3% (n=40)	1.25	0.26
- Not married	59.3% (n=16)	40.7% (n=10)		
Household position				
- Head	40.4% (n=23)	59.6% (n=33)	4.85	0.09
- Spouse	61.3% (n=19)	38.7% (n=12)		
- Others	64.3% (n=9)	35.7% (n=5)		
No. of persons in the house	5.27 ± 2.33	5.16 ± 2.17		0.80
Annual household income	F$7,626.49 US$4594.27	F$9,146.18 US$5509.75		0.31
Income change since stroke - Yes	38.9% (n=14)	61.1% (n=22)	2.98	0.08
Average loss per year - Yes	F$4,844.44 US$2918.43	F$6,081.25 US$3663.40		
Extra expenses since stroke - Yes	49.3% (n=37)	50.7% (n=38)	0.16	0.69
Average extra per year - Yes	F$634.47 US$382.21	F$1,223.33 US$736.95		

7.3.7.3 Medical risk factors for stroke and PWI

All the respondents were asked to report their five most important existing medical risk factors for stroke including high blood pressure ($\chi^2 = 0.83$, $p = 0.36$, OR = 1.47, 95% CI 0.59 – 3.68), diabetes mellitus ($\chi^2 = 0.14$, $p = 0.71$, OR = 1.18, 95% CI 0.46 – 3.03), heart disease ($\chi^2 = 1.09$, $p = 0.30$, OR = 1.79, 95% CI 0.53 – 6.52), family history of stroke ($\chi^2 = 0.03$, $p = 0.87$, OR = 1.08, 95% CI 0.41 – 2.87), and previous transient ischaemic attack or stroke ($\chi^2 = 0.11$, $p = 0.74$, OR = 0.82, 95% CI 0.21 – 3.11).

Although all the medical risk factors showed marginally higher percentages for stroke survivors with lower PWI except previous stroke survivors, who performed better probably due to better adjustment, there was no statistically significant difference in five report co-morbidities with lower and higher PWI. This suggests that the community dwelling stroke survivors in Fiji are a heterogeneous group with no statistical difference in their medical risk factors for stroke. However, having comorbidities has been shown to adversely affect psychological well-being (O'Mahony *et al*, 1998, Stutzer, 2004; Baker *et al*, 2005). These results are tabulated in the Table 27.

Table: 27 Medical Risk Factors and PWI for Stroke survivors

Medical Risk Factors	Lower PWI	Higher PWI	(χ^2)	P value
High blood pressure	53.7% (n=36)	46.3% (n=31)	0.83	0.36
Diabetes Mellitus	53.3% (n=16)	46.7% (n=14)	0.14	0.71
Heart disease	62.5% (n=10)	37.5% (n=6)	1.09	0.30
Family stroke history	51.9% (n=14)	48.1% (n=13)	0.03	0.87
Previous stroke	46.2% (n=6)	53.8% (n=7)	0.11	0.74

7.3.7.4 Socio-economic risk factors for stroke

In this study population there was no prior knowledge of the association of socio-economic variable with the level of PWI. This study showed that there were no statistically significant differences when compared with stroke survivors with lower or higher PWI, with reference to being overweight ($\chi^2 = 0.08$, p = 0.78, OR = 0.89, 95% CI 0.36 – 2.19), conscious of their diet ($\chi^2 = 1.76$, p = 0.18, OR = 0.57, 95% CI 0.23 – 1.42), smoking ($\chi^2 = 0.02$, p = 0.89, OR = 1.06, 95% CI 0.43 – 2.66), taking alcohol ($\chi^2 = 0.84$, p = 0.36, OR = 0.67, 95% CI 0.26 – 1.70) and type of work being 'professional' or 'others' ($\chi^2 = 3.09$, p = 0.08, OR = 0.41, 95% CI 0.13 – 1.23). However, the study did show that there was a statistically significant association with Kava consumption and lower PWI ($\chi^2 = 6.26$, p = 0.01, OR = 0.36, 95% CI 0.15 – 0.87) and participating in regular exercise and higher PWI ($\chi^2 = 4.27$, p = 0.04, OR = 0.36, 95% CI 0.11 – 1.05). These results are shown in Table 28.

Table: 28 Socio-economic Risk Factors and PWI for Stroke survivors

Socio-economic Risk Factors	Lower PWI	Higher PWI	(χ^2)	p value
Reported being overweight	48.6% (n=17)	51.4% (n=18)	0.08	0.78
Diet – avoided salty & fatty foods	41.2% (n=14)	58.8% (n=20)	1.76	0.18
Smoked	51.5% (n=17)	48.5% (n=16)	0.02	0.89
Consumed alcohol	43.8% (n=14)	56.2% (n=18)	0.84	0.36
Consumed Kava	39.3% (n=22)	60.7% (n=34)	6.26	0.01
Participated in regular exercise	44.9% (n=35)	55.1% (n=43)	4.27	0.04
Type of work				
– Office	33.3% (n=7)	66.7% (n=14)	3.09	0.08
– Labour	55.0% (n=44)	45.0% (n=36)		

7.3.7.5 Self- Reported Health Status of Stroke survivors and PWI

Self-reported health status has been shown to be a valid measure of one's state of health. Those stroke survivors who reported "very good" and "good" state of health were grouped together and assessed against those who report "fair", "poor" or "very poor" health as a group. There was a statistically significant association ($\chi^2 = 6.13$, $p = 0.01$, OR = 0.36, 95% CI 0.15 – 0.87) between the first group and higher PWI. Literature indicates that better self-rated health increases overall happiness and life satisfaction (McBride, 2001; Helliwell, 2003; Haller and Hadler, 2006), which is supported by this finding. This result is illustrated in Table 29.

Table: 29 Self-reported Health Status and PWI for Stroke survivors

Self-reported Health Status	Lower PWI	Higher PWI	(χ^2)	p value
- Very good and - Good	37.0% (n=17)	63.0% (n=29)	6.13	0.01
- Fair, - Poor, - Very Poor	61.8% (n=34)	38.2% (n=21)		

7.3.7.6 Uses of Health Services by Stroke survivors and PWI

There were almost similar percentages of stroke survivors admitted to acute hospitals following the stroke from both the higher and lower PWI groups with no statistically significant difference ($\chi^2 = 1.15$, $p = 0.28$, OR = 2.18, 95% CI 0.43 – 14.19) between them. There was no statistically significant difference for acute length of stays ($\chi^2 = 0.52$, $p = 0.47$, OR = 0.71, 95% CI 0.26 – 1.96), for length of stays in rehabilitation ($\chi^2 = 1.24$, $p = 0.27$, OR = 0.30, 95% CI 0.02 – 5.20), for numbers who attended outpatient therapy ($\chi^2 = 3.60$, $p = 0.06$, OR = 0.46, 95% CI 0.19 – 1.11), for those who resorted to alternative cures ($\chi^2 = 3.04$, $p = 0.06$, OR = 0.42, 95% CI 0.15 – 1.12), medication use ($\chi^2 = 1.86$, $p = 0.17$, OR = 0.56, 95% CI 0.23 – 1.38), and for number of health issues in the past six months ($\chi^2 = 0.05$, $p = 0.83$, OR = 1.13, 95% CI 0.35 – 3.70). However, there was a statistically significant association with lower PWI and admission for rehabilitation ($\chi^2 = 8.82$, $p < 0.01$, OR = 3.98, 95% CI 1.44 –

11.69), and higher PWI and visit to doctor/health facility ($\chi^2 = 9.45$, $p < 0.01$, OR = 0.20, 95% CI 0.05 – 0.64). These results imply that irrespective of their level PWI stroke survivors' utilisation of mentioned health services was similar except for admission for rehabilitation and visits to their doctor/health facility, which was statistically significantly different between lower and higher PWIs. These results are shown in Table 30.

Table: 30 Use of Health Services and PWI for Stroke survivors

Health Service		Lower PWI	Higher PWI	(χ^2)	p value
Admitted for stroke	Yes	52.2% (n=48)	47.8% (n=44)	1.15	0.28
Length of stay	< 1 week	46.2% (n=12)	53.8% (n=14)	0.52	0.47
	> 1 week	54.5% (n=36)	45.5% (n=30)		
Rehabilitation	Yes	73.3% (n=22)	26.7% (n=8)	8.82	< 0.01
Length of stay in Rehab (n=22)	< 1 week	50.0% (n=2)	50.0% (n=2)	1.24	0.27
	> week	76.9% (n=20)	23.1% (n=6)		
Outpatient therapy (n=50)	Yes	39.0% (n=16)	61.0% (n=25)	3.60	0.06
Alternative cure	Yes	44.4% (n=32)	55.6% (n=40)	3.04	0.06
Visit doctor /health facility (n=50)	Within 3 month	41.6% (n=32)	58.4% (n=45)	9.45	< 0.01
	> 3 months	78.3% (n=18)	21.7% (n=5)		
Medications	Yes	45.3% (n=29)	54.7% (n=35)	1.86	0.17
Health issues in 6 months	None	52.9% (n=9)	47.1% (n=8)	0.05	0.83
	Yes	50.0% (n=42)	50.0% (n=42)		

The stroke survivors who needed inpatient rehabilitation had significantly lower PWI while living in the community after their rehabilitation. These stroke survivors who needed inpatient rehabilitation can be assumed to have been more severely affected than those who did not need inpatient rehabilitation. The stroke survivors who visited their doctors/health facilities within three months had statistically significantly higher PWI. Whether the early visits to their doctors/health facility influence the higher PWI or they were able to make those visits because of better PWI cannot be determined from this study. This could be an area for further research. However, in the literature, severity of the paralysis from stroke has been demonstrated to adversely affect psychological well-being (de Haan *et al*, 1993; Niemi *et al*, 1988).

7.3.7.7 Functional and Social Status of Stroke survivors and PWI

All stroke survivors were asked to report whether they had “no restriction”, “some restriction” or “complete restriction” in their physical functional activities. For the purpose of comparative analysis, the stroke survivors were grouped into those with “no restrictions” at all and those with “restrictions”. The results show that there were a greater percentage of stroke survivors with restrictions in the lower PWI group. There was a statistically highly significant association between perceived physical functional activity restrictions and lower PWI ($\chi^2 = 5.92$, $p = 0.01$, OR = 0.11, 95% CI 0.01 – 0.87).

The stroke survivors were also asked to report whether they had “no restriction”, “some restriction” or “complete restriction” in their social activities. However, was no statistically significant association between perceived social activity restrictions and the level of PWI ($\chi^2 = 2.08$, $p = 0.15$, OR = 0.40, 95% CI 0.08 – 1.60).

Table: 31 Functional and Social Status and PWI for Stroke survivors

Level of Activity Limitation	Lower PWI	Higher PWI	(χ^2)	p value
Activity limitation				
- No restrictions	11.1% (n=1)	88.9% (n=8)	5.92	0.01
- Restrictions	53.8% (n=49)	46.2% (n=42)		
Social activities				
- No restrictions	30.8% (n=4)	69.2% (n=9)	2.08	0.15
- Restrictions	52.3% (n=45)	47.7% (n=41)		

This result indicates that although stroke survivors lower PWI was associated with physical functional activity restriction but not with social activities. However, it has been reported in literature that when a person has limited social activity and contact, the life satisfaction and happiness is lower (Ritchey *et al*, 2001; Lelkes, 2006). These results are presented in Table 31.

Stroke survivors' physical status was also assessed on the observer-assessed modified Rankin Scale. This scale has been detailed earlier in the chapter on methodology. For the purpose of analysis the Rankin grades were dichotomised in no symptom/significant disability (0 – 1) and slight to severe disability (2 – 5). There was no significant association ($\chi^2 = 2.56$, $p = 0.11$, OR = 0.42, 95% CI 0.12 – 1.37) between stroke survivors' physical functional status as assessed by the modified Rankin Scale and level PWI. This result is presented in the Table 32.

Table: 32 Rankin Status and PWI for Stroke survivors

Rankin grade	Lower PWI	Higher PWI	(χ^2)	p value
0 - 1	33.3% (n=6)	66.7% (n=12)	2.56	0.11
2 - 5	54.2% (n=45)	45.8% (n=38)		

The extent of impairments (de Haan *et al*, 1993; Niemi *et al*, 1988) and being disabled (Blanchflower and Oswald, 2005) from stroke has been demonstrated to adversely affect happiness and psychological well-being.

7.3.7.8 Carer and Relationship with Stroke survivors and PWI

Greater percentages of stroke survivors had lower PWI scores for all the carer related characteristics studied. However, none of the characteristic was statistically significantly associated the level of PWI being having a carer ($\chi^2 = 6.42$, $p = 0.11$, OR = 2.94, 95% CI 1.20 – 15.03), main carer ($\chi^2 = 0.59$, $p = 0.44$, OR = 0.71, 95% CI 0.27 – 1.87), paid carer ($\chi^2 = 0.36$, $p = 0.55$, OR = 1.71, 95% CI 0.23 – 19.81), carer's income loss (χ^2 = 2.41, p = 0.12, OR = 2.65, 95% CI 0.67 – 12.54) and relationship with carer (χ^2 = 3.07, p = 0.08, OR = 0.46, 95% CI 0.18 – 1.19). These results indicate that the level of PWI was not statistically associated with any carer characteristics. These results are shown in the Table 33.

Table: 33 Carer and Relationship with Stroke survivors and PWI

Carer Characteristics		Lower PWI	Higher PWI	(χ^2)	p value
Carer	- Yes	56.8% (n=46)	43.2% (n=35)	6.42	0.11
Main carer	- Spouse - Others	52.5% (n=21) 61.0% (n=25)	47.5% (n=19) 39.0% (n=16)	0.59	0.44
Carer paid	- Yes	66.7% (n=4) (n=45)	33.3% (n=2) (n=37)	0.36	0.55
Carer income loss - Yes		71.4% (n=10) (n=44)	28.6% (n=4) (n=38)	2.41	0.12
Relationship with carer		(n=46)	(n=40)		
- Very good		44.4% (n=20)	55.6% (n=25)	3.07	0.08
- Good, - Fair, Poor, Very Poor		63.4% (n=26)	36.6% (n=15)		

7.3.7.9 Social Network & Relationship with Stroke survivors & PWI

The average number of visits from family members was statistically highly significantly associated ($p < 0.01$, 99df, Standard error 0.81, 95% CI – 3.99 - 0.78) with the level of PWI, with higher scoring stroke survivors having an average of 5.73 family visits, whereas the lower scoring stroke survivors had an average of 3.43 family visits. Visits from others was statistically not associated (p = 0.45, 98df, Standard error 0.94, 95% CI – 2.57 – 1.15) with the level of PWI being an average of 4.60 and 3.94 visits, respectively.

The relationship with family members, when stratified to "very good" and others, was statistically significantly associated with PWI (χ^2 = 9.79, $p < 0.01$, OR = 0.26, 95% CI 0.10 – 0.66). The relationships within a family can be adversely affected when a member suffers from chronic illness (Clark *et al*, 2002; King *et al*, 2002; Holmes and Deb, 2003).

This result suggests that the visits from family members and the quality of their relationship with the stroke survivor have an important effect on the psychological well-being of community dwelling stroke survivors. This data is presented in the Table 34.

Table: 34 Social Network and Relationship with Stroke survivors PWI

Social Network and Relationship	Lower PWI	Higher PWI	(χ^2)	p value
Visits from family				
- No	25.0% (n=1)	75.0% (n=3)		< 0.01
- Yes (av. visits)	3.43	5.82		
Relationship with family				
- Very good	30.8% (n=12)	69.2% (n=27)	9.79	< 0.01
- Good, - Fair, Poor, Very Poor	62.9% (n=39)	37.1% (n=23)		
Other visitors				0.45
- No	80.0% (n=4)	20.0% (n=1)		
- Yes (av. visits)	3.94	4.65		

7.3.7.10 Perceived Needs by Stroke survivors and PWI

The majority of stroke survivors who received assistance from outside organisations had lower PWI. There was a statistically significant association between receipt of organisational assistance and having lower PWI ($\chi^2 = 6.74$, $p < 0.01$, OR = 0.33, 95% CI 0.13 – 0.83). There was no statistically significant association between perception of need for more help from family and the level of PWI ($\chi^2 = 2.33$, $p = 0.13$, OR = 0.29, 95% CI 0.03 – 1.77) as well as the perception of the need for more help from outside ($\chi^2 = 0.77$, $p = 0.38$, OR = 0.61, 95% CI 0.16 – 2.11).

These findings suggest that those who need and receive assistance from outside organisations are more likely to have lower PWI and are satisfied with the level of assistance they receive from outside, but perceive the need for more help from their family. Literature states that perceived lack of social support (King, 1996) has been shown to adversely influence psychological well-being, whereas adequate social resources (Clarke *et al*, 2002) enhance it. This may be due to more severely affected stroke survivors within this group. This data is shown in the Table 35.

Table: 35 Perceived Needs by Stroke survivors and PWI

Perceived Needs	Lower PWI	Higher PWI	(χ^2)	p value
Organizational help				
- No	40.6% (n=26)	59.4% (n=38)	6.74	< 0.01
- Yes	67.6% (n=25)	32.4% (n=12)		
More help from family				
- Never	25.0% (n=2)	75.0% (n=6)	2.33	0.13
- Needed help	53.3% (n=49)	46.7% (n=43)		
More help from outside				
- Never	40.0% (n=6)	60.0% (n=9)	0.77	0.38
- Needed help	52.3% (n=45)	47.7% (n=41)		

7.4 Summary and Conclusion

This study evaluated the perception of six core dimensions of psychological well-being (autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance) in a randomly selected sample of community dwelling stroke survivors and compared the findings with matched controls, who never had a stroke, and against various characteristics within the stroke survivors group with lower and higher PWIs.

The results demonstrate that stroke survivors living in the community, when compared with controls, are consistently statistically significantly ($p < 0.01$)

disadvantaged in all the six core dimensions of psychological well-being. However, two dimensions - positive relationship with others and self-acceptance, showed greater variations at the lower ends of the range, whereas the upper end of the range was not too dissimilar to the scores of the controls. This indicates that on two dimensions, the positive relationship with others and self-acceptance, while some stroke survivors are much worse off than the controls others are fairly comparable. To explain this trend it requires further in-depth study to find out reasons for the wide variation amongst stroke survivors.

Secondly, the new Psychological Well-being Index (PWI), which provides a cumulative mean score of the six core dimensions of Ryff Measure of Psychological Well-being, was used to compare stroke survivors with lower and higher PWIs. The comparative analysis of all the study variables revealed some statistically significant relationship of the variables with the level of PWI of stroke survivors living in the community for six or more months.

There was a statistically significant association of mental test score ($p < 0.001$), level of education attained prior to stroke ($p = 0.01$), employment status of being unemployed after stroke ($p < 0.001$), Kava consumption ($p = 0.01$), participation in regular exercise ($p = 0.04$), self-reported health status ($p = 0.01$), physical functional activity restrictions ($p = 0.01$), admission to rehabilitation ($p < 0.01$), visit to doctor/health facility within past three months ($p < 0.01$), relationship with family members ($p < 0.01$), lesser average number of family visits ($p < 0.01$) and perceived assistance received from organisations ($p < 0.01$) with lower and higher PWI.

The fact that the other study variables did show any statistically significant difference shows that the stroke survivors living in the community in Fiji are a heterogeneous group for those characteristics. Some of the various areas that need further research have also been identified. This chapter was devoted to the psychological impact of stroke. Apart from causing profound psychological impact stroke can cause pre-mature mortality. There are numerous aspects to the economic burden of stroke. The next Chapter 8 discusses specifically the economic cost of stroke due to pre-mature deaths of working age group.

CHAPTER EIGHT

ECONOMIC ANALYSIS OF STROKE

8.1 Introduction

"Stroke is a cause of poverty and is caused by poverty"
(Bonita and Beaglehole, 2007).

The prevalence of various medical risk factors for stroke in Fiji and the quantitative likelihood of some socio-economic factors on the probability of stroke as well as psychological impact of stroke on Fiji's community dwelling stroke survivors has been discussed. In addition to devastating its surviving victim with long-term impairments, activity limitations and participation restrictions, stroke results in mortality.

Stroke and stroke mortality impose a substantial economic burden on individuals, societies and nations. The total economic burden of stroke in Fiji would include cost resource utilisation, direct health care costs, indirect health and other costs, intangible costs, cost of carer, carers' productivity losses, stroke survivors' productivity losses due to stroke morbidity and mortality. Although it is recognised that productivity losses may begin immediately following stroke, this chapter specifically and only addresses the issue of human capital loss following stroke mortality.

As presented in earlier chapters and below, there are numerous studies addressing economic cost of resources utilisation following stroke. These costs may either be direct or indirect costs of care for the stroke survivor. These costs from stroke and stroke mortality can have two effects. Firstly, it affects the individual and the immediate family, the psychological and emotional stress and loss of financial support for the family. In Fiji, particularly when the only "breadwinner" in the family has a stroke the loss of financial support for the family can be devastating. Kepa and Makutu (2008) noted that "premature deaths in Fiji as a great concern with the implications of poverty created from loved ones lost to non-communicable diseases becoming a serious threat".

Stroke outcome studies have thus accounted for both loss of quality of life and loss of life itself. Mortality assessments can be presented as life-years gained or lost. A less simple measure is quality of life presented as estimated quality-adjusted life years (QALYs) saved or disability-adjusted life years (DALYs) lost. One DALY is one year of "healthy" life lost and the burden of disease is a measurement of the gap between the current health of the population and an ideal situation in which everyone in the population lives to old age in full health (Strong *et al*, 2007). In Australia, the first burden of disease and injury study using disability-adjusted life years (DALYs) carried out using methodology developed for the World Bank and World Health Organization Global Burden of Disease Study, adapted and applied to the local population health data, revealed that stroke and ischaemic heart disease were the leading causes of the total disease burden, together accounting for nearly 18% of the total disease burden (Mathers *et al*, 2000). In 2002, the estimated DALY's lost to stroke in Fiji was 1,442 which represents 7.1% of the loss (20,234 DALY's) from all causes in Fiji (World Health Organisation, 2004).

In terms of dollars, in Australia, an incidence-based cost-of-illness model was developed incorporating data obtained from the North East Melbourne Stroke Incidence Study (NEMESIS) to look at the costs of stroke during the first year after stroke and the value of total lifetime costs of stroke were estimated from this model (Dewey *et al*, 2001). The results showed that the total first-year costs of all first-ever-in-a-lifetime strokes that occurred in Australia during 1997 were estimated to be A$555 million (US$420 million), and the value of lifetime costs was estimated to be A$1.3 billion (US$985 million). The average cost per case during the first 12 months and over a lifetime was A$18,956 (US$14,361) and A$44,428 (US$33,658), respectively. The most important categories of cost during the first year were acute hospitalization (A$154 million or US$116.68 million), inpatient rehabilitation (A$150 million or US$113.64 million), and nursing home care (A$63 million or US$47.73 million). The average cost per case during the first 12 months of A$18,956 (US$14,361) in Australia compares to US$12,150 for initial hospitalisation for stroke rehabilitation for four weeks in Copenhagen, Denmark (Jorgensen *et al*, 1997). Gerzeli *et al* (2005) showed that the overall costs in the first six months following the stroke were 11,600 EUR (US$15,277.20) per patient; 53% of this was health care costs, 39% non-health care costs and the remaining 8% productivity (economic) losses. Age, level of disability and type of hospital ward were the most significant predictors of costs at six-months. The acute phase accounted for 50% of total health care costs, leaving the remaining 50% to the post-acute phase.

In a systemic literature review, performed using several sources, to provide insight into the quality of economic evaluation in the field of cerebrovascular diseases (stroke), Evers *et al*, (2000) found only 23 articles. Of these, evaluation studies only a few studies mentioned the perspective of the study, and in these cases it was always the societal perspective. Societal perspective implies that the study aimed to determine the needs and interests of target society, their desired satisfactions and well-being. The majority of the studies were cost-minimization and cost-effectiveness analyses based on cohort studies. Cost minimisation or cost effectiveness implies being economically feasible in that the predetermined desired target is met within the allocated budget by the utilization of one particular chosen methodology or product over another. All studies included healthcare costs, and in some instances, patient and family costs were included. Costs were usually measured by tariffs. Tariffs being value of good at source or taxes generally set on good imported into a country. Clinical end points and mortality were used to measure effects of intervention. Cost and effect measurements were based on hospital records. They concluded that only a few full economic evaluations have been undertaken in the domain of cerebrovascular diseases, and in most of the studies, the technical execution and methodology were limited. Full economic evaluations involve the *identification, measurement, and valuation,* and then comparison of the costs (inputs) and benefits (outcomes) of two or more alternative treatments or activities (Drummond *et al*, 1997, World Health Organization, 2000). Thus, there is a scarcity of studies addressing the economic analysis of stroke.

In a comprehensive but descriptive study in the United States, Taylor *et al* (1996) estimated the lifetime direct and indirect costs associated with the three major types of stroke: subarachnoid haemorrhage (SAH), intracerebral haemorrhage (ICH), and ischemic stroke (ISC). They developed a model of the lifetime cost of incident strokes occurring in 1990. An epidemiological model of stroke incidence, survival, and recurrence was developed based on a review of the literature. Data on the direct cost of treating stroke were obtained from Medicare claims data, the 1987 National Medical Expenditure Survey (NMES), and insurance claims data representing a group of large, self-insured employers. Indirect costs (the value of foregone market and nonmarket production) associated with premature morbidity and mortality were estimated based on data from the United States Bureau of Economic Analysis and the 1987 NMES. They reported that the lifetime cost per person of first strokes occurring in 1990 was estimated to be US$228,030 for SAH, US$123,565 for ICH, US$90,981 for ISC, and US$103,576 averaged across all stroke subtypes. Indirect costs accounted for 58.0% of lifetime costs. Aggregate lifetime cost associated with an estimated 392,344 first strokes in 1990 was US$40.6 billion. Acute-care costs incurred in the 2 years following a first stroke accounted for 45.0%, long-term ambulatory care accounted for 35.0%, and nursing home costs accounted for 17.5% of aggregate lifetime costs of stroke. They concluded that the lifetime cost of stroke varies considerably by type of stroke and entails considerable costs beyond the first 2 years after a stroke. These findings are also supported by an Australian study (Dewey *et al*, 2003).

In yet another study, Terent *et al* (1994) estimated direct costs (i.e., the costs for hospital and outpatient care and social services) based on two prospective population-based studies of stroke and of two nationwide cross-sectional inventories of bed-days and diagnoses. Indirect costs (i.e., the costs for loss of productivity and early retirement) were based on official statistics. They reported that the direct annual costs of care for stroke patients in 1991 in Sweden equalled 7,836 million Swedish krona (SKr) ($1,306 million in US dollars), and the indirect costs, 2,430 million SKr ($405 million US dollars). The cost of stroke care was 1,208 SKr (US$201) per capita in Sweden. The expected direct costs per patient from first stroke to death were 440,000 SKr (US$73,333).

Thus, the available literature on the economic analysis of stroke largely deals with economic cost of care or resource utilisation following stroke or is expressed as disease burden as disability-adjusted life years (DALYs). The literature search did not reveal any study specifically addressing the economic loss from stroke mortality as national human capital resource loss. Thus, this study aims to contribute an added economic dimension to consequences from stroke.

8.2 Methodology

This study aimed to address and analyse the economic loss to Fiji due to pre-mature deaths of working age group from stroke mortality in terms of national human capital resource loss. This loss from stroke mortality was calculated using the 2001 Fiji stroke mortality figures obtained from the Fiji's Ministry of Health in 2005 (Ministry of Health, 2005).

Human capital is main value of modern society and basic factor of economic achievements and refers to the stock of skills and knowledge embodied in the ability to perform labour so as to produce economic value. Such stock valuable know-how embodied in the labour force can be seen as surprisingly analogous to physical capital such as machines and buildings (Graham *et al*, 2002). Human capital typically requires investment to be created in form of education and training; it has a market value; and it can depreciate with time (Graham *et al*, 2002).

In a society which places a strong emphasis on competition, financial return and viability, the "people issues" can sometimes be neglected. The theory of the human capital has appeared as a result of the application of principles of the economic theory to problems of economy of public health services, derivation, bionomics and migration (Pushkarev, 2003). Stockley (2008) described the term human capital as recognition that people in organisations and businesses are important and essential assets who contribute to development and growth, in a similar way as physical assets such as machines and money, and that the collective attitudes, skills and abilities of people contribute to organisational (national) performance and productivity.

An estimation of economic burden of stroke in terms of national human capital resource loss with some degree of accuracy can be made. The costs of human capital resource loss may include:

- income foregone following stroke;
- cost of training, recruitment and replacement of labour force;
- increased medical and health care costs;
- costs of recruiting carer(s); and
- loss of family carers' financial income.

The loss to the economy arising from stroke of a productive worker is given by the discounted value of the output foregone over the period in which the worker is not able to earn an income, which will include period starting immediately from the onset of stroke to return to work or death. A discount rate of eight percent (8%) was utilized to compute the present value.

The maximum replacement period could be the remaining working lifespan, which is estimated by subtracting the age of the individual at stroke from the average retirement age. The annual income foregone multiplied by the number of work years lost will yield the total income foregone which must be discounted using a suitable discount rate. This, of course, assumes that the individual's annual income remains the same throughout the remaining working period.

Due to varying levels of income for individuals, the average annual income is proxied by the per capita income.

The present discounted value is the value of money today (in the present) of a payment that is or was promised to be made in the future or in the past.

A simple formula to compute the present discounted value (PV) of the income foregone is as follows:

$$\text{Output Loss from the Economy} = S\left(\frac{1}{r}\right)\left[1-\frac{1}{(1+r)^{t}}\right]$$

Where,

S is the annual income foregone;
r is the chosen rate of discount and
t is the working lifespan lost as the result of stroke.

Another method, the friction-cost method has been put forward as an alternative to the human-capital method as it allows more realistic estimates of productivity costs to be calculated for use in economic evaluations. The possibility of replacement of (long-term) absentees is at the heart of the friction-cost method. It recognises that society will restore initial production levels after some period of adaptation, the length of which may depend on the availability of labour and, hence, on unemployment.

The friction-cost method has received two main criticisms in the literature: (i) it has no theoretical underpinning; and (ii) it treats leisure time as having no value. Brouwer and Koopmanschap (2005) demonstrated in a `theoretical' time-allocation model how time use shifts in the friction-cost method and that leisure is not treated as having no value. Rather, it is considered to be valued in terms of QALYs - as is normally the case in economic evaluation. The time-allocation model also demonstrates that when using the friction-cost or human-capital method the changes in the amount of unpaid work and leisure time need to be valued separately. Unpaid production losses from the previously unemployed may be larger than the gain in unpaid production gain of the absentee, resulting in a societal loss of unpaid work or the sacrifice of leisure in order to make up for lost unpaid work. These changes should be incorporated into economic analyses.

The Model of Resource Utilization, Costs, and Outcome for Stroke (MORUCOS) (Moodie *et al*, 2004), which as the name suggests evaluates resource utilization after stroke, has been discussed in the Chapter on Methodology.

In this study, we use the Human Capital Loss method as opposed to "Frictional Cost" method. In the Frictional Cost method it is assumed that the worker is replaced at a later date. However, with the stroke victims' death the worker is taken to be totally out of the economic system. Thus, the Human Capital Loss method is more appropriate. This study utilized the simple formula, discussed above, to compute the present value (PV) of the income foregone from stroke mortality.

8.3 Results and Discussion

Utilizing the latest available stroke mortality data obtained from Fiji Ministry of Health, which was for the year 2001, and a per capita National Income figure of F$5,131.50 (US$3,078.90) for the same year, with a discounted rate of 8%, the total output loss for the economy was calculated. As presented in the Table 36 below, the annual national human capital loss from stroke mortality for Fiji for the year 2001 was calculated to be F$8.85 million (US$5.31 million). It is important to note that the loss is a direct function of the number of working age people who died from stroke. Therefore, if there is an increase the incidence of stroke and mortality this figure will also increase, thus raising the national economic loss.

This national human capital loss calculation took 55 years as the retirement age in Fiji. However, many people may remain gainfully employed past the age of 55 years in formal paid employment or informal unpaid work, caring and supporting their families (Siegrist *et al*, 2004). Stroke incidence (and associated mortality) in Fiji has been projected to rapidly increase with increasing age (Maharaj and Panapasa, 2002). Thus, if stroke mortality for ages above 55 years for those making an economic contribution is factored into the equation, the actual national human capital loss could be much higher from stroke mortality in Fiji.

Table: 36 Net Present Value of Output Loss from 2001 Stroke Mortality

Number Died	**Year to Retirement**	**Discounted Value of Output Loss per Person**		**Total Loss**	
		F$000	US$000	F$000	US$000
3	40	140.4	84.2	421.2	252.7
2	35	117.7	70.6	235.4	141.2
9	30	114.9	68.9	1,034.1	620.5
13	25	100.2	60.1	1,302.6	781.6
16	20	83.9	50.3	1,342.4	805.4
30	15	65.9	39.5	1,977.0	1186.2
34	10	46.1	27.7	1,567.4	940.4
40	5	24.2	14.5	968.0	580.8
Total				**8,848.1**	**5,308.9**

The estimated national human capital resource loss from stroke mortality for Fiji for the year 2001 of F$8.85 million (US$5.31 million) is comparatively one percent (1%) of the national government revenue of F$895.99 million (US$537.59 million) (Bureau of Statistics, 2006) and almost ten percent (9.7%) of the Ministry of Health's total budget of $91.02 million (US$54.61 million) (Ministry of Health, 2001) for the same year. In this context, it is a substantial loss to Fiji's economy.

Apart from primary prevention of stroke, it is also very important to provide good acute medical care to prevent complications and mortality from stroke as well as providing adequate rehabilitative measures to return capable stroke survivors to productive living in the community. Improved acute care and rehabilitation will reduce the economic burden of stroke – particularly which related to medical complications and mortality.

It is evident that admission to hospital (Henneman and Lewis, 1995), organised acute care for stroke (Naylor *et al*, 1994; Jones *et al*, 1998; Stroke Unit Trialists' Collaboration, 1998) preferably in a specialist stroke unit has better outcome both in terms of immediate survival and long term functional outcome after rehabilitation.

8.4 Summary and Conclusion

There was no similar study on national human capital resource loss from stroke mortality found in the literature. However, Evers *et al* (2004) conducted a literature search from January 1966 through to July 2003. They systematically reviewed 25 stroke cost studies and reported that the proportion of national health care budget for stroke in the eight countries studied was unequivocal for the more recent studies, were approximately 3% of total health care expenditures. In this context, Fiji's loss of an equivalent of 9.7% of health care budget due to stroke mortality alone, not taking into account the "health care expenditures on stroke" is comparatively much higher than the 3% reported.

As indicated earlier, this study set out only to evaluate one aspect of economic burden of stroke in Fiji. A comprehensive study of economic burden of stroke in Fiji, including resource utilisation, direct health care costs, indirect carer costs, intangible costs, carers productivity losses, stroke survivors productivity losses due to stroke morbidity, were beyond the scope of this study. To calculate stroke survivors productivity losses due to stroke morbidity one needs to have data and take into account as to on how long a stroke survivor gave up employment as a result of their stroke and whether the stroke survivors returned to productive work, at what level and for how long after the stroke.

Although this study provides only one aspect of the economic burden of stroke in Fiji it demonstrates that there is this aspect of economic loss from stroke mortality that is not well reported in literature and that this methodology can be utilized to give a fairly accurate view of economic loss from stroke mortality. The economic burden from premature deaths in Fiji has been raised as a growing concern to families and health workers (Kepa and Makutu, 2008).

This methodology could be applied to assess economic loss from any cause premature mortality. There is lack of data on economic cost of stroke in Fiji thus there is need for further research to evaluate all different aspects of economic loss from stroke in Fiji.

CHAPTER NINE

SUMMARY AND POLICY IMPLICATIONS

9.1 Introduction

This final chapter, in addition to presentations of summaries and conclusions in each of the preceding chapters, provides an overall synthesis of the study and discusses related policy implications.

This population-based case control study involving structured interviews of 102 randomly selected stroke survivors living in the community for six or more months and the same numbers of matched household and/or neighbourhood controls was conducted on Viti Levu, the main island of Fiji, over a twelve month period from April 2003 to March 2004.

This study set out to answer the following three research questions:

1) With the given socio-economic factors, what is the quantitative relationship between the socio-economic factor and the likelihood of having a stroke event in Fiji?

2) What is the difference between psychological well-being of community dwelling stroke survivors and their matched controls and amongst the stroke survivors themselves in Fiji?

3) What is the economic impact, in terms of annual national human capital resource loss, from pre-mature stroke mortality in Fiji?

To address the above research questions, therefore, the objectives of the study were to:

1) To quantify the relationship between the socio-economic factors for stroke and the likelihood of having a stroke event.

2) To assess psychological well-being and analyse the inter-relationship with matched controls and amongst the stroke survivors themselves.

3) To perform an economic analysis of stroke computing the annual national human capital resource loss from stroke mortality in Fiji.

Therefore, given the above stated research questions and objectives the null hypotheses were that:

1) There is no quantitative relationship between the socio-economic factors and the likelihood of having a stroke event.

2) There is no difference in psychological well-being of community dwelling stroke survivors and their matched controls and amongst the stroke survivors themselves.

3) There is no economic annual national human capital resource loss from stroke mortality in Fiji.

9.2 Comparative Analysis of Stroke Factors

A comparative analysis of all the study variables was performed between the stroke survivors living in the community and the controls.

There were more right cerebral strokes, that is, left hemiplegic stroke survivors living in the community. More than a third of stroke survivors demonstrated some degree of cognitive difficulty and they had more medical comorbidities than the controls. Almost 50% of the stroke survivors had at least one of the stroke risk factor medical comorbidity diagnosed following their stroke. High percentages were admitted to acute hospital following stroke but only a third were admitted to rehabilitation hospital. Majority resorted to alternative cures and perceived the need for more assistance. A high percentage had functional physical and corresponding social restrictions.

In terms of policy implications related to this research findings there is a need to provide cognitive assessment, rehabilitation, enhancement and support to those stroke survivors whose cognition is affected from stroke. Only a third of all stroke survivors, majority of those living within 10 km distance from the rehabilitation hospital, received inpatient physical rehabilitation. It has been previously reported that early rehabilitation, preferably in an organised specialised stroke unit, reduces mortality and dependency (Foley *et al*, 2007; Cadilhac *et al*, 2008). This study has also shown that stroke survivors who had physical functional activity restrictions were also restricted in social activities. Thus, the need to reduce physical dependency by providing appropriate training, services and accessibility for more social opportunities is indicated.

9.3 Impact of Socio-economic variables on Stroke likelihood: A Probability Modeling

There are various well documented and some less well-documented risk factors for stroke described in the literature as modifiable and non-modifiable risk factors. Although most of the medical risk factors for stroke are well understood and some quantified, the socio-economic risk factors are not as yet well studied or quantified.

Using Probit modeling the quantitative impact of various socio-economic specific risk factors for stroke in Fiji's population on the likelihood of a person having a stroke was examined.

The results indicate that of all the factors studied, there were two key risk factors that raised the likelihood of a person having a stroke. For this study sample being male gender, the risk was assessed as being 25.2% more than female and if a person smoked and consumed alcohol and Kava (SAK) the risk was assessed as being 21.3% more than those who did not. The composite risk of stroke for a male who smoked and consumed alcohol and Kava (male and SAK) was not analysed. However, it will be expected to be higher than either of the individual risk levels. This could be an area for further research and analysis.

Therefore, the null hypothesis that there is no quantitative relationship between the socio-economic factors and the likelihood of having a stroke event is rejected, as the study demonstrated quantitative relationship with gender and smoking, taking alcohol and consuming Kava (SAK).

Only nine socio-economic variables (ethnicity, gender, age, education, income, exercising, smoking, taking alcohol, consuming Kava with the last 3 being combined) amongst a sample size of 183 were included in this analysis. However, it maybe possible that with a much larger study sample size and increased statistical power, these or other socio-economic factors would also demonstrate a quantitative relationship with the likelihood of having stroke event. As described in the chapter on methodology the statistical power of the study was estimated to show a difference in psychological well-being between community dwelling stroke survivors and controls.

Probit modeling seems to be a useful econometric tool for quantifying the impact of various socio-economic risk factors on the probability of having a stroke. The socio-economic factors might be an important contribution to the incidence of stroke and any preventative campaign must account for their quantitative weighting thus allowing for a targeted approach to combating these socio-economic factors accordingly, especially with limited resources at ones disposal.

In the literature, smoking has been established as an important risk factor for cardiovascular disease, while alcohol consumption in moderation is supposed to be protective. The contribution of Kava consumption to stroke risk has not been studied. Having established a quantitative relationship of socio-economic risk factors with the likelihood of having a stroke, the policy implication will be to understand and individualise the impact of various socio-economic factors prevalent in Fiji's population and to develop strategies based on the quantitative information to tackle these risk factors and either eliminate or minimise their adverse effects.

In case of both of these variables, further research is needed, for example, in the case of gender there is a need to identify the specific habits and activities of males which raise their likelihood of having a stroke as compared to females. For smoking, alcohol and Kava (SAK) stroke risk there is a need to ascertain patterns and amounts (dose) of consumption that contributes to the risk of having a stroke.

Future research, following quantification of important socio-economic risk variables, could develop a “socio-economic risk calculator for stroke” similar to the ones currently in use as “cardiovascular risk calculators”, which are currently heavily weighted towards medical risk factors.

9.4 Psychological well-being of stroke survivors in Fiji

This chapter examined the six core dimensions of wellness (autonomy, environmental mastery, personal growth, positive relationship with others, purpose in life, and self-acceptance) in community dwelling stroke survivors and compared the findings with matched controls and amongst the stroke survivors themselves.

The results demonstrate that stroke survivors living in the community, when compared with their controls, are consistently significantly disadvantaged in all the six core dimensions of psychological well-being. The stroke survivors demonstrate important significant characteristics that seem to either moderate or adversely impact on their PWI.

Thus, the null hypothesis that there is no difference in psychological well-being of community dwelling stroke survivors and their matched controls and amongst the stroke survivors themselves is rejected as the study proved otherwise.

Policy implications related to the study findings are that an understanding of these characteristics that either moderate or adversely impact on stroke survivors psychological well-being should assist in designing appropriate rehabilitative programs to enhance and maintain psychological well-being of stroke survivors living in the community in Fiji.

9.5 Economic Analysis of Stroke

The annual national human capital resource loss from pre-mature stroke mortality for Fiji for the year 2001 was F$8.85 million (US$5.31 million). This was calculated to be one percent (1%) of the national government revenue of F$895.99 million (US$537.59 million) and almost ten percent (9.7%) of the Ministry of Health's total budget of $91.02 million (US$54.61 million) for the same year. In this context, it is a substantial loss to Fiji's economy.

Thus, the null hypothesis that there is no economic annual national human capital resource loss from pre-mature stroke mortality in Fiji is rejected, as there is a substantial economic impact from stroke mortality.

While it is very important to prevent stroke from occurring in the first place through primary prevention, zero incidence can hardly be achieved. Control of risk factors and prevention of complications and mortality after stroke is equally important. As history of diabetes mellitus, recurrent stroke, dysphagia, urinary incontinence, cognitive impairment, tube feeding, dysarthria, and drooling have been reported to be associated with higher mortality after stroke (Han *et al*, 2008). In terms of policy implications related to the study findings of both the decrease in psychological well-being from stroke and the economic burden of stroke from stroke mortality, it is imperative to provide good acute medical care and adequate rehabilitative measures to prevent post-stroke complications and mortality and to return capable stroke survivors to their highest potential level of function and productive living in the community.

In the literature, studies have shown that admission to hospital (Henneman and Lewis, 1995), organised acute care for stroke (Naylor *et al*, 1994; Jones *et al*, 1998; Stroke Unit Trialists' Collaboration, 1998; Ronning and Stavem, 2008) preferably in a specialist stroke unit (Foley *et al*, 2007 Cadilhac *et al*, 2008) has better outcome both in terms of immediate survival and long term functional outcome after rehabilitation, which does impacts long term survival (Slot *et al*, 2008). More specifically, it has been reported that the opening of a stroke unit in Glasgow

(Langhorne *et al*, 2007) was also associated with a significant reduction in case fatalities. Improved stroke care associated with an increase in hospital admission and brain imaging (Carter *et al*, 2007) was associated with a significant downward trend in stroke fatalities in Auckland over a 20 year period.

To my knowledge, there is no organised stroke care or stroke unit type of service available in Fiji as yet. There are no facilities for speech and language therapy, gastrostomy feeding or occupational therapy. Stroke survivors in Western countries may receive full acute care as an inpatient and prolonged organised rehabilitation either as an inpatient or within the community after early supported discharge. The Australian national average length of stay for stroke survivors in rehabilitation hospitals was 25.8 days (range 25.3 – 26.3) (n=5,023) compared to 31.6 days (range 25.5 – 37.7) (n=55) in a rural Australian rehabilitation facility (Australasian Rehabilitation Outcomes Centre, 2007) and for the combined acute and rehabilitation inpatient the average length of stay was 56 days (Katrak and Peeva, 2008) and 119 days for more severely affected stroke survivors (Smith *et al*, 2008).

As stroke care has an impact on entire spectrum of health care services, ranging from prevention to acute care, and rehabilitation and palliation of stroke it has been suggested that an epidemiologically-based needs assessment (Hunter *et al*, 2004) is essential prior to setting up recommended comprehensive care (Reckless and Buchan, 2008) and very early mobilization of stroke survivors to achieve a positive influence on psychological well-being of stroke survivors (Cumming *et al*, 2008). Most people in Fiji are discharged to the care of their families fairly early after a stroke. Thus, there is a need to develop organised and specialised stroke unit type of care in Fiji to cater for current and the future surge in stroke incidence to reduce mortality and improve stroke outcomes, thus decreasing the overall burden of stroke.

9.6 Conclusion

This population-based case control study of randomly selected community dwelling stroke survivors and their controls was conducted on the main island of Fiji. The internal and external validity and generalisability of this study is good. The results will be applicable to Fiji as well as to populations of similar characteristics and socio-economic risk factor background.

It has been demonstrated that some socio-economic factors have a quantitative relationship for likelihood a stroke. The stroke survivors living in the community in Fiji are psychologically adversely affected compared to people who have never had a stroke. Pre-mature stroke mortality of working age group has a substantial impact of Fiji's economy.

Many new research areas have been identified throughout the thesis. Stroke incidence and prevalence studies, followup of the study sample and randomised control psychotherapy interventional studies will be desirable.

A concerted and coordinated policy and service direction to seek declines in the projected rate of stroke and its complications and improvements in the health outcomes of stroke survivors will have positive implications for the individual, families of stroke survivors, society, future healthcare and social welfare costs and the national economy.

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GLOSSARY OF TERMS

Aphasia	Is an acquired communication disorder that impairs a person's ability to process language. People with aphasia can have difficulty speaking and understanding others, as well as difficulty reading and writing. It is most frequently caused by stroke as a result of damage to the language centres of the brain.
Cerebrovascular Disease	A reduction in the supply of blood to the brain either by narrowing of the arteries through the build-up of plaque on the inside walls of the arteries, called stenosis, or through blockage of an artery due to a blood clot. Cerebrovascular Disease is also known as stroke.
Cognition	The process by which we become aware of objects of thought and perception, including all aspects of perceiving, thinking and remembering.
Construction praxis	The inability to perform or plan certain purposeful motor movements without the loss of motor power, sensation or coordination.
Dementia	Significant loss of intellectual abilities such as memory capacity, severe enough to interfere with social or occupational functioning.
Dysphasia	Loss of or deficiency in the power to use or understand language as a result of injury to or

	disease of the brain, commonly due to stroke.
Dyspraxia (Speech)	Communication disorder that affects the planning and coordination of the muscle movements required for speech. In dyspraxia, the brain knows the words and there is nothing wrong with the muscles, but the there is a breakdown in planning and coordinating how the muscles need to move in order to speak.
Embolism	Occurs when a blood clot forms elsewhere in the body (usually the heart) and travels through the bloodstream to the brain. In the brain, the clot reaches a vessel it cannot pass through and blocks the flow of oxygen-carrying blood.
Haematoma	An abnormal localized collection of blood in which the blood is usually clotted or partially. A haematoma is caused by a break in the wall of a blood vessel.
Haemorrhage	Bleeding into or around the brain. Abnormal internal or external discharge of blood.
Hemiparesis	Weakness on one side of the body.
Hemiplegia	Paralysis of one side of the body, usually resulting from a stroke or other brain injury.
Heteroscedastic	Random variables have different variances. Also know as heteroskedastic is a measure in statistics refers to the variance of the errors over the sample.

Homoscedastic	When two samples have equal variance it is known as being homoscedastic.
Hyperhomocysteinemia	Elevation of the plasma concentration of homocysteine and closely related metabolites which are an independent risk factor for cardiovascular disease and stroke.
Hyperinsulinemia	High blood insulin levels. Hyperinsulinemia is a marker of insulin resistance, a correlate of the metabolic syndrome, and an established precursor of type 2 diabetes.
Hyperlipideamia	High blood cholesterol and lipids levels – a risk factor for stroke.
Hypertrophy	Enlargement or overgrowth of an organ or part of the body due to the increased size of the constituent cells. Hypertrophy occurs in the biceps and heart because of increased work. Cardiac hypertrophy is recognizable microscopically by the increased size of the cells.
Incidence	The extent or frequency of an occurrence; the number of specific new events in a given period of time.
Infarction	Tissue death resulting from an inadequate supply of oxygen, due to a reduction or lack of blood flow to the area.

Intracerebral	Pertaining to inside the brain tissue.
Intracerebral haemorrhage	Bleeding that occurs from vessels within brain itself.
Ischaemia	Inadequate oxygen supply to tissue caused by reduced blood flow to the tissue.
Lipoproteineamia	Increased levels of lipoprotein in the blood.
Nephropathy	The kidney disease associated with long-standing diabetes. Diabetic nephropathy typically affects the network of tiny blood vessels (the microvasculature) in the glomerulus, a key structure in the kidney composed of capillary blood vessels.
Neuropathy	A disease or abnormality of the nervous system, especially one affecting the cranial or spinal nerves. Typically, the feet and hands are involved first. If sensory nerves are involved, numbness, tingling, and pain are prominent, and if motor nerves are involved, the patient experiences weakness.
Non-communicable Disease	Non-communicable diseases are chronic conditions that do not result from an acute infectious process. These conditions cause death, dysfunction, or impairment in the quality of life, and they develop over relatively long period. Generally, these conditions or diseases result from prolonged exposure to causative agents, many associated with personal behaviours and environmental factors.

Polydipisia	Excessive thirst is abnormal and continuous craving for drink. Polydipsia occurs, for example, in untreated or poorly controlled diabetes mellitus.
Polyuria	Production of large amounts of urine. In uncontrolled diabetes, polyuria occurs because of high blood sugar levels. The kidneys remove some of this excess sugar from the body. To do this, the kidneys produce abnormally large amounts of urine.
Prevalence	The number of cases of a disease in a population at any given point in time.
Retinopathy	A common complication of diabetes affecting the blood vessels in the retina (the thin light-sensitive membrane that covers the back of the eye). If untreated, it may lead to blindness.
Stenosis	Narrowing or blockage of blood vessels in this case.
Subarachnoid haemorrhage	Bleeding within the meninges, or outer membranes, of the brain into the clear fluid that surrounds the brain. Caused by an aneurysm that bursts in a large artery or near the thin, delicate membrane surrounding the brain.
Thrombosis	The formation of a blood clot in one of the cerebral arteries of the head or neck that stays attached to the artery wall until it grows large enough to block blood flow and cause a stroke.

APPENDIX A

SOCIAL STROKE RESEARCH PROJECT

CASE

A research project to deliniate the:

SOCIAL MEANING AND IMPACT OF STROKE IN FIJI: A POPULATION-BASED CASE-CONTROL STUDY

Principal Researcher: Dr Jagdish Maharaj

Senior Supervisors: Dr Mahendra Reddy

Prof. Nii-K Plange

This research is supported by
Dr Jona B. Senilagakali
President, CounterStroke Fiji
&
The Research Assistants

SCHOOL OF SOCIAL AND ECONOMIC DEVELOPMENT
THE UNIVERSITY OF THE SOUTH PACIFIC
SUVA FIJI ISLANDS

QUESTIONNAIRE: Social Stroke Research Project

CONFIDENTIAL

We are conducting a study to look at social impact of stroke. We hope that the results of this study will help us recommend formulation of policy and programme for persons with stroke.

You will be asked a series of questions and your answers will be treated as strictly as confidential. You will not be identified by your name in any publications.

Do you agree to participate in this study? If yes, please sign below confirming your consent.

Name: ____________________________ Witness: ___________________

Signature: __________________________ Date: ______________________

Thank you for agreeing to participate in this study.

The Abbreviated Mental Test Score (AMTS)

1	**0**	What is the date today?
1	**0**	What place is this?
1	**0**	What is your address?
1	**0**	Who is this person?
1	**0**	What is your date of birth?
1	**0**	Who is the Prime Minister of Fiji?
1	**0**	Count 20-1 backwards
	I.	**Total score**

Circle 1 for correct and 0 for incorrect answers and total the score.

The Modified Rankin Disability Scale grades

0	No symptoms at all
1	No significant disability despite symptoms: able to carry out all usual duties and activities
2	Slight disability: unable to carry out all previous activities but able to look after own affairs without assistance
3	Moderate disability: requiring some help, but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance, and unable to attend to own bodily needs without assistance
5	Severe disability: bed ridden, incontinent, and requiring constant nursing care and attention

Decide which category the person with stroke best fits and circle only the number.

QUESTIONNAIRE: Social Stroke Research Project

I	Socio-Demographic Data	Case Number:	Code
Name:		Address:	
Date of Stroke:			
01	Region	Suva/Nausori/Tailevu/Navua/Western/Northern	
02	Ethnicity	Fijian/Indian/Others	
03	Gender	Male/Female	
04	Age at stroke	________ Years. <50/50-59/60-69/70-79/>80	
05	Education level	Primary/Secondary/Tertiary	
06	Occupation		
07	Present employment status	Employed/Retired/Unemployed	
08	Marital status	Married, Never married, Widowed, Separated/Divorced	
09	Position in the household	Head/Spouse/Child/Parents/Others	
10	No. of persons in the house		
11	Annual household income	F$	
12	Has your personal income changed since stroke?	No/Yes. If yes, by how much per year? F$	
13	Do you have extra expenses since your stroke?	No/Yes. If yes, how much extra per year? F$	

II	Stroke Risk Factors	Before your stroke -	
14	Did you have high blood pressure?	No/Yes	
15	Did you have diabetes?	No/Yes	
16	Did you have heart disease?	No/Yes. If yes, what heart condition?	
17	Was any of the above condition found for the first time after your stroke?	No/Yes. If yes, which one?	
18	Do you have any other illness or disability?	No/Yes. Specify:	
19	Did you ever suffer from condition like stroke and got completely well within 24 hours?	No/Yes	
20	Anyone in your family also had stroke?	No/Yes. If yes, what relation?	
21	According to you were you overweight or 'fat'?	No/Yes	
22	Did you avoid salty & fatty foods?	No/Yes	
23	Did you smoke?	No/Yes. If yes, how many per week?	
24	Did you take alcohol?	No/Yes. If yes, how many per week?	
25	Did you take Kava?	No/Yes. If yes, how many per week?	
26	Did you exercise?	If yes, how often?	
27	What type of work did you do most of your life?	Office (Sedentary)/Labour (Manual)	

III	Health Status		
28	How is your health these days?	Very good, Good, Fair, Poor, Very poor	

IV	Use of Health Services		
29	Were you admitted to hospital for this stroke?	No/Yes. If yes, which hospital?	
30	If yes, for how long?	< 1 week, < 1 month, < 3 months, > 3 months	
31	Were you admitted to Rehab for stroke?	No/Yes	
32	If yes, for how long?	< 1 week, < 1 month, < 3 months, > 3 months	
33	Did you get any outpatient therapy after stroke?	No/Yes. If yes, was it in the hospital or home?	
34	Did you do anything else to recover from stroke?	No/Yes. Specify:	
35	When did you last visit a doctor or health facility?	Within – 1 month, 3 months, 6 months, > 6 months ago	
36	Are you taking any medications?	No/Yes. Specify:	
37	List 5 health problems you had in the last 6 months.		

V	Functional Status		
38	Does the state of your health affect your everyday activity?	No restrictions, some restrictions, completely restricted	
39	Does the state of your health affect your social activities, such as meeting with others at your house, visiting others or going out?	No restrictions, some restrictions, completely restricted	
40	Do you have a carer?	No/Yes. If no go to Question 45.	
41	Who is your main carer?	Spouse/Child/Parents/Paid Carer/Others	
42	Do you pay the carer?	No/Yes. If yes, how much per month? F$	
43	If the carer is not paid, does he/she give up their usual earning to be your carer?	No/Yes. If yes how much per month? F$	
44	How is your relationship with main carer?	Very good, Good, Fair, Poor, Very poor	
45	Do you have regular visits from family members?	No/Yes. If yes, how many persons per month?	
46	How is your relationship with family members?	Very good, Good, Fair, Poor, Very poor	
47	Do you have visitors from outside the family?	No/Yes. If yes, how many persons per month?	
48	Do you receive any regular assistance from outside organisations?	No/Yes. If yes, how many assistance per month?	
49	Do you feel you need more support from family?	Never/Sometimes/Often	
50	Do you feel you need more support from outside?	Never/Sometimes/Often	
51	Side of hemiplegia	Right/Left	

The following set of questions deals with how you feel about yourself and your life. Please remember that there are no right or wrong answers.

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
1. Most people see me as loving and affectionate.	1	2	3	4	5	6
2. Sometimes I change the way I act or think to be more like those around me.	1	2	3	4	5	6
3. In general, I feel I am in charge of the situation in which I live.	1	2	3	4	5	6
4. I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
5. I feel good when I think of what I've done in the past/what I hope to do in future.	1	2	3	4	5	6
6. When I look at the story of my life, I am pleased with how things have turned out.	1	2	3	4	5	6
7. Maintaining close relationships has been difficult and frustrating for me.	1	2	3	4	5	6
8. I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people.	1	2	3	4	5	6
9. The demands of everyday life often get me down.	1	2	3	4	5	6
10. In general, I feel that I continue to learn more about myself as time goes by.	1	2	3	4	5	6
11. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
12. In general, I feel confident and positive about myself.	1	2	3	4	5	6
13. I often feel lonely because I have few close friends with whom to share my concerns.	1	2	3	4	5	6
14. My decisions are not usually influenced by what everyone else is doing.	1	2	3	4	5	6
15. I do not fit very well with the people and the community around me.	1	2	3	4	5	6
16. I am the kind of person who likes to give new things a try.	1	2	3	4	5	6
17. I tend to focus on the present, because the future nearly always brings me problems.	1	2	3	4	5	6
18. I feel like many of the people I know have gotten more out of life than I have.	1	2	3	4	5	6
19. I enjoy personal and mutual conversations with family members/friends.	1	2	3	4	5	6
20. I tend to worry about what other people think of me.	1	2	3	4	5	6

21. I am quite good at managing the many responsibilities of my daily life.	1	2	3	4	5	6
22. I don't want to try new ways of doing things - my life is fine the way it is.	1	2	3	4	5	6
23. I have a sense of direction and purpose in life.	1	2	3	4	5	6
24. Given the opportunity, there are many things about myself that I would change.	1	2	3	4	5	6
25. It is important to me to be a good listener when close friends talk to me about their problems.	1	2	3	4	5	6
26. Being happy with myself is more important to me than having others approve of me.	1	2	3	4	5	6
27. I often feel overwhelmed by my responsibilities.	1	2	3	4	5	6
28. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
29. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6
30. I like most aspects of my personality.	1	2	3	4	5	6
31. I don't have many people who want to listen when I need to talk.	1	2	3	4	5	6
32. I tend to be influenced by people with strong opinions.	1	2	3	4	5	6
33. If I were unhappy with my living situation, I would take effective steps to change it.	1	2	3	4	5	6
34. When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6
35. I don't have a good sense of what it is I'm trying to accomplish in life.	1	2	3	4	5	6
36. I made some mistakes in the past, but I feel that all in all everything has worked out for the best.	1	2	3	4	5	6
37. I feel like I get a lot out of friendships.	1	2	3	4	5	6
38. People rarely talk to me into doing things I don't want to do.	1	2	3	4	5	6
39. I generally do a good job of taking care of my personal finances and affairs.	1	2	3	4	5	6
40. In my view, people of every age are able to continue growing and developing.	1	2	3	4	5	6
41. I used to set goals for myself, but that now seems like a waste of time.	1	2	3	4	5	6
42. In many ways, I feel disappointed about my achievements in life.	1	2	3	4	5	6

43. It seems to me that most other people have more friends than I do.	1	2	3	4	5	6
44. It is more important to me to “fit in” with others than to stand alone on my principles.	1	2	3	4	5	6
45. I find it stressful that I can’t keep up with all of the things I have to do each day.	1	2	3	4	5	6
46. With time, I have gained a lot of insight about life that has made me a stronger, more capable person.	1	2	3	4	5	6
47. I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
48. For the most part, I am proud of who I am and the life I lead.	1	2	3	4	5	6
49. People would describe me as a giving person, willing to share my time with others.	1	2	3	4	5	6
50. I have confidence in my opinions, even if they are contrary to general consensus.	1	2	3	4	5	6
51. I am good at juggling my time so that I can fit everything in that needs to be done.	1	2	3	4	5	6
52. I have a sense that I have developed a lot as a person over time.	1	2	3	4	5	6
53. I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6
54. I envy many people for lives they lead.	1	2	3	4	5	6
55. I have not experienced many warm and trusting relationships with others.	1	2	3	4	5	6
56. It’s difficult for me to voice my own opinions on controversial matters.	1	2	3	4	5	6
57. My daily life is busy, I derive a sense of satisfaction keeping up with everything.	1	2	3	4	5	6
58. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
59. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
60. My attitude about myself is probably not as positive as most people feel about themselves.	1	2	3	4	5	6
61. I often feel as if I’m on the outside looking in when it comes to friendships.	1	2	3	4	5	6
62. I often change my mind about decisions if my friends or family disagree.	1	2	3	4	5	6
63. I get frustrated when trying to plan my daily activities because I never accomplish the things I set out to do.	1	2	3	4	5	6

64. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6
65. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6
66. Many days I wake up feeling discouraged about how I have lived my life.	1	2	3	4	5	6
67. I know that I can trust my friends, and they know they can trust me.	1	2	3	4	5	6
68. I am not the kind of person who gives in to social pressures to think or act in certain ways.	1	2	3	4	5	6
69. My efforts to find the kinds of activities and relationships that I need have been quite successful.	1	2	3	4	5	6
70. I enjoy seeing how my views have changed and matured over the years.	1	2	3	4	5	6
71. My aims in life have been a source of satisfaction than frustration to me.	1	2	3	4	5	6
72. The past had its ups and downs, but in general, I wouldn't want to change it.	1	2	3	4	5	6
73. I find it difficult to really open up when I talk with others.	1	2	3	4	5	6
74. I am concerned about how other people evaluate the choices I have made in my life.	1	2	3	4	5	6
75. I have difficulty arranging my life in a way that is satisfying to me.	1	2	3	4	5	6
76. I gave up trying to make big improvements in my life long time ago.	1	2	3	4	5	6
77. I find it satisfying to think about what I have accomplished in life.	1	2	3	4	5	6
78. When I compare myself to friends it makes me feel good about who I am.	1	2	3	4	5	6
79. My friends and I sympathize with each other's problems.	1	2	3	4	5	6
80. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6
81. I have been able to build a home and a lifestyle for myself that is to my liking.	1	2	3	4	5	6
82. There is truth to the saying that you can't teach an old dog new tricks.	1	2	3	4	5	6
83. In the final analysis, I'm not so sure that my life adds up to much.	1	2	3	4	5	6
84. Everyone has their weaknesses, but I seem to have more than my share.	1	2	3	4	5	6

APPENDIX B

SOCIAL STROKE RESEARCH PROJECT

CONTROL

A research project to deliniate the:

SOCIAL MEANING AND IMPACT OF STROKE IN FIJI: A POPULATION-BASED CASE-CONTROL STUDY

Principal Researcher: Dr Jagdish Maharaj

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This research is supported by
Dr Jona B. Senilagakali
President, CounterStroke Fiji
&
The Research Assistants

SCHOOL OF SOCIAL AND ECONOMIC DEVELOPMENT
THE UNIVERSITY OF THE SOUTH PACIFIC
SUVA FIJI ISLANDS

QUESTIONNAIRE: Social Stroke Research Project

CONFIDENTIAL

We are conducting a study to look at social impact of stroke. We hope that the results of this study will help us recommend formulation of policy and programme for persons with stroke.

You will be asked a series of questions and your answers will be treated as strictly as confidential. You will not be identified by your name in any publications.

Do you agree to participate in this study? If yes, please sign below confirming your consent.

Name: ____________________________ Witness: ___________________

Signature: __________________________ Date: ______________________

Thank you for agreeing to participate in this study.

The Abbreviated Mental Test Score (AMTS)		
1	**0**	What is the date today?
1	**0**	What place is this?
1	**0**	What is your address?
1	**0**	Who is this person?
1	**0**	What is your date of birth?
1	**0**	Who is the Prime Minister of Fiji?
1	**0**	Count 20-1 backwards
	II.	**Total score**

Circle 1 for correct and 0 for incorrect answers and total the score.

The Modified Rankin Disability Scale grades	
0	No symptoms at all
1	No significant disability despite symptoms: able to carry out all usual duties and activities
2	Slight disability: unable to carry out all previous activities but able to look after own affairs without assistance
3	Moderate disability: requiring some help, but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance, and unable to attend to own bodily needs without assistance
5	Severe disability: bed ridden, incontinent, and requiring constant nursing care and attention

Decide which category the person with stroke best fits and circle only the number.

QUESTIONNAIRE: Social Stroke Research Project

I	Socio-Demographic Data	Control Number:	Code
Name:		Address:	
01	Region	Suva/Nausori/Tailevu/Navua/Western/Northern	
02	Ethnicity	Fijian/Indian/Others	
03	Gender	Male/Female	
04	Age	________ Years. <50/50-59/60-69/70-79/>80	
05	Education level	Primary/Secondary/Tertiary	
06	Occupation		
07	Present employment status	Employed/Retired/Unemployed	
08	Marital status	Married, Never married, Widowed, Separated/Divorced	
09	Position in the household	Head/Spouse/Child/Parents/Others	
10	No. of persons in the house		
11	Annual household income	F$	
12	Has your personal income changed recently?	No/Yes. If yes, by how much per year? F$	
13	Do you have expenses towards your health care?	No/Yes. If yes, how much extra per year? F$	

II	Stroke Risk Factors		
14	Do you have high blood pressure?	No/Yes	
15	Do you have diabetes?	No/Yes	
16	Do you have heart disease?	No/Yes. If yes, what heart condition?	
17	Was any of the above condition found for the first in the last 6 months?	No/Yes. If yes, which one?	
18	Do you have any other illness or disability?	No/Yes. Specify:	
19	Did you ever suffer from condition like stroke and got completely well within 24 hours?	No/Yes	
20	Anyone in your family had stroke?	No/Yes. If yes, what relation?	
21	According to you are you overweight or 'fat'?	No/Yes	
22	Do you avoid salty & fatty foods?	No/Yes	
23	Do you smoke?	No/Yes. If yes, how many per week?	
24	Do you take alcohol?	No/Yes. If yes, how many per week?	
25	Do you take Kava?	No/Yes. If yes, how many per week?	
26	Do you exercise?	If yes, how often?	
27	What type of work do/did you do most of your life?	Office (Sedentary)/Labour (Manual)	

III	Health Status		
28	How is your health these days?	Very good, Good, Fair, Poor, Very poor	

IV	**Use of Health Services**		
29	Were you admitted to hospital in last 6 months?	No/Yes. If yes, which hospital?	
30	If yes, for what problem?		
31	If yes, for how long?	< 1 week, < 1 month, < 3 months, > 3 months	
32	Are you fully recovered?	No/Yes.	
33	Do you still visit clinic?	No/Yes. If yes, which hospital?	
34	Do you do or take anything else for your health?	No/Yes. Specify:	
35	When did you last visit a doctor or health facility?	Within – 1 month, 3 months, 6 months, > 6 months ago	
36	Are you taking any medications?	No/Yes. Specify:	
37	List 5 health problems you had in the last 6 months.		

V	**Functional Status**		
38	Does the state of your health affect your everyday activity?	No restrictions, some restrictions, completely restricted	
39	Does the state of your health affect your social activities, such as meeting with others at your house, visiting others or going out?	No restrictions, some restrictions, completely restricted	
40	Do you have a carer?	No/Yes. If no go to Question 45.	
41	Who is your main carer?	Spouse/Child/Parents/Paid Carer/Others	
42	Do you pay the carer?	No/Yes. If yes, how much per month? F$	
43	If the carer is not paid, does he/she give up their usual earning to be your carer?	No/Yes. If yes how much per month? F$	
44	How is your relationship with main carer?	Very good, Good, Fair, Poor, Very poor	
45	Do you have regular visits from family members?	No/Yes. If yes, how many persons per month?	
46	How is your relationship with family members?	Very good, Good, Fair, Poor, Very poor	
47	Do you have visitors from outside the family?	No/Yes. If yes, how many persons per month?	
48	Do you receive any regular assistance from outside organisations?	No/Yes. If yes, how many assistance per month?	
49	Do you feel you need more support from family?	Never/Sometimes/Often	
50	Do you feel you need more support from outside?	Never/Sometimes/Often	

The following set of questions deals with how you feel about yourself and your life. Please remember that there are no right or wrong answers.

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
1. Most people see me as loving and affectionate.	1	2	3	4	5	6
2. Sometimes I change the way I act or think to be more like those around me.	1	2	3	4	5	6
3. In general, I feel I am in charge of the situation in which I live.	1	2	3	4	5	6
4. I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
5. I feel good when I think of what I've done in the past/what I hope to do in future.	1	2	3	4	5	6
6. When I look at the story of my life, I am pleased with how things have turned out.	1	2	3	4	5	6
7. Maintaining close relationships has been difficult and frustrating for me.	1	2	3	4	5	6
8. I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people.	1	2	3	4	5	6
9. The demands of everyday life often get me down.	1	2	3	4	5	6
10. In general, I feel that I continue to learn more about myself as time goes by.	1	2	3	4	5	6
11. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
12. In general, I feel confident and positive about myself.	1	2	3	4	5	6
13. I often feel lonely because I have few close friends with whom to share my concerns.	1	2	3	4	5	6
14. My decisions are not usually influenced by what everyone else is doing.	1	2	3	4	5	6
15. I do not fit very well with the people and the community around me.	1	2	3	4	5	6
16. I am the kind of person who likes to give new things a try.	1	2	3	4	5	6
17. I tend to focus on the present, because the future nearly always brings me problems.	1	2	3	4	5	6
18. I feel like many of the people I know have gotten more out of life than I have.	1	2	3	4	5	6
19. I enjoy personal and mutual conversations with family members/friends.	1	2	3	4	5	6
20. I tend to worry about what other people think of me.	1	2	3	4	5	6

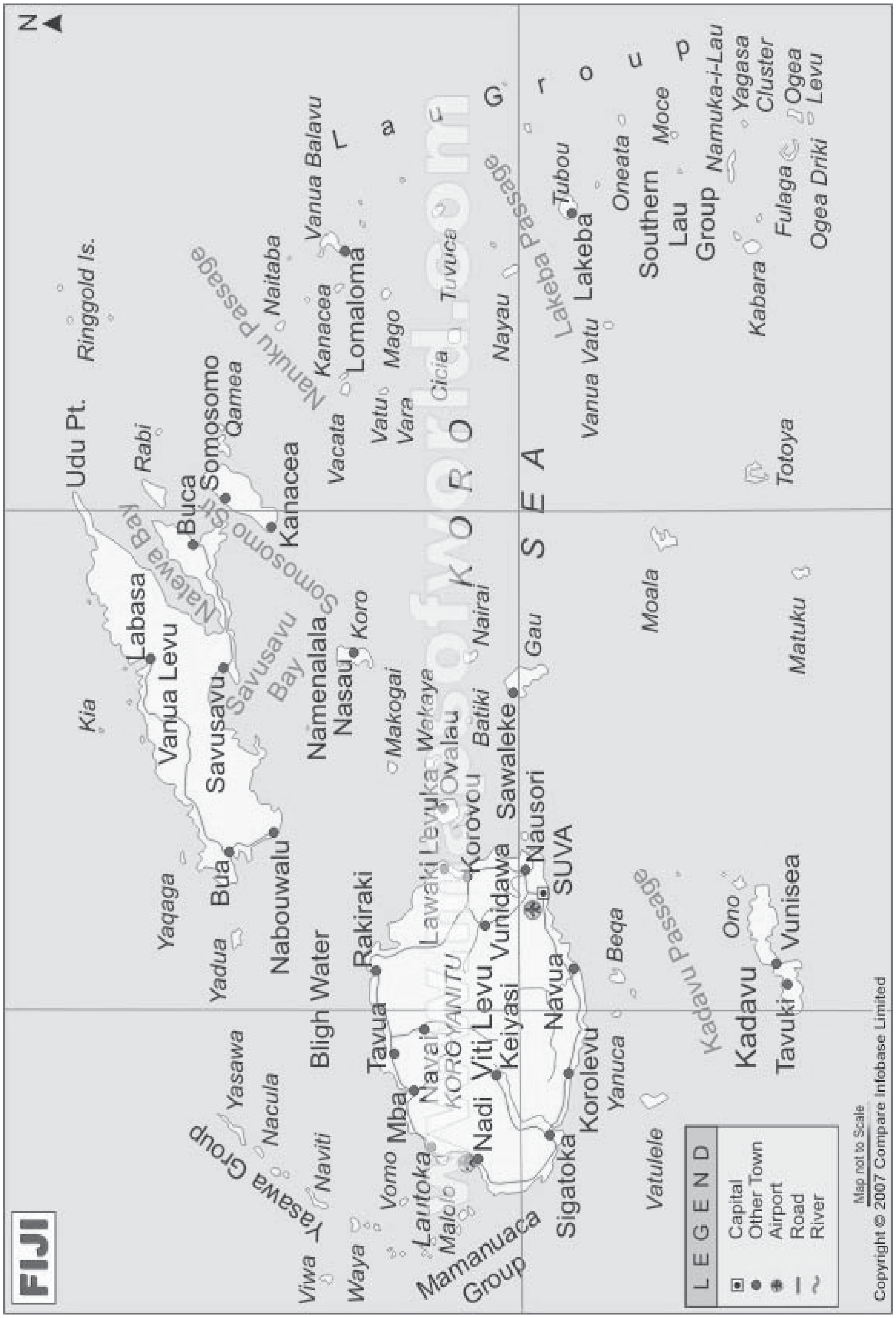
21. I am quite good at managing the many responsibilities of my daily life.	1	2	3	4	5	6
22. I don’t want to try new ways of doing things - my life is fine the way it is.	1	2	3	4	5	6
23. I have a sense of direction and purpose in life.	1	2	3	4	5	6
24. Given the opportunity, there are many things about myself that I would change.	1	2	3	4	5	6
25. It is important to me to be a good listener when close friends talk to me about their problems.	1	2	3	4	5	6
26. Being happy with myself is more important to me than having others approve of me.	1	2	3	4	5	6
27. I often feel overwhelmed by my responsibilities.	1	2	3	4	5	6
28. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
29. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6
30. I like most aspects of my personality.	1	2	3	4	5	6
32. I don’t have many people who want to listen when I need to talk.	1	2	3	4	5	6
32. I tend to be influenced by people with strong opinions.	1	2	3	4	5	6
33. If I were unhappy with my living situation, I would take effective steps to change it.	1	2	3	4	5	6
34. When I think about it, I haven’t really improved much as a person over the years.	1	2	3	4	5	6
35. I don’t have a good sense of what it is I’m trying to accomplish in life.	1	2	3	4	5	6
36. I made some mistakes in the past, but I feel that all in all everything has worked out for the best.	1	2	3	4	5	6
37. I feel like I get a lot out of friendships.	1	2	3	4	5	6
38. People rarely talk to me into doing things I don’t want to do.	1	2	3	4	5	6
39. I generally do a good job of taking care of my personal finances and affairs.	1	2	3	4	5	6
40. In my view, people of every age are able to continue growing and developing.	1	2	3	4	5	6
41. I used to set goals for myself, but that now seems like a waste of time.	1	2	3	4	5	6
42. In many ways, I feel disappointed about my achievements in life.	1	2	3	4	5	6

43. It seems to me that most other people have more friends than I do.	1	2	3	4	5	6
44. It is more important to me to “fit in” with others than to stand alone on my principles.	1	2	3	4	5	6
45. I find it stressful that I can’t keep up with all of the things I have to do each day.	1	2	3	4	5	6
46. With time, I have gained a lot of insight about life that has made me a stronger, more capable person.	1	2	3	4	5	6
47. I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
49. For the most part, I am proud of who I am and the life I lead.	1	2	3	4	5	6
49. People would describe me as a giving person, willing to share my time with others.	1	2	3	4	5	6
50. I have confidence in my opinions, even if they are contrary to general consensus.	1	2	3	4	5	6
51. I am good at juggling my time so that I can fit everything in that needs to be done.	1	2	3	4	5	6
52. I have a sense that I have developed a lot as a person over time.	1	2	3	4	5	6
53. I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6
54. I envy many people for lives they lead.	1	2	3	4	5	6
55. I have not experienced many warm and trusting relationships with others.	1	2	3	4	5	6
56. It’s difficult for me to voice my own opinions on controversial matters.	1	2	3	4	5	6
57. My daily life is busy, I derive a sense of satisfaction keeping up with everything.	1	2	3	4	5	6
58. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
59. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
60. My attitude about myself is probably not as positive as most people feel about themselves.	1	2	3	4	5	6
61. I often feel as if I’m on the outside looking in when it comes to friendships.	1	2	3	4	5	6
62. I often change my mind about decisions if my friends or family disagree.	1	2	3	4	5	6
64. I get frustrated when trying to plan my daily activities because I never accomplish the things I set out to do.	1	2	3	4	5	6

65. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6
65. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6
66. Many days I wake up feeling discouraged about how I have lived my life.	1	2	3	4	5	6
67. I know that I can trust my friends, and they know they can trust me.	1	2	3	4	5	6
68. I am not the kind of person who gives in to social pressures to think or act in certain ways.	1	2	3	4	5	6
69. My efforts to find the kinds of activities and relationships that I need have been quite successful.	1	2	3	4	5	6
70. I enjoy seeing how my views have changed and matured over the years.	1	2	3	4	5	6
71. My aims in life have been a source of satisfaction than frustration to me.	1	2	3	4	5	6
72. The past had its ups and downs, but in general, I wouldn't want to change it.	1	2	3	4	5	6
73. I find it difficult to really open up when I talk with others.	1	2	3	4	5	6
74. I am concerned about how other people evaluate the choices I have made in my life.	1	2	3	4	5	6
75. I have difficulty arranging my life in a way that is satisfying to me.	1	2	3	4	5	6
76. I gave up trying to make big improvements in my life long time ago.	1	2	3	4	5	6
77. I find it satisfying to think about what I have accomplished in life.	1	2	3	4	5	6
78. When I compare myself to friends it makes me feel good about who I am.	1	2	3	4	5	6
79. My friends and I sympathize with each other's problems.	1	2	3	4	5	6
81. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6
81. I have been able to build a home and a lifestyle for myself that is to my liking.	1	2	3	4	5	6
82. There is truth to the saying that you can't teach an old dog new tricks.	1	2	3	4	5	6
83. In the final analysis, I'm not so sure that my life adds up to much.	1	2	3	4	5	6
84. Everyone has their weaknesses, but I seem to have more than my share.	1	2	3	4	5	6

APPENDIC C

MAP OF FIJI ISLANDS



http://www.worldmapz.org/category/australia-oceania/fiji-maps/