SELF-MANAGEMENT OF

DISASTER RISK AND UNCERTAINTY

The Role of Preventive Health in

Building Disaster Resilience

A thesis submitted in partial fulfilment of the

requirements for the Degree

of Doctor of Philosophy in Health Sciences

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The material presented in this thesis is the original work of the candidate except as acknowledged in the text, and has not been previously submitted, either in part or in whole, for a degree at this or any other University.

Monica E. Gowan

To the memory of my beloved father,
the late Honourable Judge John S. Gowan, Jr.

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Abstract

One of the great challenges facing human systems today is how to prepare for, manage, and adapt successfully to the profound and rapid changes wreaked by disasters. Wellington, New Zealand, is a capital city at significant risk of devastating earthquake and tsunami, potentially requiring mass evacuations with little or short notice. Subsequent hardship and suffering due to widespread property damage and infrastructure failure could cause large areas of the Wellington Region to become uninhabitable for weeks to months.

Previous research has shown that positive health and well-being are associated with disaster-resilient outcomes. Preventing adverse outcomes before disaster strikes, through developing strengths-based skill sets in health-protective attitudes and behaviours, is increasingly advocated in disaster research, practise, and management. This study hypothesised that well-being constructs involving an affective heuristic play vital roles in pathways to resilience as proximal determinants of health-protective behaviours. Specifically, this study examined the importance of health-related quality of life and subjective well-being in motivating evacuation preparedness, measured in a community sample (n=695) drawn from the general adult population of Wellington's isolated eastern suburbs.

Using a quantitative epidemiological approach, the study measured the prevalence of key quality of life indicators (physical and mental health, emotional well-being or "Sense of Coherence", spiritual well-being, social well-being, and life satisfaction) using validated psychometric scales; analysed the strengths of association between these indicators and the level of evacuation preparedness at categorical and continuous levels of measurement; and tested the predictive power of the model to explain the variance in evacuation preparedness activity. This is the first study known to examine multi-dimensional positive health and global well-being as resilient processes for engaging in evacuation preparedness behaviour.

A cross-sectional study design and quantitative survey were used to collect self-report data on the study variables; a postal questionnaire was fielded between November 2008 and March 2009 to a sampling frame developed through multi-stage cluster randomisation. The survey response rate was 28.5%, yielding a margin of

error of +/- 3.8% with 95% confidence and 80% statistical power to detect a true correlation coefficient of 0.11 or greater.

In addition to the primary study variables, data were collected on demographic and ancillary variables relating to contextual factors in the physical environment (risk perception of physical and personal vulnerability to disaster) and the social environment (through the construct of self-determination), and other measures of disaster preparedness. These data are reserved for future analyses.

Results of correlational and regression analyses for the primary study variables show that Wellingtonians are highly individualistic in how their well-being influences their preparedness, and a majority are taking inadequate action to build their resilience to future disaster from earthquake- or tsunami-triggered evacuation. At a population level, the conceptual multi-dimensional model of health-related quality of life and global well-being tested in this study shows a positive association with evacuation preparedness at statistically significant levels. However, it must be emphasised that the strength of this relationship is weak, accounting for only 5-7% of the variability in evacuation preparedness.

No single dimension of health-related quality of life or well-being stands out as a strong predictor of preparedness. The strongest associations for preparedness are in a positive direction for spiritual well-being, emotional well-being, and life satisfaction; all involve a sense of existential meaningfulness. Spiritual well-being is the only quality of life variable making a statistically significant unique contribution to explaining the variance observed in the regression models. Physical health status is weakly associated with preparedness in a negative direction at a continuous level of measurement. No association was found at statistically significant levels for mental health status and social well-being. These findings indicate that engaging in evacuation preparedness is a very complex, holistic, yet individualised decision-making process, and likely involves highly subjective considerations for what is personally relevant. Gender is not a factor. Those 18-24 years of age are least likely to prepare and evacuation preparedness increases with age.

Multidimensional health and global well-being are important constructs to consider in disaster resilience for both pre-event and post-event timeframes. This work indicates a need for promoting self-management of risk and building resilience by incorporating a sense of personal meaning and importance into preparedness actions, and for future research into further understanding preparedness motivations.

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Gowan, M.E., and Ellis, D. (2009), *Applications of salutogenesis in disaster contexts as a construct and measure of health and well-being: Case studies in disaster prevention and response planning*. New Zealand Psychological Society Annual Conference Abstracts (Oral), Palmerston North, New Zealand.

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CHAPTER 1. INTRODUCTION

"Health is the extent to which an individual or group is able, on the one hand, to realize their aspirations and satisfy needs; and on the other hand, to change or cope with the environment. Health is, therefore seen as a resource for everyday life, not an object of living; it is a positive concept emphasizing social and personal resources, as well as physical capacities." (Ottawa Charter, WHO, 1986)

STUDY OVERVIEW

Disasters are astounding and extremely complex phenomena, the outcome of dynamic events and interactions between physical and social factors that create destruction, loss and overwhelming experiences. Self-management strategies are important because individuals, communities, and institutions can be overwhelmed to the extent that the ability to cope with disaster consequences is exceeded.

The overall aim of this research is to contribute an evidence base for health promotion programmes to develop self-management behaviour in community populations that increase personal health resilience to future disaster. Health promotion is "*the process of enabling people to increase control over their health and its determinants, and thereby improve their health*" (WHO, 2005a). This study quantitatively measures key indicators of health, well-being and health-protective behaviours that are related to disaster resilience and explores their strength of association in a sample of the general adult population in Wellington, New Zealand. The study context is readiness for evacuation due to earthquake and tsunami. Identifying baseline health resources in the study population and the contribution of various health determinants to preparedness will provide insight into developing more effective intervention programmes to increase personal disaster resilience.

At the time this PhD proposal was approved (December 2007), the public perception of disaster risk – and the focus of attention for emergency management – was arguably towards the threat of earthquake and tsunami in the nation's capital, Wellington. Accordingly, data collection for this study (publicly known as "The

Wellington Disaster Prevention Study") went into the field in November 2008. These threats certainly persist for Wellington. Since then, however, much has changed in New Zealand and throughout the world. Notably, the Canterbury earthquake sequence beginning on 3 September 2010 16:35:46 UTC expanded awareness of nationwide disaster vulnerability, devastated Christchurch, and removed any doubt about the relevance of the New Zealand nickname, "The Shaky Isles."

Further, the relentless aftershocks – continuing to present day – reinforce the emerging scientific consensus from the 2011 Japan earthquake and tsunami that "*earthquakes interact in ways never before imagined*" (Toda, Lin & Stein, 2011) and "*mainshocks perturb*." These scientific conclusions go beyond their technical meaning to poignantly express the felt human experience in Canterbury. Perhaps this metaphor can be transcended with the popular rhetorical expression that of the Chinese word for "crisis" (*wēijī*) is composed of two characters representing "danger" and "opportunity." Together they may provide a pathway for rising above the difficult realities and daunting prospects confronting all places on Earth with seismic risk.

This study is grounded in the concept that well-being is a health management resource, affecting and affected by how you think, feel, act, and what you believe. Positive well-being is an asset, certainly a mutable one, but this fluidity also means it is constructible. Well-being thus offers an opportunity and pathway for enhancing life's experiences, in spite of disaster, and amid the uncertainty. *Haere mai.*

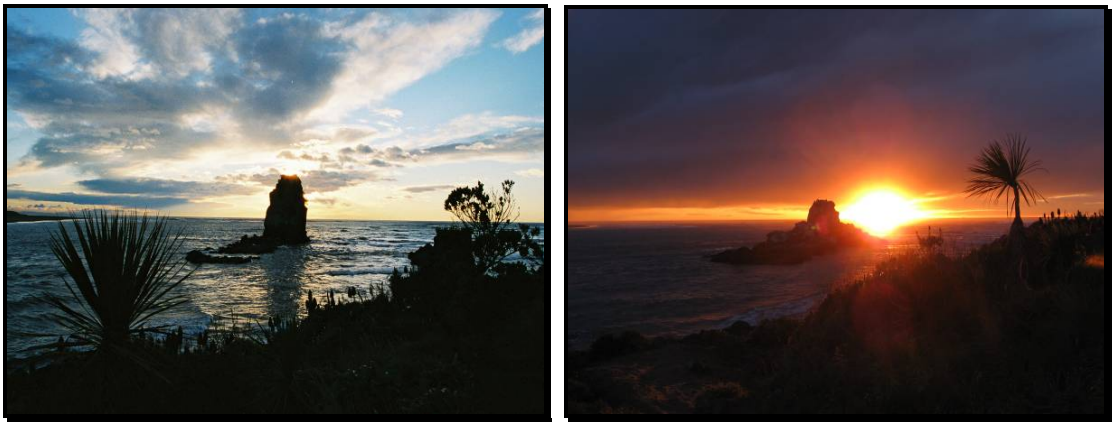


Photo credits: Monica Gowan

"Shag Rock," July 2007 (left), and "Shag Pile," July 2011 (right), Sumner/Redcliffs, Christchurch, New Zealand

"The only constant is change."
Heraclitus of Ephesus (c.535 BC – 475 BC)

CHAPTER 2. LITERATURE REVIEW

A vast amount of literature has been published on the causes, consequences, and management of disasters, and the processes and outcomes of disaster resilience. The aim of this chapter is to communicate findings from a critical appraisal of the literature extracted from research studies, policy documents and data bases that have a particular bearing on the research questions developed for this study.

In **Section 2.1, The Challenge of Disaster**, the reader is introduced to the scope, scale, and consequences of disaster, both worldwide and in New Zealand. The devastating impacts are outlined in Section 2.1.1, with a focus on natural disaster in the last decade. The concept of the disaster 'riskscape' and its expanding reach is then defined in Section 2.1.2 for the purposes of this study. Section 2.1.3 introduces the health consequences of disaster and in Section 2.1.4, the opportunity for disaster prevention. In **Section 2.2, The New Zealand Physical Riskscape**, the reader is oriented to the environmental context of this study, the risk of earthquake and tsunami, and the scale of effects from these hazards. Special emphasis is placed on the field area, the Wellington Region of the lower North Island. **Section 2.3, The Need for Disaster Preparedness**, summarises current findings from key preparedness studies in New Zealand and common barriers to preparedness observed worldwide. Protocols for emergency management and preparedness planning in Australasia, Canada, the UK, and the USA are highlighted in **Section 2.4, Disaster Management Frameworks**. The evolution of disaster research paradigms is discussed in **Section 2.5, Disaster Research Frameworks**. This chapter concludes with a presentation in **Section 2.6, Study Framework**, on the theoretical foundations of this PhD research.

2.1 The Challenge of Disaster

Dramatic increases over the last decade in the type, scale and consequences of natural and human-induced disasters, combined with unprecedented losses due to natural disaster in the first three quarters of 2011, are producing urgent calls for

reducing disaster risk and building disaster resilience through effective prevention strategies (UN, 2011; UNISDR, 2011a; World Bank, 2010).

The UN International Strategy for Disaster Reduction defines disaster as "*a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources*" (UNISDR, 2009). Disasters are commonly classified by causal agent (hazard or threat) into one of three types: natural (e.g., geophysical, meteorological, biological); technological ("non-intentional disasters" or human systems accidents); or human-induced ("intentional disasters" such as acts of terrorism and mass violence, war, ethnic conflict, or civil strife).

2.1.1 The Scope of Disaster

2011 has been year of very severe disaster, following an exceptionally tragic decade of catastrophes. The compound disaster of the 11 March 2011 Japan earthquake, tsunami and Fukushima nuclear accident redefined for many the scope and global reach of natural disaster, as millions vicariously experienced the sudden and shocking calamity through media broadcast of the tsunami rushing ashore. New Zealand's largest disaster, the 2010-2011 Canterbury earthquakes, provides an extraordinary example of how a catastrophe frequently perceived internationally as localised and small-scale – due to the heartbreaking yet relatively low numbers of fatalities – is a globally exceptional event in terms of insurance losses, is producing persistent and extensive suffering and hardship, and will affect a developed country's living standards for years to come.

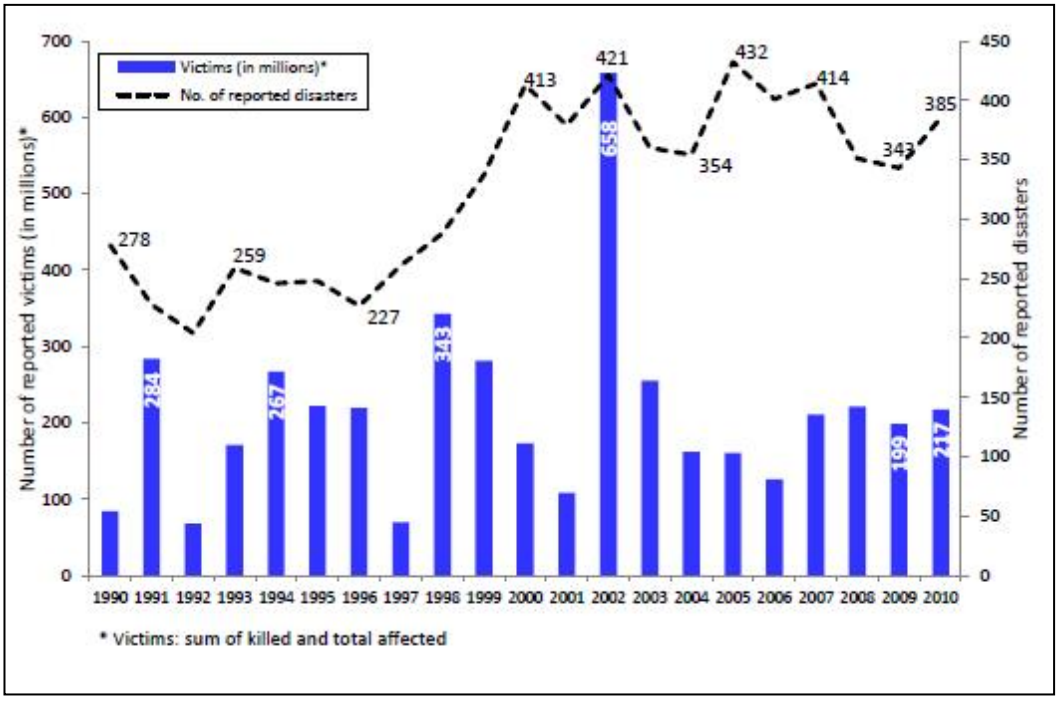
In the last decade, natural disasters affected Australasia, the Americas, Eurasia, and Africa, leaving virtually no inhabited landmasses unscathed. Other technological disasters such as mining and aviation accidents touched the world, and the tenth anniversary of 9/11 this year poignantly marked the horror of intentional disasters.

Throughout the turmoil of these events, however, the word 'resilience' keeps appearing in everyday language. Resilience is now an established concept in popular books and the media, and is a frequent and universal theme of encouragement and aspiration in speeches by mayors, prime ministers and presidents. This paradigm shift in recognising disaster as more than exposure to a physical event, and as an opportunity to transcend the suffering, underlines the importance of research to develop strategies for disaster prevention and resilience from the individual to global level.

2.1.1.1 Recent Impact Statistics

Disasters consistently affect millions of people every year, as shown by the vertical bars in Figure 2.1 below. In just one year alone (2002), one drought affected 300 million people in India, another affected 60 million people in China; a wind storm affected 100 million people in China, and a flood affected 60 million people in China (Hoyois et al., 2007). The dashed line portrays how there has also been a sharp increase in the number of reported disasters since 1990.

Figure 2.1 Trends in Occurrence and Victims of Natural Disaster, 1990 – 2010 (Guha-Sapir, et al. 2011).



Earthquakes are among the most destructive, deadly, and uncertain natural disasters. Since the beginning of the 20th century, 2.6-3 million people have lost their lives in earthquakes around the world (Li et al. 2009), and many millions more have been affected.

Disaster impact statistics commonly record the number of fatalities, injuries, number of people affected, number of people displaced, as well as property damages, economic losses, and other indicators. The following sections briefly underscore the staggering losses of life and economic impacts from natural disaster in the last decade. Statistics regarding disaster impacts vary depending on the source and methodologies applied in collecting the data and thus are relative rather than absolute. A single source was used here for fatality numbers to minimise distortions: The Emergency Events Database EM-DAT of the Centre for the Research of the Epidemiology of Disasters, CRED, Universite Catholique de Louvain in Brussels, Belgium. Other sources are cited where applicable

2.1.1.1.1 Global Synopsis – The Years 2001 to 2011

Since 2001, natural disasters have claimed over a million lives, adversely affected hundreds of millions of people and resulted in billions of dollars in damage (EM-DAT, 2011). Two of the ten deadliest natural disasters ever recorded in history occurred in the last seven years: the 12 January 2010 Haiti earthquake (M_w 7.0[1]) and the 26 December 2004 South Asian ("Boxing Day") earthquake (M_w 9.3) and tsunami. While expert estimates report wide variance in the absolute number of fatalities, approximately a half million people lost their lives in just these two events combined (EM-DAT, 2011).

An estimated quarter million people were killed in total by 4 other earthquake disasters: Wenchuan, Sichuan, China (M_w 7.9 on 12 May 2008), Kashmir, Pakistan (M_w 7.6 on 8 October 2005), Bam, Iran (M_w 6.6 on 26 December 2003), and Gujarat, India (M_w 7.7 on 26 January 2001). The death toll from Cyclone Nargis in Myanmar

[1] M_w = Abbreviation for Moment Magnitude Scale (MMS), which measures the seismic moment magnitude of an earthquake, or energy released at the source of an earthquake.

(2 May 2008) was at least 150,000. Nearly 100,000 perished in heat waves in Russia (2010) and Europe (2003).

Other natural disasters in the last ten years caused significant casualties, the displacement of populations from the thousands to millions (IDMC, 2011), and global disruptions in travel and commerce. This formidable list of tragic events includes: floods in Queensland, Australia (2011), Brazil (2011 and 2008), China and Pakistan (2010), and West Africa and India (2009); wildfires in Texas, USA (2011) and the Black Saturday bushfires in Victoria, Australia (2009); Hurricanes Irene (2011), Ike (2008) and Katrina (2005) in the USA; Cyclone Yasi in Australia (2011); tornadoes in the USA (2011); earthquakes in Van, Turkey (2011), Yushu, China (2010), L'Aquila, Italy (2009), and Bingol, Turkey (2003); the Samoan earthquake and tsunami (2009); volcanic eruptions in Chile (2011) and Iceland (2010, 2011); and disease outbreaks in Haiti (2010-2011, cholera), Zimbabwe (2008-2009, cholera), Asia (2002-2003, SARS), and worldwide flu pandemic (2009).

2.1.1.1.2 Pacific Précis – The Years 2010 to 2011

Although the Haitian earthquake was the worst catastrophe of 2010 in terms of victims dead or missing (published fatality estimates range from 222,000 to 310,000 people), this tragedy did not register on the list of the 20 most costly insurance losses for that year (Swiss Re, 2011a), reflecting that risk is also the value of infrastructure and other assets. The 27 February 2010 Chile earthquake (M_w 8.8), which killed 562 people, was the most costly disaster in the world in 2010 with USD 8 billion in insured loss (Swiss Re, 2011a). The second most-costly was the 4 September 2010 Canterbury ("Darfield") earthquake (M_w 7.0; M7.1[2]) in New Zealand, in which there were no direct reports of loss of life[3], yet insured losses total at least USD 4.5 billion and are still mounting (Swiss Re, 2011a).

[2] M = Abbreviation for the Richter Magnitude Scale (also abbreviated as M), which also measures the energy released by an earthquake at its source. GeoNet, the geological hazard monitoring system in New Zealand at GNS Science, reports earthquake magnitude in Richter values for local and regional seismological observations.

[3] Anecdotal evidence from hospital staff suggests multiple cardiac deaths were associated with the 22 February 2011 Canterbury earthquake.

For 2011, the biggest natural disaster to-date is the 11 March 2011 Japan earthquake (M_w 9.0) and tsunami, which claimed the lives of approximately 28,000 people. The Canterbury province of New Zealand also experienced two major earthquakes in 2011 thus far, worsening the disaster that began with the 4 September 2010 earthquake. On 22 February 2011 an earthquake (M_w 6.2; M6.3) struck the Canterbury region, killing 181 people in Christchurch (www.police.govt.nz/list-deceased). Another earthquake (M_w 6.0; M6.3) powerfully shook the city again on 13 June 2011. The latter quake did not lead to direct loss of life[4], yet both the February and June earthquakes generated devastating effects and losses from violent ground shaking, landslides and liquefaction.

The 2011 Japan and Canterbury earthquakes also produced extremely powerful ground motions or peak ground accelerations (PGA, expressed in units of gravity, *g,* equivalent to g-force). The force of the 11 March 2011 Japan earthquake was 2.93g (USGS, 2011a). The 22 February 2011 Canterbury ("Christchurch") earthquake was 2.2g, measured in the Heathcote Valley (GNS Science, 2011a). The 13 June 2011 Canterbury ("Port Hills") earthquake was recorded in Sumner at 2.13g (GNS Science, 2011b).

The violent ground motion in each of these three events was from more than double to over triple that of the 2010 earthquake in Haiti (M_w 7.0, 0.83g) (USGS, 2011a). All three also significantly exceeded the maximum PGA for other well-known earthquakes: the 23 August 2011 earthquake in Virginia, USA (M_w 5.8, 0.5g); the 27 February 2010 Chile earthquake (M_w 8.8, 0.78g); the 28 February 2001 Seattle ("Nisqually") earthquake (M_w 6.8, 0.2g); the 16 January 1995 Kobe Japan earthquake (M_w 6.9, 0.8g); and the 17 January 1994 Northridge, California earthquake (M_w 6.7, 1.7g) (Allen et al. 2008; USGS, 2011a).

From the perspective of total economic loss, preliminary estimates from the first half of 2011 indicate that this year already ranks as the costliest in history (approximately USD 278 billion) for natural and man-made disasters (Munich Re, 2011a, 2011b; Swiss Re, 2011b). Most of the losses are from the 2011 Japan earthquake and

[4] Anecdotal evidence from local news outlets suggests a cardiac death may have been associated with the 13 June 2011 Canterbury earthquake.

tsunami (USD 210 billion), far surpassing the prior record set for the costliest natural catastrophe (USD 125 billion) from 2005 Hurricane Katrina in the USA. Total economic losses from the 2011 February Canterbury earthquake amount to at least USD 20 billion (Munich Re, 2011a, 2011b; Swiss Re, 2011b). Numbers are not yet available for the 2011 June Canterbury earthquake.

In terms of effects on gross domestic product (GDP), New Zealand Treasury estimates that damages from the 2010 September and 2011 February Canterbury earthquakes are about 8% of GDP and 2.5% of the nation's capital stock (New Zealand Treasury, 2011). Comparatively, damage from the 2011 Japan earthquake and tsunami was an estimated 3-5% of Japan's GDP, and Hurricane Katrina in 2005 cost about 1% of the USA's GDP (EQC, 2011a).

For natural catastrophe-insured losses, the tally from 2011 is nearly five times greater than the 10-year average of the first six months in the period 2001-2010 (Munich Re, 2011a, 2011b). In terms of earthquake-insured losses, 2011 is already the costliest in history. Early estimates of insured losses are USD 39-42 billion, including USD 30 billion for the March Japan earthquake and tsunami and USD 9-12 billion for the February Canterbury earthquake (Swiss Re, 2011b). The 2010 September and 2011 February Canterbury earthquakes will likely rank as the fourth most costly global event for earthquake-insured losses since 1970, after the 1994 Northridge earthquake, the 2011 Japan disaster, and the 1995 Kobe earthquake (EQC, 2011a).

2.1.2 The Concept of the Disaster Riskscape

The preceding section illustrates how disasters are usually characterised by the phenomenon of origin and often measured by the physical consequences of fatalities, injuries, physical damage and economic losses. Similarly, in disaster risk management, risk is conventionally conceptualised as the probability or likelihood of damage, loss or other consequence from a hazardous event. This concept of risk is further discussed in Section 2.6.3.2. The following three subsections introduce how the level of disruption from disaster to a community or society extends far beyond

physical and economic consequences to other unseen human consequences, and how this footprint of disaster vulnerability and risk is growing.

2.1.2.1 The Physical Riskscape

Disaster risk profiles or 'riskscapes' are generally defined as a function of the hazard (type of destructive agent or threat), vulnerability (susceptibility to damage or loss, as a function of exposure, both location and duration), and consequences (effects or impacts). These consequences may vary in their physical extent, magnitude, frequency, duration or persistence, predictability, and onset (e.g., gradual or sudden).

This 'physical riskscape' of disaster thus reflects an ecological or physical footprint characteristically defined by spatial and temporal criteria. Mortality (loss of human life) and impacts to real property, infrastructure, and economic exposure are commonly overlain on this physical riskscape in the creation of risk profiles. The physical riskscape for New Zealand and the Wellington Region, as the study field area, are elaborated on in Section 2.2.

2.1.2.2 The Human Riskscape

Disasters, whatever their source, scale or physical consequences, bring with them the potential to cause profound suffering, stress and distress extending far outside the physical impact area in both time and space (NHS, 2009a). This 'human riskscape' includes the medical, psychological and psychosocial footprint of an event on the health of individuals and communities.

Health consequences can become most acute when living conditions are substandard or uncertain, creating additional exposure to health impacts beyond the immediacy of the original disaster, or require evacuations that displace populations from their homes, livelihoods and normal day-to-day activities. The primary external impacts of physical destruction or change combine with secondary internal impacts of personal distress and losses to create a disaster footprint that reaches far beyond any visible physical damage. In the case of earthquakes, the uncertainty of future

aftershock magnitudes, intensities, and frequencies can further compound these effects.

Therefore, from a health perspective disasters are a function of both the physical event and the human health response to the potentialities and consequences of an event. Noji (1997, pg. 7) rather bluntly stated, "*From a public health perspective, disasters are defined by what they do to people; otherwise they are simply interesting geological or meteorological phenomena*."

2.1.2.3 The Expanding Riskscape of Disaster

The physical riskscape of disaster is increasing due to the changing nature and scale of disaster in recent decades, coupled with the growing potential for worldwide epidemic disease and the lasting presence of natural hazards (NIH, 2006; NSF, 2004). There is also increased human vulnerability to disaster, both within and outside of the physical riskscape.

Although overall rates of disaster mortality have dropped over the last century, in part due to early warning systems, the risk of individual exposure to natural disaster over the course of a person's lifetime is substantial and growing (UNISDR, 2011a). This is due to many factors such as population growth and migration to disaster-prone locations, globalisation, modern travel and potential climate change.

While the number of actual earthquakes and tsunamis is not increasing (Dunbar et al. 2010), the numbers of people exposed to earthquake and tsunami risk around the world has risen from thousands to millions with the migration of populations to rapidly growing urban areas with high population densities located in seismically active areas. The numbers of fatalities and insured losses from earthquakes are also rising due to population growth and higher population density, especially in urban areas, exposing more people to single damaging earthquakes (Swiss Re, 2011a). The probability for earthquakes with a high death toll is continuously increasing, although the seismic threat itself remains unchanged (Swiss Re, 2011a).

Other factors that expand the human riskscape from the health consequences of disaster are further discussed in the following section.

2.1.3 The Health Consequences of Disaster

The next three subsections provide a snapshot of the literature on the potential health consequences of disaster, with a special emphasis on the psychosocial 'footprint' of disaster as a health-related outcome, and on concerns commonly associated with disaster evacuation. This section is followed by an introduction to the need for a preventive health approach to disaster (Section 2.1.4). Management and research frameworks for these themes are discussed in detail in Sections 2.4 and 2.5, respectively.

2.1.3.1 The Medical Footprint

From a health perspective, disasters are usually first recognised as extreme events that cause mortality and morbidity. Disaster medicine tends to focus on emergency care and the level of resources needed to meet demands adequately within the medical community's organisation and response. The delivery of medical care in response to a catastrophe differs radically from the routine; the philosophy of care shifts from a focus on the individual patient to casualty triage (Waeckerle, 1991). Medical resources, personnel, supplies, and facilities are managed to provide the greatest good for the greatest number. Contrary to many expectations, this means that treatment might not be available for all those suffering physical trauma, expanding the medical footprint of disaster.

On the other hand, Noji (2005) reported that despite the importance of planning for the critically injured and developing health sector capacity to meet needs, evidence from epidemiologic studies indicates that most disaster injuries are relatively minor and can easily be treated outside the hospital setting, relieving some strain on hospital facilities. This shifts the medical response to other health care sectors such as primary care (e.g., Freedy & Simpson, 2007), specialty/clinical care environments (e.g., Freedy et al. 1992), and to public health (e.g., Logue, 1996; Mokdad et al.

2005; Murthy & Christian, 2010). Capacity building for disaster prevention and response is increasingly important in all of these sectors.

Many positive developments over the last 30 years have led to better understanding of the medical footprint of disasters, include rapid impact and epidemiologic needs assessments that estimate casualties, injury, acute illness, and effects on chronic disease (e.g., Lechat, 1990; Logue, 1981; Logue et al. 1981a, 1981b; Mokdad et al. 2005; NAS, 2007; Noji, 2000, 2005). These types of studies are invaluable for disaster medical planning and for developing effective clinical and public health response capacity to the physiological impacts of disaster.

2.1.3.2 The Psychological Footprint

Noji (2005) also argued that the psychosocial consequences of survivors' struggling for years after an event must be successfully integrated into health systems disaster planning, emphasizing that, "*social and mental health problems will appear when the acute crisis has subsided and the victims feel (and often are) abandoned to their own means.*" This echoes earlier propositions that "*the health consequences of a disaster might differ from immediately post impact, when casualties are being cared for, to the recovery period when stress-related chronic diseases might predominate*" (Logue et al. 1981b, pg. 218). This is also consistent with studies of grieving that have demonstrated the critical time for support is after the acute or crisis phase has passed and the person is expected to return to 'normal' (Scruby & Sloan, 1989).

Indeed, there has long been widespread agreement across disaster research communities that the primary external impacts of destruction, disruption, or change can be catastrophic stressors that may strain or exhaust an individual's internal resources and adversely affect a person's physical and mental health. Thirty-five years ago, Erikson (1976) recognised that adverse mental health outcomes from disaster (e.g., pre-event anxiety, peri-trauma, post-traumatic stress, depression, and other emotional sequelae) increase overall morbidity and mortality and associated suffering, and adversely impact civil society at all population and infrastructure levels. Important subsequent reviews from the behavioural sciences (e.g., Freedy et al.1994; Reyes & Jacobs, 2005; Shrubsole, 1999; and Stein & Myers, 1999)

summarised the broad range of emotional and behavioural sequelae from disaster that can lead to chronic problems if left untreated.

For example, disasters can cause or contribute to depression, anxiety, and post-traumatic stress disorder (PTSD). Rubonis & Bickman (1991) found a 17% increase in the prevalence of short-term psychopathology following disaster exposure. Rates of PTSD in disaster survivors have been found to vary from about 5-22%, depending on the severity of the event (Green & Lindy, 1994). Long-term effects of PTSD, also called the 'disaster imprint' (Gleser et al. 1981), may affect survivors' sense of control, predictability, safety, and trust (Weisath, 1993).

2.1.3.3 The Psychosocial Footprint

The term 'psychosocial' is an adjective that is used to describe the psychological and sociological processes that occur within and between people and across groups of people (NHS, 2009a, 2009b). In studying the psychosocial footprint of disaster, researchers often return to Erikson's (1976) work and the recognition that trauma can occur both individually and collectively. Erikson (1976) described these two distinct types of disaster trauma as: 1) individual trauma, "*a blow to the psyche that breaks through one's defences so suddenly and with such brutal force that one cannot react to it effectively*"; and 2) collective trauma, "*a blow to the basic tissues of social life that damages the bonds attaching people together and impairs the prevailing sense of communality*." Norris and colleagues (2002a, 2002b) identified a broad range of psychosocial effects of disaster affecting individuals and communities, influenced by demographic factors and the presence or absence of psychosocial resources. Psychosocial effects and resources are further described in Section 2.5.

The conceptualisation of a psychosocial footprint and the collective experience of disaster trauma worked their way into contemporary international definitions of disaster in the early 1990s. The World Health Organization (WHO, 1992, p. 2) defined disaster as "*A severe disruption, ecological and psychosocial, which greatly exceeds the coping capacity of the altered community*." McFarlane and Norris (2006, p. 4) also defined disaster as "*a potentially traumatic event that is collectively*

experienced, has an acute onset, and is time-delimited." The emphasis on psychosocial impact is now a fundamental underpinning of the current UNISDR definition in use today and presented earlier in this chapter (UNISDR, 2009).

2.1.3.3.1 Disaster Evacuation

The psychosocial footprint of disaster can be profoundly enlarged at both the individual and collective level when populations are displaced or must evacuate. Each year, millions of people are displaced by natural or human-induced disasters resulting in humanitarian crises (NAS, 2007). Forced displacement is occurring on a huge scale and affecting all regions of the globe; over 42 million people across the world were forced to flee due to disasters triggered by sudden-onset natural hazards in 2010 (IDMC, 2011).

Evacuees can suffer up to twice the rate of illness of others affected by disaster (Whiteford & Tobin, 2004) and significant psychological distress from social network disturbances (Bland et al. 1997, 2005). Coping skills are especially needed, whether during internal displacement within a person's home country or resettlement in another country, to overcome the emotional suffering from the trauma and losses experienced and promote positive adaptation in a new environmental and cultural setting (Houston et al. 2009; Pahud et al. 2009). A global database on the "Guiding Principles for Internal Displacement" consolidates international standards for the protection of all internally displaced persons in natural disasters and other situations of forced displacement (Brookings Institution, 2007).

Identifying people at risk of displacement and helping them and those already displaced is an essential component of psychosocial resilience for communities and nations worldwide. Population displacement may occur pre-disaster or post-disaster due to the physical hazards of an event (e.g., destructive forces) or from the physical and social consequences of an event (e.g., lifeline utility/infrastructure failure, disruptions to social networks and social support). The timing of evacuations may depend on the nature of the hazard.

For instance, advance warning evacuations are possible for cyclones, tornadoes, wildfires, and floods, and depending on proximity and warning systems, for tsunamis, volcanic eruptions and lahars (mudflows), landslides, and avalanches. Real-time evacuations take place when danger is imminent or at hand. Post-event evacuations may be immediate due to devastation or when 'personalised risk assessments' (e.g., Mileti & Fitzpatrick, 1993; Mileti & Sorensen, 1987) determine that the uncertainties of survival or resource availability are no longer acceptable, tolerable, or prudent to bear. In such cases, evacuation may have health-protective benefits.

Evacuations may be voluntary or spontaneous at the individual level, or occur as required mass evacuations under statutory law. Small-scale emergency evacuations of communities in New Zealand are relatively common (MCDEM, 2008a), and some hazards, including earthquake and tsunami, could call for mandatory evacuation of large numbers of people. The New Zealand National Civil Defence and Emergency Management Plan (§76) states that evacuation should be considered when one or more of the following situations exist (MCDEM, 2006):

- Personal safety is under continuing threat
- There are properties classified as unsafe or insanitary or both and there is a lack of suitable shelter or alternative accommodation
- Public health is gravely threatened
- Food and water are not available
- The burden of caring for people in the area is far greater than it would be than under evacuation

Houston et al. (2009) summarised numerous reasons why dislocation is particularly challenging. People who have been displaced may be: 1) disoriented – they are in unfamiliar surroundings, 2) disconnected from social support, 3) disconnected from pets, 4) disconnected from information (news about what is going on and about what happened to family and friends or their homes), 5) disconnected from personal belongings (e.g., items for daily living, cherished possessions, no access to money), 6) disconnected from familiar activities and routines (without a job or unable to attend

school), 7) disconnected from familiar resources (unaware of where to go for medical help or other services; without transportation).

These risks must be balanced against unexpected and often unwelcome realities that disaster survivors face. In the case of the Canterbury earthquakes, a recent Christchurch residents survey (n=400) conducted in June 2011, both before and after the 13 June 2011 earthquake, found a 6% drop (from 87% to 81%) in the number of people intending to keep living in Christchurch for the next few years (UMR, 2011). Prior to 13 June, of those people who don't expect to live in Christchurch, the reasons cited were *fear of more quakes* (17.6%); *depressing, loss, stressful* (14%); *for the children/family* (10.6%), *uncertain future* (6.9%); *lack of infrastructure* (6.5%);and *house is to be demolished* (5.4%). These findings illustrate that, similar to the example of the medical footprint, not everyone adversely affected by the psychosocial consequences of disaster can be reached, and the scattering of effects can further widen the psychosocial footprint of disaster.

2.1.4 The Need for a Preventive Health Approach to Disaster

It is important to note that many researchers have recognised that the magnitude and consequences of psychological trauma may be less than expected (e.g., Bravo et al. 1990; Norris, 2006a, 2006b), and that many trauma survivors have resilience to psychosocial impacts (e.g., Calhoun & Tedeschi, 1998, 2001; Tedeschi & Calhoun, 1995, 2004; Tedeschi & Kilmer, 2005). Significantly, it has also been found that distress produces multiple patterns of traumatic and resilient outcomes; trauma and resilience can be temporally variable and transient, following a variety of trajectories (Bonnano, 2004; Hobfoll et al. 2009; Norris et al. 2009).

Some individuals present negative or positive outcomes in the peri- or acute post-disaster phase, followed by latent growth toward similar or reverse outcomes over a period ranging from several months to years. Rather than a homogenous distribution of change, an in-depth review of studies on reactivity to life stress suggests a more heterogeneous response (Bonanno et al. 2010). Some people respond positively immediately post-disaster and struggle months or years later.

Others experience significant disruptions in functioning through the first months or half-year of a disaster and then begin to recover quickly.

Disaster research thus examines a continuum of outcomes between illness to wellness, and explores how adaptive capacities and quality of life can enhance self-management of disaster risk and response at both the individual and community level through all phases of the disaster cycle. Preventive development of a stronger 'baseline' of resilience and well-being in the population, buffering the impacts of disruptions in functioning created by disaster, can create more resilient outcomes. Theories and findings relevant to resilience, quality of life, and preventive health in this context are further detailed in Sections 2.5 and 2.6 of this chapter.

The need for preventatively building resilience to the personal and societal costs of disaster was perhaps first noted by Quarantelli (1985) and has received increased emphasis as a research priority for at least the last five years (e.g., NIH, 2006). At the same time, within health sector practise and management frameworks, disaster response and recovery efforts have been recognised as overwhelmed with needs exceeding available resources (e.g., Kaminsky et al. 2006). Underscoring this fact, the expression "YOYO" ("You're On Your Own") has become part of the popular lexicon in emergency management, communicating a frank recognition that service providers might not be able to respond to the needs of affected populations, thus necessitating self-management of disaster risk. Compounding these problems, disaster self-management skills are recognised as widely underdeveloped (Myers & Wee, 2005).

Since 9/11 and subsequent natural disasters worldwide, there have been improvements in building resilience at institutional, community, and individual levels. However, this is not a time to ease up. Disasters will continue to happen and will affect increasingly larger numbers of people. Further, from an economic standpoint, the risk of financial loss from disaster is now rising faster than wealth creation, even in developed nations (UNISDR, 2011b). Disaster prevention is being called for, now more than ever, as a matter of public policy:

"We can do nothing about the severity of earthquakes, tsunamis, cyclones and other natural hazards. But, what we can do is to understand our risks and reduce our vulnerability as well as the impact to our economies to these hazards. We cannot afford to wait as the costs from disasters continue to rise."

- Margareta Wahlstrom, Special Representative of the UN Secretary-General for Disaster Risk Reduction, 14 July 2011.

Understanding risk and promoting preparedness and self-management skills is thus of continued keen interest throughout the disaster research, practise and emergency management communities.

The next three sections of this chapter set the stage for the overall aim of this research study, to contribute an evidence base for health interventions to develop self-management behaviour that increases personal resilience to disaster in community populations. Section 2.2 describes the physical 'riskscape' for this study, the well-known vulnerability to earthquake and tsunami in New Zealand, with a specific focus on Wellington, a vibrant and geographically isolated coastal Capitol city with a recorded history of earthquakes and tsunamis and the field area for this research. The general status of disaster preparedness at the population level is summarised in Section 2.3. The emergence of the prevention perspective in disaster management, practise and research is discussed in Sections 2.4 and 2.5. The study framework is presented in Section 2.6.

2.2 The New Zealand Physical Riskscape

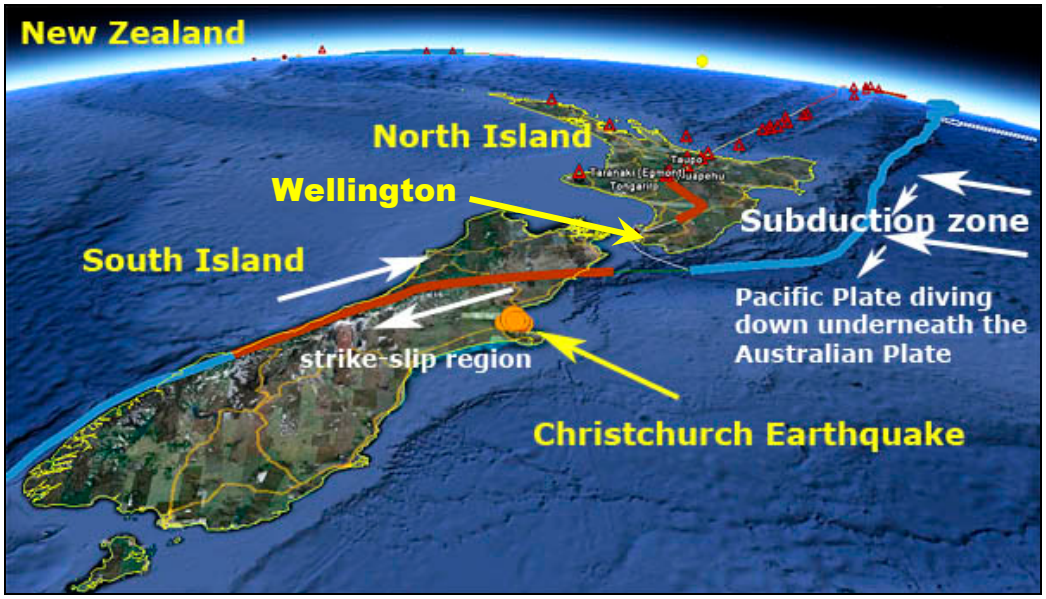
The environmental context of this PhD thesis is set in the geological sciences, where natural hazards research focuses on scientifically measuring the objective nature and behaviour of physical phenomena, and characterises the physical consequences for events such as earthquake- or tsunami-triggered disaster. These types of phenomena in New Zealand, and their real and potential human consequences, are briefly described in the following subsections.

2.2.1 Overview

New Zealand is one of the most active and dynamic landscapes on Earth. A catalogue of the many types and varied range of natural hazards in New Zealand is provided in the National Hazardscape Report (NHR, 2007). Earthquakes, tsunamis, and volcanoes are potentially the most damaging and disruptive natural hazards in New Zealand. Other significant natural hazards include coastal hazards, droughts, floods, landslides, severe winds, snow, and wildfires. Between 1980 and 2010, New Zealand was affected by 44 natural disasters (28 floods, 9 severe storms, 2 major earthquakes, 1 volcanic eruption, 1 wildfire,1 drought, 1 epidemic, and 1 extreme temperature disaster) killing 23 people and costing USD 4.7 million (EM-DAT, 2011).

Earthquakes and tsunamis, along with volcanic eruptions, owe their presence to the New Zealand tectonic setting where the Australian and Pacific Plates are both converging and shearing past one another. East of the North Island, the Pacific Plate is being pushed down under the Australian Plate by subduction processes Figure 2.2). Southwest of the South Island, the Australian Plate is subducting under the Pacific Plate. Earthquakes occur along the plate interface and within the subducting slabs as they grind past one another; this strain also creates regional fault systems throughout New Zealand. In between these two subduction zones lies the Pacific-Australia transform plate boundary. There, the two plates are transpressively shearing past one another along the Alpine Fault (Figure 2.2, “strike-slip region”) at one of the fastest rates in the world, creating an internationally renowned seismic hazard.

Figure 2.2 Schematic of the New Zealand Tectonic Setting



Modified from: http://modernsurvivalblog.com/wp-content/uploads/2011/02/new-zealand-plate-tectonics.jpg

When earthquakes displace a large volume of a body of water, a devastating tsunami can result. Off-shore movement of local and regional faults can thus create tsunamis affecting the New Zealand coastline. In addition to risk from its tectonic setting, New Zealand also has tsunami exposure from events triggered by local submarine landslides and from earthquakes in other tectonic settings. Additional details on the history and riskscape of earthquake and tsunami in New Zealand are contained in the next two subsections.

2.2.1.1 Earthquakes

The largest loss of life of any earthquake in New Zealand's history was in the M7.8 Hawkes Bay earthquake on 3 February 1931, when at least 256 people died and thousands required medical treatment (Dowrick & Rhoades, 2005a). Between the 1931 Hawkes Bay earthquake and the 2010 M7.1 Darfield earthquake, there were no major earthquakes close to urban areas in New Zealand. Yet in 2007, the National Hazardscape Report projected that at least 1 million New Zealanders (around 25 per cent of the population) were expected to experience seismic shaking

great enough to damage household contents and buildings in the next 50 years (NHR, 2007).

Sadly, this projection is already partially fulfilled through repeated exposure to shaking and damages for well over 300,000 people in the Canterbury region, due to the sudden onset of severe earthquakes along previously-unrecognised faults and their progressive growth and amalgamation within an evolving immature wrench fault system (Sibson & Ghisetti, 2011). Extremely violent ground shaking was produced by the M_w 7.1 Darfield earthquake on 4 September 2010 (03 Sept 2010, 16:35:46 UTC), the M_w 6.3 Christchurch earthquake on 22 February 2011 (21 Feb 2011, 23:51:43 UTC), and the M_w 6.0 Port Hills earthquake on 13 June 2011 (13 June 2011, 02:20:50 UTC).

This protracted seismic sequence in Canterbury has also dealt 29 aftershocks in the M5.0-5.9 range; 323 between M4.0-4.9; 2457 in the M3.0-3.9 range; and 4897 between M2.0-2.9 (as of 27 October 2011, http://quake.crowe.co.nz). The initial Darfield earthquake produced surface rupture for approximately 30 kilometres across the Canterbury Plains, with right-lateral displacement along the Greendale Fault of up to 5 meters (Quigley et al. 2011; Van Dissen et al. 2011). Surface rupture and displacement relative to rupture length of the Greendale Fault during the Darfield Earthquake are amongst the largest ever recorded for a continental strike-slip earthquake (Quigley et al., in press).

The Alpine Fault, a 650-km long expression of the right-lateral strike-slip Australian-Pacific Plate transform boundary, runs almost the entire length of the South Island (*see* red line, Figure 2.2). The Alpine Fault is of the largest sources of seismic hazard in New Zealand and is capable of causing earthquakes in the range of M8 at recurrence intervals from about 100 to 350 years, indicating that a large earthquake is very likely within the next 100 years (NHR, 2007).

The most recent earthquake along the Alpine Fault most likely occurred around 1717 AD, as determined by radiocarbon dating within a 4-meter high thrust scarp (De Pascale & Langridge, 2011) and involved surface rupture along almost 400 km of the fault. Propagation of an Alpine Fault rupture northward with the mainshock

perturbing fault systems in the Wellington Region, is believed to be a possible outcome of a large Alpine Fault event.

At the time this study was initiated (2007), most of the focus for earthquake and tsunami readiness in New Zealand was on the Wellington Region. Wellington was the centre of the highest zone of projected earthquake intensity, with a 20% probability of violent to cataclysmic levels of seismic shaking (Modified Mercalli Scale IX-XII) being exceeded in 50 years (UNOCHA, 2007). Seismic shaking in this range of intensity was not projected for the Canterbury region, but has since been experienced with the 2010-2011 earthquakes on previously unknown faults. The recent Canterbury events, however, do not change the likelihood of a major earthquake in the Wellington Region.

The Wellington Region remains the scene of New Zealand's largest historical earthquake, the M8.2 Wairarapa earthquake on 23 January 1855. This earthquake was accompanied by surface rupture along 140 km of the Wairarapa Fault on the eastern margin of the Tararua Range and caused up to 6m of uplift to the west of the Wairarapa Fault; it also triggered landsides across 20,000 sq. km. of land and generated a 9m-high tsunami in Palliser Bay and measured 2-3m in Wellington Harbour (Grapes & Downes, 1997; Little et al. 2009; NHR, 2007; Rodgers & Little, 2006). Seven deaths were reported. Today the number of fatalities would be significantly higher. Further details on the Wellington riskscape are provided in Section 2.2.2.

2.2.1.2 Tsunamis

New Zealand's tsunami risk is comparable to or larger than its earthquake risk. Large tsunamis are documented within written history and from Māori tradition records within the last 1000 years (Goff et al. 2009). There is also geological evidence of tsunamis with up to 60m run-ups (maximum vertical height reached on land above normal sea level) affecting the New Zealand coast within the last 6000 years (NHR, 2007).

Risks are present from distant-, regional- and local-source tsunamis (generated more than three hours' travel time, one to three hours travel time, and less than one hour's travel time from New Zealand, respectively). The largest contributors to New Zealand's tsunami hazard are earthquakes off the South American coast (Power et al. 2007), capable of generating distant-source tsunamis, or along the southern Kermadec (regional source) and Hikurangi (local source) subduction zones (Power et al. 2008) to the east of the country. Other offshore local faults also contribute but to a lesser degree. Submarine landslides also present a local source risk of tsunami.

All major distant tsunami sources are more than 10 hours' travel time from New Zealand giving, in theory, adequate time for warning and evacuations, although wave heights may be difficult to predict (NHR, 2007). Regional and local tsunami sources, however, may be only minutes to a few hours travel time from the nearest New Zealand coast. There may not be enough time to confirm a tsunami and issue a warning before it reaches New Zealand shores.

The most recent damaging distant-source tsunami to significantly affect New Zealand was generated by an M_w 9.5 earthquake off the coast of Chile on 22 May 1960, the most powerful earthquake ever recorded on Earth, causing fluctuations of up to 4.5 metres above normal sea level along the New Zealand coast (Power et al. 2007). No human fatalities were reported in New Zealand despite damages to facilities and widespread self-evacuation to higher ground following a large aftershock on 25 May 1960 (Johnston et al. 2008).

With greater population densities and increased coastal development over the last few decades, a large tsunami today is likely to be highly damaging. A tsunami hazard and risk study undertaken for the New Zealand Ministry of Civil Defence and Emergency Management (MCDEM) by GNS Science (Berryman, 2005; Smith, 2007) estimated deaths ranging from 2,900 to 10,000 people and property damages of NZD12-21 billion nationally from a 500-year return period tsunami. New Zealand is a member of the Pacific Tsunami Warning System under UNESCO; dissemination of national tsunami advisories and warnings falls under the purview of MCDEM. Details are provided in the National Tsunami Advisory and Warning Plan (MCDEM, 2010a).

2.2.2 The Wellington Physical Riskscape

The city of Wellington, New Zealand, is situated at the southern end of the North Island of New Zealand (Figure 2.2). It is the nation's capital and the Wellington metropolitan area is home to over 375,000 people. Nearly a half-million people live in the Wellington Region and are exposed to a wide range of potentially devastating impacts from natural hazards, including droughts, earthquakes, floods, landslides, tsunami, wildfire, and wind and storms (Greater Wellington Regional Council, 2004). For a recent review discussing the broader natural hazardscape of Wellington, the reader is referred to Khan (2009). For the purposes of this study, earthquake and tsunami are the hazards discussed in this chapter.

2.2.2.1 Earthquakes

Wellington is located in the North Island Fault System, one of the most active seismic regions in New Zealand (Figure 2.3). High-hazard zones for earthquakes in the greater Wellington Region include the Wairarapa and Wellington areas (Cousins et al. 2008a).

The city of Wellington has been subject to significant earthquakes in the last 150+ years (e.g., 1848 Marlborough, 1855 Wairarapa, and 1942 Wairarapa I and II) (GNS, 2011c). The right-lateral strike-slip Wellington Fault is the most active earthquake-generating fault in the Wellington Region and is considered capable of generating M7.6 earthquakes (NHR, 2007; Van Dissen et al. 2010).

The last time the Wellington Fault ruptured through the Wellington Region and caused a major earthquake was around 200-450 years ago; it is thought to rupture, producing a major earthquake, every 500-1000 years (Langridge et al. 2008; Little et al. 2010). Modelling of data from the "It's Our Fault" project at GNS Science has established an estimated probability of a Wellington Fault rupture at approximately 10-12% within the next 100 years (Rhoades et al. 2010; Van Dissen et al. 2010).

Other faults around the Wellington Region that are also active and capable of generating major earthquakes include the Ohariu Fault and the Wairarapa Fault (Figure 2.3). The frequency of large earthquakes severely affecting the Wellington Region is a return period of about 150 years for a very strong or extreme ground shaking quake (Dowrick & Rhoades, 2005a, 2005b; Rhoades et al. 2010).

Figure 2.3 Major Faults of the Wellington Region

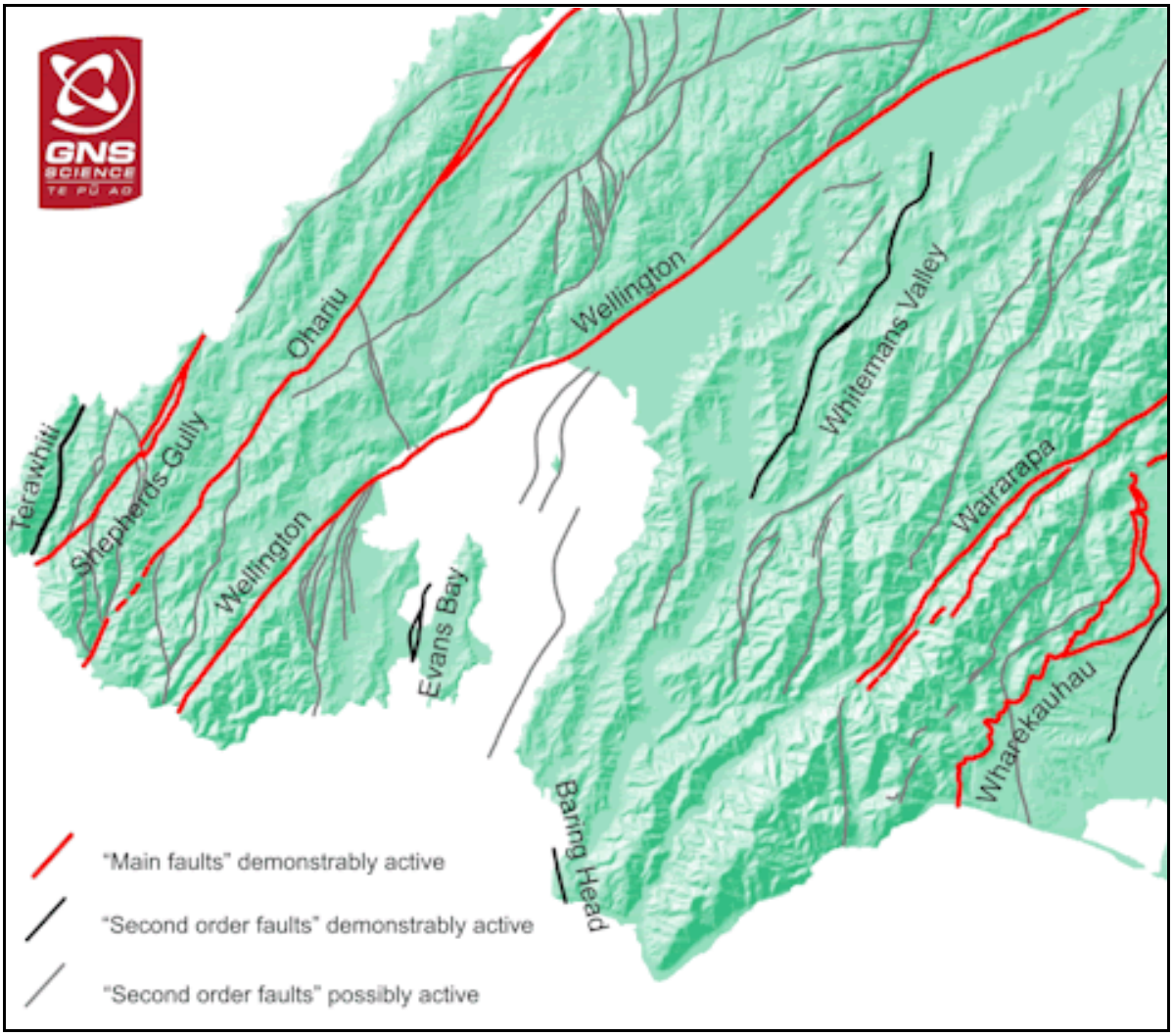


Image Courtesy of GNS Science

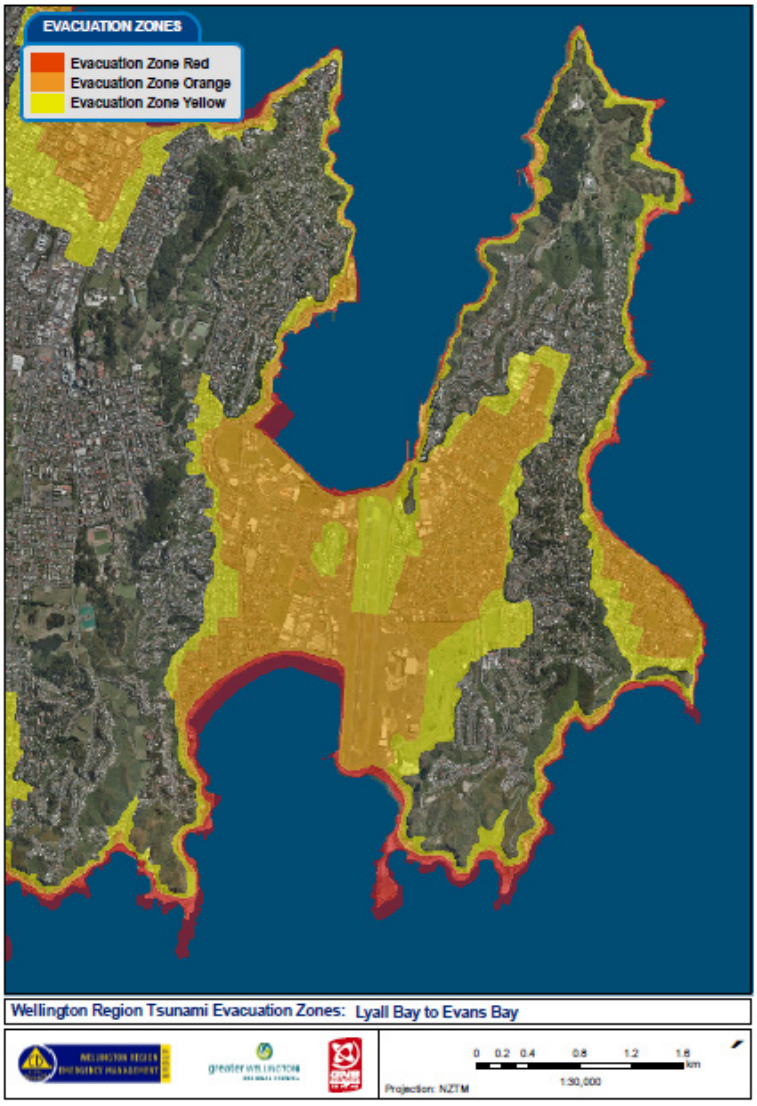
For a comprehensive overview of the geology of the Wellington area, including faulting, see Begg & Mazengarb (1996). For additional information on earthquake likelihood for the Wellington, Wairarapa, and Ohariu Faults and Cook Strait active faulting, see Barnes & Pondard (2010), Carne et al. (2011), Langridge et al. (2008),

Little et al. (2009, 2010), Litchfield et al. (2010), Rhoades et al. (2010), and Van Dissen et al. (2010).

2.2.2.2 Tsunamis

The tsunami hazard for Wellington is greatest from local source areas, and the area of greatest hazard in New Zealand from any tsunami source area is the east coast of the North Island, including the Wellington Region (Berryman 2005, Cousins et al. 2008a). Low-lying parts of the Wellington coast are particularly vulnerable to tsunami (Goff et al. 2001; Leonard, 2009). These areas include Lyall Bay, Evans Bay, Eastbourne, Wellington Harbour, lower Hutt Valley, and Porirua Harbour.

Figure 2.4 Tsunami Evacuation Zone Map for the Study Area (Leonard, 2009)



The most significant local-source tsunami in historic times was from the 1855 Wairarapa Fault earthquake (M8.2), which produced a tsunami in Lyall Bay of around 9 to 10 metres. A seiche (pronounced "saysh") from the 1855 Wairarapa earthquake also created sloshing motion generating a 1-metre wave that flooded low-lying areas along Wellington Harbour, including Lambdon Quay. Seiche is a phenomenon that occurs when seismic waves passing through water generate standing waves that can then inundate the surrounding shorelines.

In historic times (1886, 1877, and 1960), three distant-source tsunamis generated by large South American earthquakes also reached Wellington but had only minor impacts (Grapes & Downes, 1997). Of increasing concern is the potential for a local-source tsunami due to plate boundary rupture at the Hikurangi subduction zone, which runs along the east coast of the North Island. An earthquake event along the Hikurangi subduction zone is now considered the most likely source of a damaging tsunami for the Wellington Region, most of the east coast of the North Island, and much of the South Island coast (Berryman 2005, Wallace et al. 2009).

2.2.2.3 Consequences of Earthquake and Tsunami

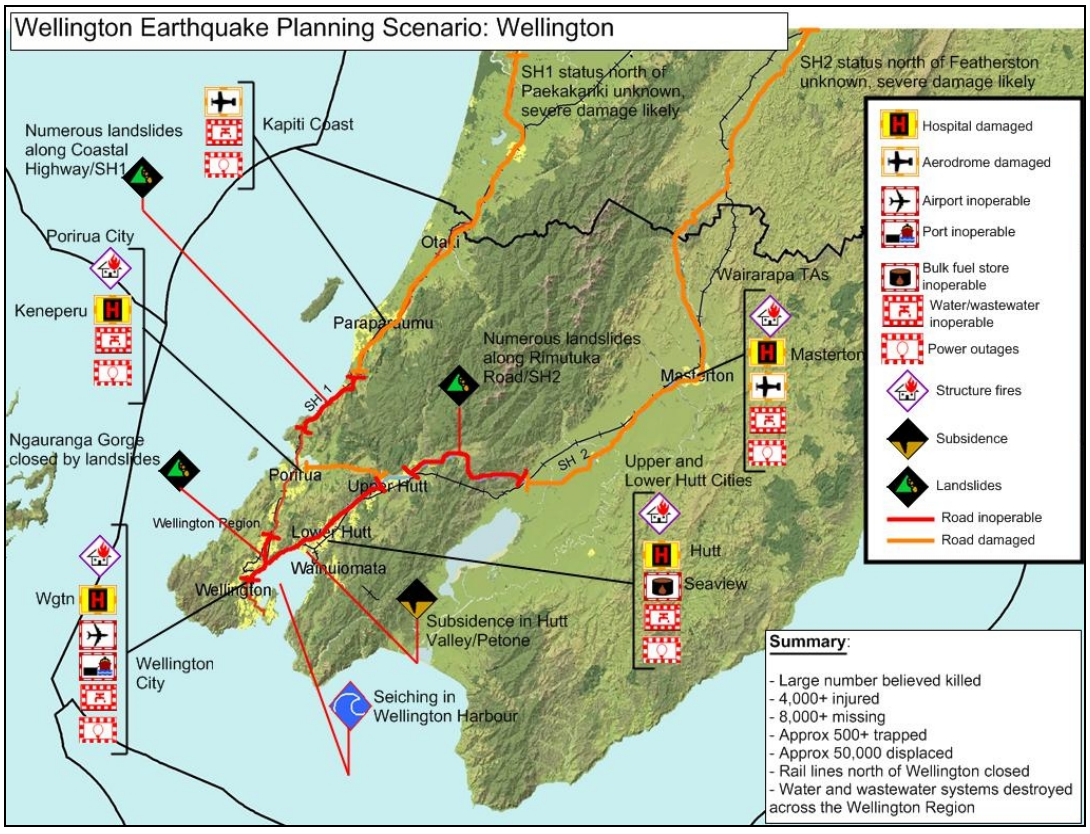
Recent hazard modelling has improved understanding of the risk to Wellington from earthquake and tsunami events. Rupture of the Wellington Fault or other active faults in the Wellington Region (including the Wairarapa Fault, the Ohariu Fault, the BooBoo Fault, and the Hikurangi subduction zone interface) have the potential to result in major loss of life and substantial damage to Wellington (Berryman, 2005; Cousins et al. 2008b; Dowrick & Rhoades, 2005a, 2005b; Rhoades et al. 2010; Wallace et al. 2009). These seismic hazards are all capable of generating tsunami.

Following the 2005 national tsunami hazards and risk review (Berryman, 2005) and a parallel review of New Zealand's preparedness for tsunami hazards (Webb, 2005), additional studies were undertaken to advance knowledge for earthquake and tsunami losses in the Wellington Region. Cousins et al. (2008a) modelled four main earthquake and tsunami scenarios, and found that combined earthquake and

tsunami losses could range from NZD800 million to NZD14 billion, depending on the fault scenario. Deaths and injuries will vary by time of year and time of day, and on whether advance warning can be issued before the tsunami reaches the coast.

A M7.6 earthquake on the Wellington Fault alone could cause around 3000-4000 casualties, including between 200 and 600 deaths, and cause more than $10 billion worth of direct damage (Cousins et al. 2008b). The worst-case planning scenario for the Wellington Earthquake National Initial Response Plan (WENIRP) is for 50,000 people displaced, 8,000+ missing, 500+ trapped, 300+ deaths, and 4,000+ injured (MCDEM, 2010b). The WENIRP assumes that all roads into Wellington would be cut; there would be widespread power outages, main gas pipeline failures, and damage to hospital facilities; and airport, port, rail, bulk fuel storage, and water/wastewater facilities would be inoperable (MCDEM, 2010b; Woodley, 2010). The disaster would be on a national scale, with damages likely in surrounding regions as well. Figure 2.5 depicts the expected impact of a magnitude 7+ earthquake centred about Wellington (MCDEM, 2010b).

Figure 2.5. Scenario for Magnitude 7+ Wellington Earthquake



Source: Wellington Earthquake National Initial Response Plan, MCDEM (2010b).

A narrative presented on the GNS Science website (GNS Science, 2010) paints not only a troubling picture of a Wellington Fault earthquake, but also presaged many of the effects now being seen in Christchurch:

"The most severe and damaging effect will be strong ground shaking. There will be other damaging effects of a large Wellington earthquake: Many slips will occur throughout the region, especially if the hill slopes are already saturated by recent rainfall. In flat areas underlain by unconsolidated sediments the ground can liquefy, tilting buildings and causing buried pipelines and other structures to float to the surface. Many of the coastal areas of the lower North Island will be at risk of a tsunami, caused by the Wellington fault displacing the seafloor or triggering a submarine slump. Within Wellington Harbour and on rivers and lakes in the region there may also be a 'seiche,' as was observed in the harbour after the 1855 Wairarapa earthquake. The Wellington Fault passes under significant infrastructure such as the ferry terminal, motorway, railway, and several bridges along the Hutt Valley. Transport routes throughout the region may also be affected by landslides and liquefaction. Water supplies, electricity and phone lines may also be disrupted."

The vulnerability of the road network in the Wellington Region to earthquakes was initially highlighted by a lifelines/utility infrastructure study in the early 1990s (CAE, 1991). Subsequent studies, which do not account for ground damage from fault rupture, led to the development of GIS-based road network resilience maps and a programme of risk mitigation since 2003 (Brabhaharan, 2010). The potential economic and social consequences of utility/lifeline services failure in Wellington are especially severe due to the expected isolation of central and eastern Wellington (areas east of the Wellington Fault) from vital supplies of water, food, power or fuel; all have to be imported through the steep terrain surrounding the city (Cousins et al. 2009, 2010). In a M7.6 earthquake rupture scenario of the Wellington Fault, complete failure of the bulk water supply pipeline system is expected at each of several crossing points along the Wellington Fault (Cousins et al. 2010). The shortest time needed to get a survival-level water supply back into Wellington is five to eight weeks; a future 6-12 months might be required for full restoration of reticulated water to households (Cousins et al. 2010).

2.3 The Need for Disaster Preparedness

When people accurately perceive disaster risk and effectively prepare, their losses are reduced (Lindell & Perry, 1992; Lindell & Whitney, 2000; Mileti & Sorensen, 1987). However, the majority of people at risk from seismic hazards do little to significantly reduce their vulnerability; this is true both for New Zealand and around the world (MCDEM, 2011b; Rossetto et al. 2011; Solberg et al. 2010; Spittal et al. 2008; Statistics New Zealand, 2008). Compounding this problem, evacuation readiness typically pales in comparison to the most widespread type of activity, 'shelter-in-place' post-disaster survival preparedness (Solberg et al. 2008).

Since the Canterbury earthquakes of 2010-2011, natural disaster risk and readiness has been receiving heightened attention in New Zealand and numerous studies are now underway to quantify post-earthquake changes in levels of disaster awareness and preparedness. The two following subsections briefly compare pre- and post-Canterbury preparedness levels in New Zealand. Next, the specific area of evacuation preparedness is highlighted, followed by a discussion on barriers to overall preparedness. This section concludes with select examples of national and Wellington Regional preparedness efforts and collaborations.

2.3.1 New Zealand Disaster Preparedness, Pre-Canterbury Earthquakes

Prior to the on-going Canterbury disaster, a number of studies found that while most people acknowledged earthquakes and tsunami were a threat to New Zealand, there was a limited understanding of earthquake risk, in terms of awareness that a major event would have any real consequence, and substantially less awareness of tsunami consequences (e.g., Johnston et al. (in review); Ronan et al. 2001). Levels of overall disaster preparedness were also less than expected and desired.

The New Zealand General Social Survey (Statistics New Zealand, 2008) gathered information on what preparations the usual resident population has made at home for a natural disaster. The NZGSS surveyed more than 8,000 individuals at a national level over a twelve-month period, from April 2008 to March 2009, covering

the complete field period for this study (November 2008 to March 2009). Data were collected on thirteen types of natural disaster preparedness activities at a categorical (yes/no) level of measurement. The findings on nation-wide levels of preparedness were of concern, although preparedness levels in Wellington were somewhat higher (Statistics New Zealand, 2008):

- Only 15 percent of New Zealand households had made all three "basic preparations."[5]
- About one in ten households (11%) had met all the requirements needed for "better preparation."[6]
- While most New Zealand households (87%) had food for three days, less than half (41%) had a three-day supply of water.
    - Half of households in the Wellington Region had a three-day supply of water.
- One-quarter (26%) of New Zealand households had a household emergency plan.
    - One-quarter of Wellington households had a household emergency plan.
- Household emergency plans were the least common type of natural disaster preparation, ranking 13th out of 13 preparedness actions.

Similar findings were reported for April to May 2008 from monitoring research for the national "Get Ready Get Through" social marketing campaign (MCDEM, 2008b), which has been surveying about 1,000 people living in New Zealand annually since 2006 to measure people's disaster preparedness. Results on a few of the many indicators for 2008 are as follows:

- About one-quarter (26%) of New Zealanders met the requirements for being "prepared at home."[7]

[5] "Basic preparation" was defined as having enough food and water for three days and a household emergency plan.
[6] "Better preparation" included also having a torch (flashlight), portable radio, spare batteries, first aid kit and essential medicines.
[7] "Prepared at home" was defined as having an emergency survival plan, having emergency survival items and water, and regularly updating these items.

    - Slightly under half (41%) of Wellingtonians were “prepared at home.”
- About one in ten (10%) New Zealanders were “fully prepared”[8] for disaster.
    - About one-quarter (24%) of Wellingtonians were “fully prepared.”
- Less than half (46%) of New Zealanders had a three-day supply of water stored for each household member.
    - About two-thirds (62%) of Wellingtonians had a three-day supply of water.
- About half (50%) of New Zealanders had an emergency survival plan.
    - About two-thirds (63%) of Wellingtonians had a plan.

Other studies have examined hazard awareness and preparedness for earthquake in Wellington and tsunami for the North Island of New Zealand. For examples, the reader is referred to Johnston et al. 2003, 2008; McClure et al. 2009; McClure & Sibley, 2011; Pishief, 2007; and Spittal et al. 2008.

2.3.2 New Zealand Disaster Preparedness, Post-Canterbury Earthquakes

These are early days for post-Canterbury assessments of disaster preparedness, and multiple surveys have excluded Cantabrian populations at this time as a matter of ethical research practise. Nationwide results, excluding Canterbury, are available for the “Get Ready Get Through” 2011 survey, conducted between 16 May and 12 June 2011 (MCDEM, 2011a). These results show increases in preparedness to the highest levels since the 2006 benchmark, in many categories of preparedness and within most regions of New Zealand, with strong indications of preparedness prompted by the Canterbury earthquakes (MCDEM, 2011b).

- About one-third (32%) are “prepared at home,” compared to 26% in 2008.
    - About half (51%) of Wellingtonians are “prepared at home.”
- Nearly one-fifth (18%) are “fully prepared” for disaster.
    - About one-third (33%) of Wellingtonians are “fully prepared.”

[8] “Fully prepared” was defined as having an emergency survival plan that includes what to do when away from home, having emergency survival items and water, and regularly updating these items.

- About half (53%) have a three-day supply of water stored for each household member.
    - Over two-thirds (79%) of Wellingtonians have a three-day supply of water.
- About two-thirds (63%) have an emergency survival plan.
    - Over three-quarters (79%) of Wellingtonians have a plan.
- For about two-thirds (60%), the main prompt for taking action was either the September 2010 or February 2011 earthquake.
    - Wellington residents are more likely than average to have taken steps to prepare due to the Christchurch earthquakes (81%) than the national average (60%).

Data were also collected on a "preparedness continuum" of 5 overall categories for disaster preparedness: "*unaware," awareness" or have an understanding of the types of disasters that could occur, "understanding" or have a good understanding of the effects if disaster struck, "commitment" or have water and survival items, and "fully prepared"*. 18% indicated "unaware"; 82% "awareness"; 84% "understanding"; 49% "commitment"; and 18% "fully prepared" (MCDEM, 2011b).

2.3.3 Evacuation Preparedness

Evacuation preparedness is a category of readiness with a voluminous body of literature, often drawing upon seminal work in risk perception, risk communication, and social processes (e.g., Kasperson et al. 1988, Slovic, 1987). Research has extensively focused on explaining the characteristics of those who evacuate and the efficacy of warning systems (Drabek, 1969, 1983, 1986, 1992; Kang et al. 2007; Lindell & Perry, 1992; Mileti, 1975; Mileti & Sorenson, 1990; Perry, 1979; Quarantelli, 1980, 1984; Sorensen, 1991; Sorensen & Vogt-Sorensen, 2007; Vogt & Sorensen, 1992).

Personal decision-making is a particularly complex aspect of the evacuation process, which can confound or modify levels of readiness (Mileti & Fitzpatrick, 1992; Sorensen, 2000). Historically, understanding the role of personal-decision making

has largely been focused on advance evacuations for hurricanes and response to flooding watches and warnings, in part because warning systems are well-established for these hazards.

Recent research in Australasia, Hawaii, and the US-Canadian Pacific Northwest has significantly expanded the scope of evacuation research into planning for real-time evacuations from a variety of hazards such as bushfire, floods, tsunami, and volcanic hazards (e.g., Becker et al. 2007a, 2007b; Cole et al. 2005; Davis et al. 2006; Dengler, 2005; Garside et al. 2009; Gregg et al. 2004, 2007; Johnston et al. 2009a, 2009b, 2011; Johnstone & Lence, 2011; Jonientz-Trisler et al. 2005; Leonard et al. 2008a; Paton et al. 2006, 2008; Wood & Soulard, 2008, 2009a, 2009b; Wood et al. 2010, 2011). This research is furthering knowledge on risk perceptions and preparedness actions, socio-demographic vulnerabilities, factors in decision-making, and improving warning systems and responses.

Home evacuation decision-making and population movement research during earthquake disasters is limited, but evolving in New Zealand and western North America. For further information the reader is referred to studies from Chang, 2009, 2010; Lamb & Walton, 2011; Love, 2011; Russell et al. 1995; Walton & Lamb, 2009; and Wright & Johnston, 2010.

2.3.4 Barriers to Preparedness

While the Canterbury earthquakes and the 2011 Japan earthquake and tsunami have changed disaster risk perceptions in New Zealanders toward more realistic levels and are raising readiness, maintaining awareness and preparedness is complicated by uncertainty and a natural human tendency toward unwarranted confidence in the face of unavoidable risk (Slovic, 1987). Numerous studies, including several fielded in New Zealand, have found that converting awareness to action can be confounded by many factors that influence levels of preparedness, such as false optimism, normalisation biases, risk propensity, fatalism, framing effects, and the perceived efficacy of preparations (Finnis, 2004; Lindell & Perry, 2000; Lindell & Whitney, 2000; Lindell et al. 2009; McClure, 2006; McClure et al.

1999, 2001, 2007; McClure & Sibley, 2011; Solberg et al. 2010; Spittal et al. 2005, 2008).

National-level disaster preparedness surveys recently fielded in the USA found low perceived susceptibility to disaster and large gaps between perceived risk and levels of personal preparedness (CEG/ARC, 2007; FEMA, 2009). Further, these studies found a strong need for more emphasis on preparation beyond stockpiling food and water, and a greater appreciation for the importance of household plans. Some of the major psychosocial barriers observed for disaster preparedness were denial, fatalism, perceived efficacy of preparations, and high expectations of assistance from emergency responders. Results from preparedness data collected at the Stages of Change process level (*precontemplation, contemplation, preparation, action, and maintenance*, after Prochaska & DiClemente, 1982, 1983) suggest that focusing interventions on individuals in the contemplation and preparation stages may yield the greatest results for increasing readiness levels (FEMA 2009).

Other universals common to preparedness surveys are that individuals report lack of time, knowledge, and cost as factors that limit their preparedness (e.g., FEMA, 2009; MCDEM, 2011b). Continuing to advocate preparedness and finding effective ways to both motivate and support action thus remain critical components of preventing future disaster.

2.3.5 Community and National Preparedness Campaigns

"The Way Forward" is the strategic framework for the New Zealand disaster public education programme (MCDEM, 2011c). Other nationally-recognised campaigns, such as the aforementioned "Get Ready Get Thru" (MCDEM, 2011a) and the "Public Education Toolbox" (EQC, 2011b; MCDEM, 2011c) encourage citizens to prepare for disasters and protect their property from natural disaster damage. The "What's the Plan Stan?" campaign provides resources for schools to incorporate disaster awareness and preparedness into teaching, school management, and for prompting students and their families to prepare (MCDEM, 2011c).

In Wellington, the “It’s Easy!” campaign also provides emergency preparedness information (Greater Wellington Regional Council, 2011). The Island Bay Tsunami Awareness Project is a community effort involving citizens of a Wellington suburb in identifying and marking evacuations routes and safe locations in the event of a tsunami (WEMO, 2011). Recent exercises and surveys in Wellington primary and intermediate schools have also evaluated and tested preparedness, response and building evacuation skills (Coomer et al. 2008; Johnston et al. 2011; Tarrant & Johnston, 2010).

Key governmental agencies in New Zealand regularly engage in disaster simulation exercises to test operational readiness and response capabilities through the National Exercise Programme (MCDEM, 2011d). Exercise Capital Quake 2006 was a national disaster preparedness exercise involving over 1,000 participants to test New Zealand’s all-of-nation arrangements for responding to a M7.6 earthquake on the Wellington Fault. Capital Quake led to the development of the Wellington Earthquake National Initial Response Plan (Woodley, 2010). At the local and regional level, the Wellington Region Civil Defence Emergency Management Group continues to test operational response to a M7.6 Wellington Fault earthquake through the annual exercise Operation Phoenix Series, observed by this author in November 2008. Another national preparedness exercise, Exercise Shakeout 2009 (“The 2009 West Coast Shakeout”), involved over 8,300 participants and tested local civil defence response to a M8.2 rupture of the Alpine Fault (Coomer et al. 2009). Exercise Shakeout will be conducted again in 2012.

Distant- and regional-source tsunami preparedness exercises have also been held in New Zealand to improve warning and response capability. Exercise Pacific Wave 2006 and Exercise Tangaroa 2010 simulated the national response to distant source tsunami originating from South America. Exercise Pacific Wave 2011 will test a scenario for a destructive regional source tsunami from the New Hebrides Trench near the South Pacific island archipelago of Vanuatu (MCDEM, 2011d).

These and other on-going efforts help identify preparedness gaps and goals for disaster management and research frameworks, which are discussed in detail in the next two sections.

2.4 Disaster Management Frameworks

This section discusses practise frameworks for disaster preparedness and resilience. Civil defence and emergency management organisations are increasingly embracing the concept of prevention through all phases of disaster and conceptualising success as a 'non-event' achieved through resilience. Health service delivery partners – some of whom are charged by law to implement these principles and outcomes – have been working on the operational aspects of how to deliver service resiliently within their organisations, how to build resilience in the populations they serve, and communicating critical needs and information gaps back to the policy makers and the research community.

2.4.1 International and National Protocols for Emergency Management

Organisational theory accounts for how people act and interact within systems and organisations, and what their operational frameworks are. No single unified theory of disaster management exists, and no organisational model completely accounts for all the systems and the responses. Since World War II, however, a shared history of common themes and cross-pollinations can be tracked through the United Nations (UN), the International Federation of Red Cross/Red Crescent Societies (IFRC), the UK and Commonwealth countries, and the United States. Relevant emergency management paradigms are discussed here and reveal an overall progression from event management to prevention, and an increasing focus on the psychosocial dimensions of disaster.

2.4.1.1 Incident Management Paradigms

From WWII through the beginning of the new millennium, emergency management was guided predominately by a civil defence and/or public safety perspective, conducted in what was more or less a 'crisis management' mode. It was task-specific and focused on the organisational aspects of short-term management of the impacts of particular categories of extreme events. Disasters were largely thought of as 'accidents', 'incidents', or *events which could not be anticipated,* resulting in an

orientation towards responding to the immediate needs created by a disaster, rather than preventing or reducing effects (IFRC, 2008).

In the 1970s, however, seasonal disasters such as catastrophic wildfires triggered by the Santa Ana winds in southern California clearly illustrated that at least *some events could be anticipated* – as could recurring response problems due to communication and management deficiencies. This growing awareness – along with the routine presence of loss of life, injury, and property damage in the millions from wildfire at the urban-bush interface – led to the advent of advance planning for emergency management (Auf der Heide, 1989).

Plans were operationalised through the development of an 'incident command system' (ICS) structure under California's Standardised Emergency Management System (SEMS), designed to coordinate the deployment of personnel and resources in response to catastrophic events. In 2003, SEMS was adopted at the national level with the creation of the US National Incident Management System (NIMS). At the same time, all federal, state and local agencies were required to use NIMS to manage emergencies in order to receive federal funding (DHS, 2004a).

ICS is also widely used in Australasia, Canada, and the United Kingdom. Australia adapted ICS into the Australasian Inter-Service Incident Management System (AIIMS), and New Zealand implemented a similar system known as the Coordinated Incident Management System (CIMS). All of these systems involve a highly-structured and hierarchical incident management framework, reflecting their civil defence and public safety roots, and were built around responding to specific events that have already occurred.

Events are still at the hub of emergency management frameworks today, however the strategic design of emergency management plans significant changed with the introduction of the '*all-hazards'* model in the United States (FEMA, 1996). This approach features a pre-event planning perspective that is oriented toward managing disaster response and providing adaptability regardless of the event type (e.g., natural, technological or human-induced). Subsequently, all-hazards models were widely adopted elsewhere and incorporated into emergency management

legislation and practise, especially after the intentional acts of terrorism on September 11, 2001. In New Zealand, all-hazards management was incorporated into law through the adoption of the Civil Defence Emergency Management Act of 2002 ('CDEM Act').

2.4.1.2 Risk Management Paradigms

Toward the end of the last century, emergency management was also being increasingly integrated into a wider '*risk management*' framework, driven by needs for greater organisational integration and for placing emergency management into the context of reducing losses (Britton, 2004). Organisations began conceptualising "*phases of disaster*" or "*stages of the disaster life cycle*" to describe the types of management activities and various stakeholder roles, and for use in planning risk management interventions. In a sense, this represented a shift from a 'crisis management' mode to a 'navigate and mitigate' mode, formalising the importance of pre-event planning.

There is no universally accepted terminology to describe the phases of an incident or event timeline. A fundamental theme of 'preparedness, response and recovery' is used internationally to describe the types of activities or steps that are conducted within corresponding pre-event, within-event, and post-event timeframes. This generic model integrates both the life cycle of disaster and the ways organisations prepare for incidents.

For example, the New Zealand Emergency Management Model is known as "*The 4 R's*" or "*Reduction, Readiness, Recovery and Response*" (MCDEM, 2006). Reduction and readiness comprise two discrete aspects of preparedness in the pre-event context. In the US, these same four phases are known as "*Mitigation, Preparedness, Response, and Recovery*" (DHS, 2004a, 2004b). Similar principles in the New Zealand National Civil Defence Emergency Plan (MCDEM, 2006) and the US National Response Framework (DHS, 2008) build on incident management systems and guide all response partners to prepare for and provide a unified national response to disasters and emergencies through an all-hazards approach.

2.4.1.3 Risk Reduction Paradigms

While even the developed nations are challenged by the scope and complexity of managing disasters, underdeveloped countries are additionally burdened by an internal lack of resources when disaster strikes and by reliance on humanitarian aid for response and recovery. Recognising the social vulnerability of these populations, United Nations initiatives have helped define needs and refine the concept of reducing loss through *'risk reduction'* (exposure management).

This concept was formally advanced in December 1987 through the UN's 42nd General Assembly proclamation of the 1990s as the 'International Decade for Natural Disaster Reduction' (IDNDR). The UN subsequently developed a successor programme called the International Strategy for Disaster Reduction (ISDR) and an administrative paradigm for disaster risk management termed 'disaster risk reduction,' defined as follows (UNISDR, 2004):

> "*The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.*"

Disaster risk reduction (DRR) suggests a systematic approach to identifying, assessing and reducing the risks associated with hazards and human activities, and incorporates a social vulnerability element. In addition to responding to the needs of those vulnerable in humanitarian crises, the IDNDR and the new paradigm of disaster risk reduction have also helped prompt a shift in humanitarian and development work from what was primarily a '*risk-deficit' to a 'strength-asset*' approach. By both necessity and design, disaster risk reduction put attention on what affected communities can do for themselves and how best to strengthen them (IFRC, 2004b).

In 2005, the UN adopted the Hyogo Framework for Action 2005-2015 (UNISDR, 2005). 'The Hyogo Declaration' is the first internationally accepted framework for disaster risk reduction. Together with extensive work in disaster preparedness by

the Pan American Health Organization (PAHO, 2000) and the Asia Disaster Preparedness Centre, these efforts have greatly advanced knowledge on effective approaches to mitigate the effects of disasters and support communities in coping with disaster consequences (IFRC, 2008).

Without abandoning the need and duty to provide service delivery in the 'crisis management' and 'navigate and mitigate' modes, these protocols highlight a progression toward a 'communicate and support' mode that can assist individuals and communities in self-managing disaster risk. Two strategic goals in the Hyogo Framework are focused on risk reduction. The third focuses specifically on building strengths: *"(The) development and strengthening of institutions, mechanisms and capacities to build resilience to hazards*" (UNISDR, 2005). This formal acknowledgement of 'resilience' in the international language of disaster risk reduction reflects the increasing attention that is now paid to the capacity of disaster-affected communities to 'bounce back' or to recover with little to no external assistance following a disaster.

2.4.1.4 Resilience Paradigms

At the national level, resilience is rapidly emerging as an organising concept for disaster management. New Zealand is implementing the Hyogo Framework through the National Civil Defence and Emergency Management Plan's strategic goal of "Resilient New Zealand," where "communities understand and manage their hazards" and "broader policy directions support the sustainable growth and the safety of citizens and communities." (MCDEM, 2011e).

In February 2011 the Council of Australian Governments adopted a National Strategy for Disaster Resilience, to provide a "*whole-of-nation resilience-based approach to disaster management*," deliver sustained behavioural change for preparedness and support enduring partnerships to meet the needs of local communities (COAG, 2011). Supporting this strategy, the Australia's Natural Disaster Resilience Program (NDRP) is a grant-funding scheme for building partnerships across governments, communities, business and individuals for disaster resilience (EMA, 2010; SES, 2010).

These governmental strategies follow many calls for a paradigm shift in emergency management towards identifying resilience as the core concept. For example, Kahn et al. (2009) presented an 'operational framework for resilience' as a basis for incorporating resilience into infrastructure and society to enhance public safety, and defined resilience as an outcome or 'end state' that needs to be planned in advance through the establishment of 'resilience profiles' for key functions within critical systems.

Reviews by Luthar et al. (2000) and Manyena (2006) note that the meaning of 'resilience' varies widely in academic research and emergency management communities. Kaplan (1999) suggested this lack of agreement may stem from resilience being generally defined on the one hand as an outcome(s), and on the other as a process leading to a desired outcome(s). Manyena (2006. p. 438) prudently suggests resilience may be a bit of both, where "*disaster resilience is seen as a quality, characteristic or result that is generated or developed by the processes that foster or promote it*." While theoretical and working definitions of 'resilience' remain under debate, consensus continues to build on the importance of gaining strength despite adversity (Almedom, 2008; Almedom & Tumwine, 2008; Christensen, 2008) and the importance of making preparedness central to emergency management and practise frameworks.

2.4.1.5 Prevention Paradigms

In 2005, the same year that the Hyogo Framework placed international emphasis on disaster risk reduction and disaster resilience, Pelfrey (2005) conceptualised a 'Cycle of Preparedness' as a strategic framework for governmental and non-governmental entities to prepare for natural and intentional disasters. He argued that the cycle of preparedness involves preparing in stages, but independent of a chronological timeline. He describes preparedness as an on-going, multidimensional process, operationalised simultaneously over the domains of prevention, awareness, response and recovery. The core component of the cycle of preparedness is the concept of prevention.

Prevention-based ‘preparedness’ is specifically a process that is never declared or finished. Unlike historical conceptions of an incident-centric disaster lifecycle that starts with an event and reaches an end-state, Pelfrey’s (2005) model is a cycle of adaptability, leading to an outcome that is, essentially, a *non*-event.

Pelfrey’s (2005) prevention paradigm is a synthesis of existing management models and an extension of those models. Prevention is defined as “*a process of identifying risks associated with events most likely to affect the security, safety and well-being of the community and eliminating or mitigating those risks.*” Preparedness is the capability (or the ability to “*ready the resources”*) that can be drawn on to prevent, recognise, respond and recover from event consequences at any event stage. Prevention is the ‘first priority’ of the US National Strategy for Homeland Security (HSC, 2007), and the US National Response Framework (DHS, 2008) identifies domains of prevention, preparedness, response, and recovery.

There are strong parallels in Pelfrey’s prevention paradigm to risk reduction and resilience paradigms. Perhaps even stronger is the conceptual bridge to the health sciences. Pelfrey (2005) proposed that the health sciences come closest to serving as a metaphor for the ‘Cycle of Preparedness,’ where prevention is not and cannot be considered only in dichotomous terms.

The etiological meaning of prevention (*eventus (latin):* occurrence; *even (ire):* to happen) is the act of keeping from happening. Yet the success of preventive health approaches are not measured by the complete absence of adverse health events in life. The aim instead is to reduce the likelihood or the harm of those events. Further, even though clinicians still spend most of their time diagnosing and treating rather than preventing disease, health sciences research efforts over the last two decades have increasingly aimed at finding ways to prevent illness, increase quality of life, and promote health.

In health systems, prevention is relevant at any stage of an adverse health event. The strategic objectives of disease prevention are pursued at primary, secondary or tertiary levels as described in models of epidemiology, public health, and preventive health care. Primary prevention avoids the development of adverse health outcomes

by removing its causes (Fletcher et al. 1996). Health behaviour is a cornerstone of primary health prevention (Kasl & Cobb, 1966); it is often accomplished outside the health care system at the community level through promotion of positive health-related behaviours. Secondary prevention focuses on preventing progression of illness and tertiary prevention refers to activities that reduce complications (Fletcher et al. 1996).

Irons (2008) adapts Pelfrey's cycle of prevention into a 'Prevention Cube' model, using categories drawn from the medical model of 'disease prevention,' to advance a paradigm of 'terrorism prevention.' The 'Prevention Cube' is a heuristic device and visual aid to analyse the way prevention principles inform risk management and enable pre-emption of terrorism threats; it has been used in terrorism preparedness exercises in Australia, the UK and the USA.

The Prevention Cube exemplifies how key variables interrelate without an exact start or finish and how the process is cyclical rather than linear. Intervention can take place in multiple modes to reduce risk: 1) Primary mode: specific threats are unknown but a threat capability, or vulnerability, is recognised; 2) Secondary mode: a specific threat is recognised but no immediate threat exists; and 3) Tertiary mode: an intervention is needed to reduce, or pre-empt, a threat that poses a clear-and-present danger (Irons, 2008). Since the prevention process involves cycling through multiple instances of assessing risks and considering decision-making opportunities, the Prevention Cube forms more of a systems conceptualisation of risk management, rather than more traditional hierarchical frameworks.

Baldwin, Irons & Palin (2008) initially applied the Prevention Cube as a method of catastrophe preparation for law enforcement and fire-fighters. The authors also note the utility of the Prevention Cube as a 'thinking tool' for interventions against natural and accidental threats. Although not described as a 'preventive paradigm,' the Australian Natural Disaster Resilience Grant Scheme guidelines (SES, 2010) echo the theme of pursuing prevention and processes (rather than outcomes) as the central organising principle for risk management:

"Conceptually, disaster resilience is developed and enhanced through prevention, mitigation and preparedness activities and has its effect on outcomes during and after response and recovery operations. In this sense, resilient communities are built through a cycle of understanding risks and reducing exposure and vulnerabilities; preparing and building capability and capacity to respond; and learning, innovating and adapting for future risks."

Emergency responders, law enforcement, and health professionals engage in prevention activities every day, in the absence of incidents. Pre-event planning for natural hazards in land use contexts, through principles of sustainability, also provides an opportunity to prevent disaster at the community level before disaster strikes (Glavovic, 2010). Granted, crime, fire, disease, and disaster will keep happening. Nonetheless, by engaging in prevention activities every day – in the absence of incidents – success can be routinely achieved by turning potential events into non-events. These examples point toward an emergent paradigm of 'disaster prevention' – similar to trends towards 'disease prevention' and 'terrorism prevention' – where developing and maintaining positive adaptive strategies can lead to healthy outcomes in the face of intense adversity.

2.4.2 Health Emergency Practise Frameworks

Health systems are the framework for delivering services provided for the purpose of promoting, maintaining, monitoring or restoring physical or mental health. Health systems are generally divided into patient-oriented and community-oriented (public) health services. Following a brief introduction below, the focus of this discussion will be principally on the nature and practise of public health emergency services, in keeping in scope with the thesis topic.

2.4.2.1 Service Delivery Frameworks

Patient-oriented health services are delivered in multiple health care environments, generally known as primary care (general practitioner's office), specialty care (clinical setting), and critical care (hospital facilities). The corresponding 'treatment mode' (or

'model of care') is known as primary, secondary, or tertiary, respectively. Community-oriented (public) health services are generally delivered in public health facilities or in the field. In addition to screening and treatment, public health services may also include population-based epidemiological assessments and community interventions.

In the disaster context, health service delivery takes place in every health care environment. It may correspond to the usual practise environment under non-disaster conditions (e.g., disaster medicine is largely practised in the critical care environment; disaster behavioural health is addressed in the specialty/clinical setting, especially in the recovery period; and disaster public health is practised in the community). Any of these health services, however, may be conducted in the field during a disaster and post-disaster. This is particularly true for disaster epidemiologists and public health responders. Public health practitioners are also most likely to be working in the community during the pre-event phase to characterise risk or communicate health-protective strategies.

Public health planning for disaster preparedness, response and recovery has followed a similar path to that of civil defence and emergency management; in some cases public health has led the way with new conceptualisations for disaster prevention. The following three sections summarise findings from a review of relevant literature on health emergency management frameworks and discuss emerging psychosocial trends.

2.4.2.1.1 The 1990s and the International Decade for Natural Disaster Reduction

Throughout the 1990's, important contributions by Noji (Noji, 1992, 1994, 1997; Noji & Toole, 1997) characterised the public health consequences of disaster and chronicled the history and development of health emergency management and service delivery. Other important papers were also published emphasizing the critical role of the health sector within the IDNDR context (introduced in Section 2.4.1.3), and identifying needs for 'capacity-building' within health systems for improving incident response and integrating prevention programmes (Freedy &

Simpson, 2007; Freedy, Resnick, & Kilpatrick, 1992; Lechat, 1993-1994; Logue, 1996; Waeckerle, 1991).

The primary focus of disaster medicine has historically been on the response capability and roles of the medical community for the immediate care of the injured during mass-casualty incidents. As noted earlier in this chapter, disasters typically trigger the need for triage and stabilisation of casualties in the critical care or hospital environment. Waeckerle (1991) summarised many variables that contribute to the potential for traumatic injury during disaster (e.g., community resources, medical resources, community disaster plans, advance warning, population distribution and characteristics, timing, weather, geographic location, other environmental and structural factors); these variables are used in making estimations of not only the number but also the types (i.e., surgical vs. medical) of casualties.

Clinical and public health roles were also raised by Waeckerle (1991) to highlight the importance of post-disaster environmental health needs assessments for physical survival and mental health care for psychosocial recovery – for both disaster responders and survivors. Following the advancement of a conceptual framework for disaster mental health clinical interventions (Freedy et al. 1992), Lechat (1993-1994) observed a shift in the overall public health approach to disasters from 'post-disaster improvisation to pre-disaster planning', and also the emergence of a professional consensus described as a "*strong feeling that one should be able to prevent or mitigate the human consequences through improved preparedness*."

Lechat (1993-1994) also noted that epidemiology is an essential tool to study the health effects of disasters at each phase of the disaster process, and argued that disaster preparedness "*should be part and parcel of primary health care in disaster-prone areas*." Logue (1996) affirmed that a prevention approach should be a priority of epidemiology and related fields. Logue (1996) further noted that although rapid epidemiological assessments – such as those conducted by the World Health Organization (WHO), US Centers for Disease Control (CDC) and disaster relief agencies – had been providing surveillance data on natural disaster mortality and morbidity for the medical disaster response model for many years, gaps existed in response capacity for meeting both environmental health needs (e.g., clean water,

sanitation, shelter/housing) and for supporting mental health services following disasters.

These gaps continue to persist. For example, infectious diseases can occur when there is an interruption of lifeline services due to destruction of the local infrastructure. Consensus has emerged that the risk of infectious disease outbreaks following disasters is much lower than typically construed (the current Haiti cholera epidemic notwithstanding), but it remains crucial that infectious issues are taken into account for the potential risk that they pose, particularly for displaced populations (Floret et al. 2006; Mayer, 2007; Murthy & Christian, 2010; NAS, 2007; Watson et al. 2007).

In the case of mental health services, many authors (e.g., Young et al. 1998) have pointed out that the mission of disaster mental health is, to a certain extent, a reverse from the regular charge of mental health programmes. Disaster mental health is primarily directed toward addressing 'normal reactions to abnormal situations' and identifying persons at risk for severe impairment in functioning due to psychological or psychosocial trauma. Most of this work must take place in non-clinical settings (e.g., shelters, schools, community centres, disaster welfare centres) and is provided by relief, social service and public health agencies. Providing mental health service delivery under these unusual and demanding situations and in potentially unfamiliar environments thus requires advance planning, additional resources and support.

O'Sullivan (1997) identified early gaps of this nature in New Zealand disaster mental health care through a literature review. She concluded that New Zealand health emergency management in the 1990's was directed toward the surgical, physical and medical needs of casualties, despite an expectation that all services would respond in a disaster (including mental health).

2.4.2.1.2 The 2000s and the Psychosocial Footprint of 9/11

The underdeveloped capacity in the type, focus and environments of disaster mental health care service – along with the imperative to develop organisational frameworks

centred on prevention – acquired greater urgency on September 11, 2001, when terrorists assaulted the world with a horrendous example of a disaster intentionally designed to create mass trauma. Mental health preparedness was solidified as a critical element of the disaster management almost overnight.

While deliberately seeking terror and trauma, the intentional disaster of 9/11 actually reinforced prevention concepts that were already evolving for health systems practitioners and have since strongly influenced the development of disaster health management paradigms around the world. Further, the emergency rooms that were largely empty of physical casualties on 9/11, along with the limited extent of physical co-morbidities (with the notable exception of the World Trade Center attacks, where longitudinal studies are tracking the health impacts of airborne dust (e.g., Plumlee, 2009)), turned attention toward the 'walking wounded' survivors and responders.

Since 9/11 and up to the present day, frameworks for health emergency planning and practise have been charged with preparing effective responses to the psychosocial consequences following disasters of every type and cause. Strategic plans also frequently refer to the cultivation and promotion of 'psychosocial resilience' at the individual and community level during pre-event, within-event, and post-event phases, and increasingly call for the synthesis of both health emergency practise and preventive health/health maintenance activities.

For example, the current US National Health Security Strategy (DHHS, 2009a) is the first comprehensive security strategy focusing specifically on emergency public health and resilience. It defines national health security as "*a state in which the Nation and its people are prepared for, protected from and resilient in the face of health threats or incidents with potentially negative health consequences*" (DHHS, 2009a, pg. 3). The NHSS is built on "*a foundation of community resilience – healthy individuals, families, and communities with access to health care and with the knowledge and resources to know what to do to care for themselves and others in both routine and emergency situations.*" (DHHS, 2009a, p. i).

2.4.2.1.2 Current Protocols for Disaster Health Service Delivery

In the international disaster assistance communities, building programmes and activities at the grass-roots or field level is strongly advocated for dealing with complex emergencies (IFRC, 2008). The current edition of the International Red Cross/Red Crescent Societies Public Health Guide in Emergencies (IFRC, 2008) emphasises strengthening the capacities of individuals and organisations providing assistance to "reduce the risks and vulnerabilities of populations to events which cannot always be prevented" through "careful application of public health knowledge." The focus is on building the capacity for resilience in aid workers, but also includes post-disaster interventions for populations at-risk.

U.S. disaster mental health frameworks are built on a series of milestones that started with a post-9/11 workshop by the National Institute of Mental Health in October 2001. Convened with 58 disaster mental health experts from six countries, the workshop led to a consensus report which provided an evidence base for best practises in psychosocial interventions (NIMH, 2002). The next year the U.S. National Library of Medicine published a "Resource Guide for Public Health Preparedness" (NLM, 2010), providing web-based access to expert guidelines, factsheets, websites, research reports, articles and other tools aimed at the public health community. The following year the U.S. Mental Health All-Hazards Disaster Planning Guidance was published (DHHS, 2003) as a resource for directions, support, and considerations in the planning process for all-hazards response plans.

DHHS Disaster Planning Guidance authors also contributed to the development and implementation of an all-hazards disaster behavioural health programme (Shultz et al. 2005) for building psychosocial resilience in the health sector throughout the US. Like the IFRC practise framework, these programmes focus first on capacity-building within service providers but also provide best practises for individual and community-based interventions. The current interim implementation guide for the new National Health Security Strategy (DHHS, 2009b) establishes multi-disciplinary objectives that could unify preparedness programmes to build resilience and ensure prevention or mitigation of emerging threats to health.

In Canada, a psychosocial risk assessment and management ("PRAM") framework for post-event interventions is under development and testing (Lemyre et al. 2005, 2010). Designed to limit negative psychosocial impacts and promote resilience and adaptive responses to chemical, biological, radiological, and nuclear events, the authors also advocate the applicability of the PRAM framework as an integral part of all-hazards emergency preparedness. The proposed outcome is to train and enhance the capability of key responders in Canada to mitigate the psychosocial impacts of terrorist threats and attacks. Lemyre's framework also models the interaction between the individual, community and society, with characteristics of the event as mediators of the psychosocial response. Resilience is facilitated by the presence of protective factors at each population level "that serve to mitigate the impacts of adversity and strengthen community capacity to deal with existing and future events" (Lemyre et al. 2005, p. 319).

In New Zealand, a major shift in the health sector role – from hospital-based emergency planning to community-focused planning – took place under the Civil Defence and Emergency Management (CDEM) Act of 2002. Responsibilities for the health response were placed under the umbrella of District Health Boards (DHBs), working as part of regional CDEM Groups. For example, three DHBs operate in the Wellington Region (Capital & Coast, Hutt Valley, and Wairarapa) and are part of the Wellington Regional CDEM Group. The current National Health Emergency Plan (MOH, 2008a) provides the strategic guidance to DHBs and CDEM Groups on planning for individual and community recovery in an emergency event.

The main focus of the National Health Emergency Plan is on the response and recovery phases of an emergency event. However, the Plan describes operationalising psychosocial recovery principles in the pre-event or 'readiness' phase. Guidelines for the Plan outline "*the importance of psychosocial recovery when planning how to respond to and recover from an emergency event*" (MOH, 2007, pg. vi). They describe the process of psychosocial recovery as "*easing the physical and psychological difficulties for individuals, families/whanau and communities, as well as building and bolstering social and psychological wellbeing*" (MOH, 2007, pg. vi). They further note, "*psychosocial recovery in the field of emergency management begins at the level of prevention through risk reduction*"

(MOH, 2007, pg. 3) and "*a key principle in prevention (the readiness phase) is for communities to prepare effectively in advance of an emergency event*" (MOH, 2007, pg. 11).

The Wellington Regional CDEM Group Recovery Plan (2008-2011), also reflects a resilience theme in its title ("*Together Wellington Regional Communities are Resilient*") and substance, through definition of social recovery as "*the restoration of material and emotional needs of individuals and groups within the community: ongoing welfare requirements, health and physiological issues, psychological impacts and stress management.*" (§26.1).

Another significant shift in disaster mental health organisational frameworks arose in 2009, when the United Kingdom Department of Health released a new vision document ("New Horizons") for emergency planning and mental health services (NHS, 2009a). Consistent with common principles and recommendations from the NATO Joint Medical Committee and the EU European Network for Traumatic Stress (summarised in Williams et al. 2009), and the Inter-Agency Standing Committee Guidelines on Mental Health and Psychosocial Support in Emergency Settings (IASC, 2008), New Horizons specifically focused on the needs of people being served (NHS, 2009a). It sought to continue the transformation of existing specialist mental health services and to create a public mental health framework that builds personal psychosocial resilience and the collective psychosocial resilience of families and communities. These concepts are presented as two important overarching themes for disaster mental health practise (NHS, 2009a; NHS, 2009b):

> 1) Prevention and Mental Health – recognising the need to prevent, as well as treat, mental health problems and to promote mental health and well-being through public mental health.
>
> 2) Personalised Care – ensuring that care is based on the individual person's needs and wishes, leading to recovery.

In February 2011, New Horizons was superseded by "*No Health without Mental Health: A cross-governmental mental health outcomes strategy for people of all*

ages" (NHS, 2011). This plan presents a Public Health Outcomes Framework "*to improve and protect the nation's health and wellbeing and to improve the health of the poorest, fastest*" and proposes a number of national-level indicators. Domain 1 is "*Health protection and resilience: Protecting the population's health from major emergencies and remaining resilient to harm*." (NHS, 2011, pg 70).

The next section of this chapter provides an overview of research frameworks for disaster resilience**.** Around the world, researchers from various perspectives – physical, social, biomedical, and health scientists – are working to provide guidance to emergency managers, health service practitioners, and educators about how to develop and maintain resilience.

A strong evidence base is needed for decision-making and intervention at several levels: to better define human vulnerability factors within the disaster riskscape; to understand what processes predict, create, or promote resilience as both a process and outcome; and to be able to measure and build resilience. Scientific understanding on these subjects is described in the following pages.

2.5 Disaster Research Frameworks

Providing evidence-based recommendations to practitioners and managers on how to navigate the broad terrain between an event, intervention, and prevention – and how to best define and generate personal preparedness or 'resilience' that can lead to successful disaster recovery – is an enormous challenge for disaster researchers. The plethora of conceptualisations and definitions of resilience, supporting background theories, and the many associated constructs make it difficult for the disaster research community to speak as one voice. Yet there is a common desire to examine the evidence on approaches to characterizing risk and generating and maintaining health. In addition, the direction and synthesis of research agendas for disaster behavioural health is clearly moving from an illness to a wellness paradigm, and expanding from a predominantly cognitive-behavioural focus to include the subjective perspective through the affective domain.

2.5.1 Overview

Disaster research is an increasingly interdisciplinary field of study that describes both individual and community reactions to events, explores a wide variety of associations between responses and behaviours that affect coping with disasters and their aftermath, and suggests responses to enhance coping. Epidemiologists, medical geologists, and health geographers are frequently involved in describing the incidence, prevalence, determinants, and patterns of morbidity and mortality; sociologists examine social vulnerability and coping resources; psychologists explore reasons for stress reactions and behaviours; and risk communicators and health educators try to develop the best messages to address all of these interactions and effects.

In disaster risk factor studies, impacts are generally measured as psychosocial outcomes, such as fear/distress, maladaptive behaviour change, and illness affecting the functionality of individuals, communities, and organisations. Protective factor studies examine optimal, healthy human functioning during and after extreme events, despite the presence of event-specific stressors.

Prominent theoretical conceptualisations of disaster risk and resilience are discussed here. Section 2.6 then discusses the theoretical conceptualisation of this study.

2.5.1.1 Vulnerability Paradigms

Research continues to build on previous work compiled over the last two decades to identify psychosocial risk factors, vulnerabilities and needs of populations in the disaster context. Disaster vulnerability science looks at how functional and demographic determinants of psychosocial risk (e.g., gender, age, culture, ethnicity, socioeconomic status, family factors, predisaster functioning, experience, personality and environmental exposure), can interact to produce diverse health outcomes following disaster (e.g., Norris, 2006a, 2006b; Norris et al. 2002a, 2002b).

There are various methods for estimating, characterizing and comparing populations at-risk and for understanding the determinants of psychosocial vulnerability. Descriptive epidemiological surveillance needs assessments, and risk factor studies are important tools. Freedy, Kilpatrick, and Resnick (1993) were among the first to develop a risk-factor model for natural disasters that included determinants of both psychological and social vulnerability. Since then, significant work has been done in disaster epidemiology, geography, and demography to characterise patterns of risk factors (e.g., distributions of personal attributes that predispose populations to adverse health outcomes) and also the geographic distribution of resources in exposed populations (e.g., Norris et al. 2002a, 2002b; Norris 2006a, 2006b, Lindsay 2007, NAS 2007, Wood & Soulard, 2008).

While these types of epidemiological studies are making progress on the distribution of "*who is vulnerable*" to adverse impacts in the human riskscape of disaster, it is has been more difficult to precisely say "*why*." Many factors play a role in determining the reasons for psychosocial vulnerability. Kaniasty, Norris & Murrell (1990) observed that expectations of social support were overly-optimistic prior to disaster exposure, and the subsequent unmet expectations following exposure were associated with declines in perceptions of future support and social participation. Myers (1994) found that difficulties experienced by disaster survivors are usually

stress-induced symptoms precipitated by countless practical problems of daily living they encounter, rather than manifestations of pre-existing psychological vulnerabilities. In a pre- and post-disaster longitudinal study, Hutton (2001) also reported that a person's response is often more reflective of the hardships encountered during recovery and rebuilding. Dealing with extensive bureaucratic processes, loss of job, loss of community status, or a changed sociocultural community are all experiences that may occur following a disaster and may actually be more significant, over time, than an individual's exposure to the disaster agent itself (Flynn, 1999). These issues can be heightened when populations are displaced.

The complexity of attributing specific psychological or public health problems to various factors is compounded by the wide variety of survey instruments that have been used to describe, explain and assess individual outcomes following a disaster: the use of diverse sets of instruments makes it difficult to judge which emotional reactions to a disaster may be considered normal and transitory, and which are pathological and require intervention (Shrubsole, 1999). More recent syntheses (Norris, 2005; Kessler et al. 2008) on patterns and correlates of post-disaster psychopathology in populations have also found them hampered by inconsistencies in both study design and measures.

Definitive approaches for how to identify vulnerable populations and the reasons for vulnerability can be further confounded by the different models, measures or conceptualisations that are applied to describe "successful recovery" (Mileti, 1999). Therefore, methodological development continues to remain extremely important in vulnerability research at both descriptive and strategic levels (Kessler et al. 2008; Allen & Katz, 2009). This work is critical for developing a stronger evidence base of reliable approaches for generating valid and generalisable results, and anticipating special needs for eliminating health disparities.

Disaster risk factor studies also prompted a corresponding interest in protective factor studies, exemplified by Tedeschi and Calhoun (1995), in identifying strengths in both attitude and action that can lay the optimal groundwork for post-traumatic

growth. Research into disaster-resilient processes and outcomes are discussed next.

2.5.1.2 Resilience Paradigms

Disasters, despite being "*bad events writ large*" (Bonanno et al. 2010), can be growth experiences. Accordingly, a comprehensive understanding of disaster impacts requires considering both negative and positive outcomes. Psychosocial resilience is a process for the attainment of positive outcomes, facilitated by the presence of protective factors that mitigate the impacts of adversity and strengthen capacity to deal with existing and future events (e.g., Hobfoll, 2001; Rutter, 1985).

A 'resilience' perspective broadens the focus of the risk assessment process in disaster management from simply examining vulnerabilities, needs, and impacts to one that includes assets, resources, and capacities for recovery from the individual to the community level (Christensen, 2008; IFRC, 2004b). Disaster resilience is thus a fundamentally asset- or strengths-based conceptualisation, rather than deficit- or risk-based.

Most disaster resilience models are drawn from the field of cognitive psychology. These models are typically based on stress-coping ('threat-get') theory (Lazarus, 1966; Hobfoll, 1989) or social-cognitive ('think-do') theory (Rotter, 1966; Bandura, 1977, 1997), paired with behaviour change theory (e.g., Ajzen, 1991) to promote post-traumatic growth.

Researchers in psychotraumatology (e.g., Tedeschi and Calhoun, 1995; Calhoun and Tedeschi, 2000; Tedeschi and Calhoun, 2004) firmly established the phenomenon of post-traumatic growth, defining it as "*positive psychological change experienced as a result of the struggle with highly challenging life circumstances*."

Studies focused on protective personal characteristics and positive changes are now prominent in disaster resilience research. For example, application of the Conservation of Resources stress model (Hobfoll, 1989) in post-disaster contexts found positive effects such as increased self-esteem and self-control (Sattler et al.

1995, 2000). The Johns Hopkins model of human resilience (Kaminsky, et al. 2006) also focuses on personality factors in pre-event disaster planning. The model seeks to proactively build resistance or immunity to distress and dysfunction, enhance resilience, and lay the groundwork for facilitating recovery for adaptive functioning in psychotherapeutic populations through constructs such as hardiness (Kobasa, 1979; Kobasa et al. 1982).

Social-cognitive theory (Bandura, 1977, 1997) further influenced psychosocial models of disaster resilience that explore relationships between personality factors (e.g., self-efficacy, outcome expectancy, coping style) and the development of preparedness intentions and actions (Paton, Smith & Violanti, 2000; Paton et al. 2006). External factors such as collective efficacy and social support, and normative beliefs such as trust and empowerment, are also considered at the community and institutional level. The Warning and Response Model (Lindell & Perry, 1992; Perry & Muskhatel, 1984) further suggests that cognitive variables, such as perceptions of threat, can affect whether protective actions are taken for earthquake preparedness.

Other cognitive variables examined empirically in disaster behavioural health studies include internal locus of control (Rotter, 1966; Wallston et al. 1976); expectancy and realistic preparation (Hobfoll & Jackson, 1991; Seligman et al. 1995); mastery (Perlin & Schooler, 1978); and positive cognitions (Everly & Lating, 2002; Ehlers & Clark, 2003). Discussion of these cognitive variables is beyond the scope of this study, but they are noted here for potential interest to the reader.

While achieving post-traumatic growth as both a process and outcome remains of great interest, how to do this at the individual level – and especially at the population level – is not well understood. Cognitive processes are undoubtedly important, yet a recent review of multivariate studies on disaster risk and resilience factors indicates that there is no one single dominant psychosocial predictor of disaster outcome, and that most predictor variables exert small to moderate effect sizes (Bonanno et al. 2010). The combination or additive total of risk and resilience factors does appear to influence disaster outcomes, yet consistent with the Conservation of Resources model (Hobfoll, 1989), many of the predictors are likely to fluctuate over time with changes in the availability of resources or life circumstances.

Therefore, both a 'resilient' process and outcome can be highly contextual, reflecting how the challenges of disaster are conceptualised and success is defined by the individual. This context may be best measured through the subjective assessment of the disaster survivor.

2.5.1.3 Well-Being Paradigms

Resilience models in positive psychology emphasise the importance of the affective domain, by focusing on subjective well-being ('feel-do'), meaning ('believe-do') and motivation ('want-do') for behaviour change (e.g., Diener et al. 1985; Antonovsky, 1987; Deci & Ryan, 1985, 1991, 2000; Pavot & Diener, 1993, 2008; Ryff & Singer, 1998; Seligman & Csikszentmihalyi, 2000). Well-being studies are relatively new and few in the disaster context.

Seminal work by Seligman and Csikszentmihalyi (2000), who argued that "*psychology is not just the study of pathology, weakness, and damage; it is also the study of strength and virtue*", became the foundation of what is generally referred to as positive or strengths-based psychology. This was reinforced by Duckworth et al. (2005, page 261) with their discussion of assessment tools for a "*build-what's strong*" approach to supplement the traditional "*fix-what's-wrong*" modality frequently found in therapeutic settings. Folkman's (1997) findings on the importance of positive psychological states in coping with severe stress further advanced the idea that interventions should not only reduce suffering, but also enhance the quality of life, and that the subjective perspective is core to understanding resilient processes and outcomes.

These developments contributed to the integration of the affective domain and self-perceived measures of well-being into post-disaster resilience research. To-date, this has transpired largely through applying the construct of life satisfaction (after Diener, 1985; Diener et al. 1991; Pavot & Diener, 1993, 2008), and through the use of health-related quality of life measures in post-disaster settings.

For example, the relationship between health-related quality of life and social support was studied on survivors of the 2008 Wenchuan, Sichuan, China earthquake (Ke, et al. 2010). Life satisfaction was an affective construct included in a post-disaster study of resilience among survivors of the 1999 earthquake in western Turkey (Karairmak, 2007). The relationships between affect, well-being and decision-making behaviour were examined following the 2004 South Asian tsunami disaster, to better understand how to counteract the "psychological ripples" of disaster present even in a non-exposed, remote population (Vastfjall, Peters & Slovic, 2008).

2.5.1.3.1 Meaning Paradigms

A subdomain of well-being, meaning in life or meaningfulness, has also emerged as an important construct in resilience research (Ryff & Singer, 1998; Ryff, 1989; Keyes, 2002; King et al, 2006; Steger et al. 2006; Hobfoll et al. 2007, 2009). Hobfoll et al. (2007) observed that in survivors of terrorism exposure in New York City and Israel, post-traumatic growth (PTG) cognitions don't always lead to healthy outcomes: those that fail to integrate personal meaning can show negative adaptations, while those who integrate meaning turn beliefs into actions and experience a protective effect of PTG.

Hobfoll et al. (2007) further cite literature reviews (Linley & Joseph, 2004; Joseph & Linley, 2005; Zoellner & Maercker, 2006) that find no consistent trend for post-traumatic growth due to cognitive factors, suggesting that growth must be related to other factors, and state "*we believe there is good evidence that the cognitive emphasis of the first generation of research on PTG leads to poor outcomes and misleading conclusions about PTG's benefit*."

Thus, Hobfoll et al. (2007) conceptualise true PTG not simply as a cognitive process, but as 'salutogenesis' through meaning-making (Frankl, 1963, 1975, 1984; Antonovsky, 1987) and self-determined action-focused growth (Deci & Ryan, 1985, 1991, 2000). This is also consistent with findings that meaning is a positive variable of subjective well-being and robust indicator of healthy human functioning (Steger, 2007). Stated simply, doing what is meaningful leads to resilience.

The above-referenced works are also in parallel with numerous other theories of human developmental psychology, which focus on stages of growth. For example, they show strong consistency with constructs from humanistic and transpersonal psychology such as self-actualisation (Maslow, 1943, 1968, 1970); self-concept and unconditional positive regard (Rogers, 1959, 1961); self-esteem (Rosenberg, 1965; Robins et al. 2001); self-transcendence (Cloninger et al., 1993); and suprameaning (Frankl, 1975). Under these paradigms, humans are motivated to go beyond the scope of basic needs and find meaning as a critical component of their personal health and well-being.

2.5.1.3.1.1 Salutogenesis Theory

The capacity for the transformation of traumatic experience into resilience was studied in Holocaust survivors by Antonovsky (1979, 1987) and led to the development of his conceptualisation of salutogenesis theory. Salutogenesis (Antonovsky, 1987) is a strengths-based approach to studying the origins of health (*genesis* = origin, *saluto* = health) and directly incorporates meaning into a model of health and well-being.

Antonovsky's perspective as a medical sociologist took him beyond the traditional medical question of *"Why do people get sick?"* to address the more positive question of *"How do people stay healthy?"* In salutogenesis, health and disease processes are considered on a continuum between "dis-ease" and "ease." Salutary or health-promoting factors assist an individual to maintain physical and psychological well-being in the face of stressors. In Antonovsky's assets-based model, the attitude of positive life orientation is a key strategy used to optimise existing and potential strengths or "*generalised resistance resources*" for preservation of health and active adaptation to change. Orientation to life is operationalised through the Sense of Coherence (SOC) construct (Antonovsky, 1987, 1993), a dispositional "*way of seeing the world*" through three core components of comprehensibility, manageability, and meaningfulness (Antonovsky, 1987, pg. 16-19):

> *"The Sense of Coherence is a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence*

that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable, and explicable (comprehensible); (2) the resources are available to one to meet the demands posed by these stimuli (manageable); and (3) these demands are challenges, worthy of investment and engagement (meaningful)."

This attitudinal perspective has led some researchers to examine whether SOC is a unidimensional measure of a coping disposition or a global measure of well-being (Sullivan, 1993; Cederblad & Hansson, 1996; Sammallahti et al. 1996; Pallant & Lae, 2002; Eriksson & Lindstrom, 2006; Steger, 2007). The intent and conclusion of the model's developer was as follows:

"It does not refer to a specific type of coping strategy, but to factors which, cross-culturally, always are the basis for successful coping with stressors. Sense of Coherence thus represents "positive life orientation" that underlies the development of coping strategies and is a possible change predictor. It is hypothesised to be a significant predictor or determinant of location and movement on the health continuum and a vital ingredient in the domain of resilience (Antonovsky & Sagy, 1986; Antonovsky, 1996).

SOC is strongly correlated (r = .43 to .53) with both cognitive and affective indicators of psychological well-being including life satisfaction, optimism, and positive and negative affect (Pallant & Lae, 2002). Research by Almedom (2005) determined that the sense of coherence construct is inclusive of several related concepts of resilience (e.g., hardiness, after Kobasa, 1979; PTG, after Tedeschi & Calhoun, 1995; self-efficacy, after Bandura, 1977; resilience, after Rutter, 1985). SOC is also structurally validated as a reliable measure of health-related quality of life (Eriksson & Lindstrom, 2005, 2006). Both arguments can thus be reasonably made.

Regardless of viewpoint, salutogenesis differs significantly in concept, measurement and timing from the deficits-based pathogenic paradigm found in the traditional biomedical model, which establishes a dichotomy between healthy and sick individuals; focuses on risk factors, abnormality, maladjustment, dysfunction, disorder, and disease; and is often remedial or reactive to symptoms (Maddux et al.

2004; Strumpfer et al. 1998). It also represents a departure from wholly cognitive-based models of resilience, by integrating the affective domain and viewing health as a dynamic state of well-being facilitated through the development and use of health management resources.

Significantly, resilience can emerge despite the presence of PTSD – the most vulnerable can be the most resilient – in the presence of meaning (Almedom & Glandon, 2007; Almedom & Tumwine, 2008). Although resilience can and is often measured through pathogenic-based assessments of PTSD (e.g., Bonanno et al. 2006), SOC may better incorporate meaning and give a fuller understanding of the complexity of resilience. Almedom & Glandon (2007) note that the SOC construct operationalises "*a dynamic steady state that cannot be measured in isolation from its context of generalised resistance resources, including social support. Meaning making is an integral part of human nature and the capacity to overcome adversity, and only the SOC scale accounts for it in quantitative terms*" (Almedom & Glandon, 2007, page 140). In the disaster context, SOC has been found to be inversely correlated with prolonged displacement and cumulative exposure to war, civil distress, and forced displacement due to internal conflict (e.g., Almedom et al 2005; Almedom, 2011; Pham et al. 2010), and with hurricane evacuation and maritime accidental disaster (Almedom, 2011; Eriksson & Lundin, 1996). However, higher SOC scores were observed in those who had returned to their homes compared to those who were still displaced eighteen months after Hurricane Katrina in Louisiana, USA (Glandon et al. 2008), suggesting that SOC is indeed a dynamic steady state that can be supported through interventions that reflect what is meaningful for the disaster survivor.

SOC is also amenable to empirical examination in a preventive health context. Salutogenesis and SOC are discussed in more detail in Section 2.6.2, as they contribute to the conceptual basis of the disaster prevention approach tested in this study. The SOC construct is tested in this study as a single measure of emotional coping, used within a multi-dimensional approach designed to assess health-related quality of life and well-being. The health sciences research framework for this study is discussed in the next section.

2.6 Study Framework – Disaster Prevention through Health and Quality of Life

This section presents the theoretical basis for this PhD research. In biomedical and health sciences research, perhaps because of a professional orientation to understanding the patient's subjective experience and interpretation of their 'global' health or overall quality of life, the value of measuring multiple domains of well-being has been recognised for over 20 years (Bergner, 1989; Cella, 1994; Wilson & Cleary, 1995). This is also consistent with the World Health Organization's definition of health (1948) as a multi-dimensional and dynamic state of well-being.

The theoretical foundation of this thesis thus takes an affective perspective that integrates health and well-being. It draws on quality of life theory from the health sciences (WHOQOL Group, 1996) and salutogenesis theory from preventive medicine (Antonovsky, 1987), while complementing both stress-coping and social-cognitive theory from the discipline of psychology. Measures of self-reported well-being are thus of interest in this thesis primarily as affective (rather than cognitive) indicators of resilience and potential predictors of motivating preparedness actions.

One affective perspective that has universal salience and frequently demonstrates great strength of will in individuals is the drive for survival, health and well-being. Most people are naturally motivated to feel good, empowered, and satisfied with their life circumstances. Shifting the rationale for disaster preparedness – from threat-motivated to health-motivated – could lead to significant behaviour change; it may be an important factor for engagement in preparedness activities, greater self-management (coping and acceptance) during disaster, and increasing personal and community resistance to peri- and post-disaster trauma.

Preventing adverse outcomes and promoting health through disaster preparedness also has the inherent advantage that health-seeking is closely aligned with the natural human desire to integrate personal values, beliefs and goals (Sheldon et al. 2003). Recognising and nurturing impulses toward health is also consistent with the

research perspectives of positive psychology, human developmental psychology, and action-growth explored in the previous section.

2.6.1 A Health Sciences Research Perspective

Biomedical, behavioural, and health systems perspectives are increasingly sought in disaster research frameworks (NIH, 2006), and health sciences research is increasingly aimed at developing a solid evidence base of ways to prevent illness, enhance quality of life, and promote health (Fletcher et al. 2006). Health promotion is a process of strengthening the personal skills and capacities of individuals through preventive activities that can be directed toward reducing the impact of adverse events on public and individual health (WHO, 1998).

This study explores a preventive health approach to disaster preparedness using health sciences research theory, study design, and methods. It examines relationships between positive health-related attitudes and health-protective preparedness behaviours through multiple domains of quality of life and well-being. This conceptual design will provide data that addresses gaps identified in disaster management frameworks for preventing disaster impacts, promoting health, and ensuring individual needs are considered during the prevention phase of the disaster preparedness cycle (e.g., Section 2.4, Disaster Management Frameworks).

The study perspective also follows the trajectory of disaster research toward greater integration of the affective domain and global well-being into resilience and meaning paradigms (Section 2.5, Disaster Research Frameworks). It takes the research a step further in a novel way by considering global well-being from a multi-dimensional health perspective, comprehensively examining the individual contributions from the multiple domains of quality of life toward engaging in preparedness actions.

The results of this study will contribute to the evidence base for future health promotion intervention designs and disaster resilience programmes throughout the disaster cycle.

2.6.1.1 Conceptualisations of Health

Health is conceptualised in this study as a dynamic and multi-dimensional state of balance characterised by physical, mental, emotional, spiritual, and social well-being. Health is also conceptualised as a resource, a set of health-protective attitudes and behaviours for managing the challenges of living in a way that produces a subjective positive assessment of wellness and overall quality of life.

2.6.1.1.1 Defining Health and Well-Being

The interdependence of health and well-being with psychological resilience is woven throughout most definitions of mental health used by health and other professionals (EMIP, 2004), drawing on definitions from the World Health Organization (WHO) and the Ottawa Charter for Health Promotion:

> *"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."* (WHO, 1948)

> *"Health is the extent to which an individual or group is able, on the one hand, to realize their aspirations and satisfy needs; and on the other hand, to change or cope with the environment. Health is, therefore seen as a resource for everyday life, not an object of living; it is a positive concept emphasizing social and personal resources, as well as physical capacities."* (WHO, 1986).

The Ottawa Charter (WHO, 1986) specifically calls for action on re-orientating health care services toward prevention of illness and promotion of health. The Jakarta Declaration (WHO, 1997) adds emphasis to certain aspects of the Ottawa Charter, voicing the intention and need to increase community capacity to empower the individual for participation in the self-management of their own health.

The goal of promoting a "positive sense of well-being" appears in other key EU/WHO policy documents as well:

"Mental health is the emotional and spiritual resilience which allows us to enjoy life and to survive pain, disappointment and sadness. It is a positive sense of well-being and an underlying belief in our own, and others' dignity and worth." (Health Education Authority (1997) Mental health promotion: a quality framework, London)

"We believe that the primary aim of mental health activity is to enhance people's well-being and functioning by focusing on their strengths and resources, reinforcing resilience and enhancing protective external factors." (Europe Declaration, WHO, 2005b)

Developing a preventive health-oriented perspective for disaster preparedness also acknowledges and integrates the *a priori* basis for the practise of medicine – maintaining and restoring health through the Hippocratic Oath – and it is consistent with the vision, mission, and goals of the U.S. Institute of Medicine (IOM):

"The mission of public health is to fulfil society's interest in assuring conditions in which people can be healthy." (IOM, 1988)

2.6.1.1.2 Defining Quality of Life

Quality of life is a complex concept with a wide variety of definitions and measures. The WHO definition of quality of life (1996) emphasises the subjective and multi-dimensional nature of the concept:

"Quality of life is defined as individual's perceptions of their position in life in the context of the culture and value system where they live, and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept, incorporating in a complex way a person's physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features of the environment. This definition reflects the view that QOL refers to a subjective evaluation which is embedded in a cultural, social, and environmental context. As such, QOL cannot be simply equated with the terms "health status," "life-style," "life

satisfaction," "mental state," or "well-being". Rather, it is a multidimensional concept incorporating the individual's perception of these and other aspects of life." (WHOQOL Group, 1996)

Empirical research studies in the health sciences often focus on one or more of the domains of health (WHO, 1948) in order to measure quality of life within populations of interest. Numerous taxonomies of health-related quality of life domains have been proposed over the years, largely based on a WHO tripartite of physical, mental and social well-being (e.g., Bergner, 1989; Cella, 1994; Cella et al. 2007; Reeve et al. 2007; Wilson & Cleary, 1995). Quality of life (QoL) is defined in this study using the WHO constructs of global life satisfaction and self-reported health and well-being in the core health-related domains: physical, mental, emotional, spiritual, and social (WHOQOL, 1995).

2.6.2 Foundational Theories for this Study

The most effective health promotion programmes are based on tested health theories, providing the conceptual and empirical foundation on which programmes are built and guiding the actual process of programme design, implementation, and evaluation (Fertman & Allensworth, 2010).

A theory is "a set of interrelated concepts, definitions and propositions that present a systematic view of events or situations by specifying relationships among variables in order to explain and predict the events or situations" (Kerlinger, 1986). The science of health promotion uses theories that explain changes in behaviours. Explanatory theories identify modifiable constructs, and change theories guide the development and evaluation of interventions. The conceptual, explanatory basis of health promotion is a wellness model. Health-related quality of life and salutogenesis are the explanatory theories forming the wellness foundation of this study and are further described below.

The practical basis of health promotion draws on health behaviour change theory. The ecological health perspective or 'level of influence' (McLeroy et al. 1988) for

understanding behaviour change in this study is the intrapersonal (individual) level. The selection of a decisional balance model, focused on individual readiness to change behaviour, is further described in Section 2.6.2.3.

Other contributing factors of interest in this study that can influence behaviour include the nature of the physical and social environment. Perceptions of the level of autonomy versus control can affect motivation, as can perceptions of physical and personal vulnerability to the consequences of disaster. Both of these contextual effects are considered and a brief background on their theoretical perspectives is provided, although investigating their relationship with health-protective preparedness behaviours is not the specific aim of this study. They are, however, important contextual factors to take into consideration in assessing preparedness status and designing any future intervention design.

2.6.2.1 Health-Related Quality of Life Theory and Domain Constructs

The broad theory of health-related quality of life ('HrQoL') integrates the physical, psychological, social and spiritual domains of health and well-being to describe the processes and outcomes of coping with disease and promoting health.

Twenty years ago, quality of life was described as the "missing measurement in health" (Fallowfield, 1990), but HrQoL is now well-established in the health sciences and evidence-based medicine (e.g., Cochran Reviews). It has been accompanied by a transition from clinical definitions of illness to patient-reported outcomes of wellness as important elements of effective health service delivery.

HrQoL theory gained early traction in cancer survivorship interventions beginning in the 1980's, and subsequently became a mainstream part of clinical research and practise in other chronic disease contexts (e.g., Alzheimer's). Quality of life is increasingly being integrated into health promotion and is becoming part of the practise of preventive medicine.

In a disaster context, little has been done in HrQoL research, especially from the prevention perspective. There are examples, however, of multi-level systemic

approaches to identify protective factors that influence positive outcomes in post-disaster contexts. For instance, a Canadian disaster impacts assessment model was developed that characterises effects of terrorism events by categories of cognitive, behavioural, emotional, spiritual, social, and physical effects (Lemyre, et. al. (2005).

This thesis uses HrQoL theory in the pre-disaster context to examine the association between HrQoL domains of well-being and health-protective behaviours. It is based on the general conceptualisation that the subjective interpretation of one's health correlates with engagement in preparedness activities and can affect disaster resilience.

The theoretical background and construct relevance of each domain of health-related quality of life defined for this study are summarised here. Specific details on the applications and psychometric properties of the measures are provided in Chapter 3, Methods, Section 3.3.3.2.

2.6.2.1.1 Physical and Mental Health Status

Historically, a small set of standardised health measures have been used worldwide as indicators of physiological and mental health status, and to some extent, health-related quality of life. These measures are near the peak of the landscape of thousands of health measures, starting with single indicators focusing on one particular aspect of health. Single health indicators serve as explanatory variables to help understand specific changes in population health (e.g., obesity). Disease-specific scales, which may aggregate single indicators, are often symptom- and function-focused, but rarely tell about the whole person (Patrick & Deyo, 1989). Higher-level aggregated measures, such as generic health status profiles, provide a coordinated summary of health of an individual (Fryback, 2010). To varying degrees, many represent multiple domains of well-being. Health-related quality of life indexes have aimed to further standardise health outcome research, yet each measures health somewhat differently. Similar to generic health status profiles, distinctions between individual domains in health indexes are less clear than in instrument batteries of health-related quality of life.

Because this study uses a multi-dimensional approach to measuring quality of life, a way of measuring physical and mental health was sought to compliment other measures of emotional, spiritual, and social well-being. Ware et al. (1994) developed a general health status profile formally known as the Medical Outcome Study Short Form-36 (SF36). It groups 8 scales of self-rated health into 2 clusters, physical health and mental health. It is perhaps the most widely used health status profile in the world (Fryback, 2010), and an abbreviated version, the SF12 (Ware et al. 1996), was selected as the appropriate measure of physical and mental health status in this study.

2.6.2.1.2 Emotional Well-Being

Salutogenesis, introduced in Section 2.5.1.4., is a theoretical model (Antonovsky, 1987) of well-being that has received attention in health promotion research communities because of how it integrates the cognitive and affective domains and incorporates meaning. It is also designed to measure personal well-being on a health continuum.

The model's core construct, Sense of Coherence (SOC), represents a global orientation to life; to view the world as comprehensible (cognitive domain), manageable (behavioural domain), and meaningful (affective or motivational domain). All three components are closely intertwined and considered as a global quality of life measure by Eriksson & Lindstrom (2005). SOC is also used by researchers as a discrete measure of emotional well-being (Steger, 2007).

The Sense of Coherence (SOC) construct reflects a person's capacity to respond to stressful situations and has been found to have predictive validity for health in numerous longitudinal studies examined in meta-analyses (Eriksson & Lindstrom, 2005; Harrop, 2007). These systematic reviews found that SOC is strongly related to perceived health, especially mental health, and seems to be a health-promoting resource that strengthens resilience and develops a positive subjective state of health. This relationship is present in study populations regardless of age, sex, ethnicity, nationality, and study design (Eriksson & Lindstrom, 2006).

Further, Sense of Coherence seems to be able to predict health, being identified as a strong indicator for both mental and physical health in a wide range of studies that demonstrate positive associations with a variety of health behaviours (Abrahamsson & Ejlertsson, 2002; Freire et al. 2001; Hassmén et al 2000; Lindmark et al. 2005; Myers et al. 1994; Sanden-Eriksson, 2000; Savolainen et al. 2005). A study of post-traumatic growth in survivors of law enforcement officers killed in the line of duty showed high Sense of Coherence was associated with decreased manifestation of Post-Traumatic Stress Disorder (Bear & Barnes, 2001).

Sense of Coherence has been evaluated as a target for intervention designs and health promotion strategies in scores of studies around the world (e.g., Eriksson & Lindstrom, 2005, 2006, 2007; Harrop et al. 2007). Researchers have indicated that the most immediate research needs for salutogenesis theory should be to implement the theory into practise, such as in mental health promotion (Eriksson & Lindstrom, 2005; Lindstrom & Eriksson, 2005).

2.6.2.1.3 Spiritual Well-Being

While valid and reliable instruments for measuring physical, mental, emotional, and social well-being are widely available and well-established in the literature, spiritual well-being is a less well-developed and arguably less accepted construct. Further, available instruments operationalise this construct in quite different ways (Kreitzer et al. 2009). Consensus in the literature on this subject is clearly still maturing.

Yet spirituality has been linked to coping with stressful life conditions (e.g., Folkman, 1997; Lazarus & Folkman, 1984; Snyder, 2000) and to health benefits (Brady et al. 1999; Gorsuch & Miller, 1999; Miller & Thoresen, 1999; Ryff & Singer, 1998). The importance of measuring spiritual well-being in quality of life assessments is reflected in its presence within the final structure of the WHOQOL-100 instrument as Domain VI, 'Spirituality/religion/personal beliefs' (WHO, 1998), and in the WHOQOL-BREF instrument under Domain IV, 'Psychological', as a subdomain or facet of 'Spirituality' (WHOQOL Group, 1996, 1998). This facet of well-being was designed

to address people with differing religious beliefs, as well as people with personal and spiritual beliefs that do not fit within a particular religious orientation (WHO, 1998).

In this study, spirituality is considered a multidimensional concept that is related to but distinct from religiosity, or a particular faith tradition or practise. Institutionalised religion and religious traditions are considered an aspect of spirituality by Burkhardt (1989) and Gorsuch & Miller (1999). Murray & Zentner (1989, page 259) defined spirituality as "*a quality that goes beyond religious affiliation*" in those who strive for meaning and purpose, regardless of religious belief.

A sense of equanimity, experienced regardless of life circumstances, is considered an important aspect of well-being, particularly in humanistic theories (e.g., Rogers, 1961). Frankl (1963, 1984) considered spirituality the primary motivational force. Larson et al. (1998) defined spirituality as the search for meaning and purpose in life. Nursing studies refer to spirituality concepts such as hope, acceptance, meaning in life, serenity and self-transcendence (e.g., Haase et al. 1992; Paloutzian & Ellison, 1982; Roberts & Whall, 1996; VandeCreek et al. 1994; Warner & Williams, 1987).

Serenity is considered a critical concept for spiritual well-being research because of its inherent and in-depth holistic approach (Boyd-Wilson et al. 2004). Serenity is defined by Gerber (1986) as a sustained state of inner peace that can bring comfort to persons who are experiencing harsh life events; it is independent of external events and sustained during both good and bad times. Serenity has also been defined as a spiritual state that decreases stress and promotes optimal health (Roberts & Cunningham, 1990), and a spiritual experience of inner peace that is independent of external events (Roberts & Fitzgerald, 1991). Indeed, part of being healthy is being well integrated and at peace (Pert, 1993, p. 189).

Serenity thus enhances one's ability to accept with equanimity whatever adversity is being experienced and "contributes to self-possession during difficult times" (Roberts & Messenger, 1993). Roberts & Whall (1996) further conceptualised serenity as a learned, positive emotion that decreases perceived stress and improves health and can be achieved despite negative circumstances. These definitions lay the foundation for measuring serenity in a health promotion context.

Kreitzer et al. (2009) found that serenity predicts quality of life, and advocates use of the serenity construct as a non-religious approach to exploring links between spirituality and spiritual interventions and health outcomes. Because the state of serenity transcends formal religious dogma, measurement of the serenity construct is more likely to be acceptable to persons regardless of the presence, absence, or type of any religious beliefs or traditions (Roberts & Aspy, 1993).

2.6.2.1.4 Social Well-Being

Psychological attachment theories postulate that social networks affect response to stressors (Weiss, 1973; Cassel, 1976) and that social support provides a 'buffer' against crises (Cobb, 1976; Cohen & Wills, 1985; Peplau & Perlman, 1982).

The importance of measuring social well-being in quality of life assessments is reflected in its presence within the final structure of the WHOQOL-100 instrument as Domain IV, 'Social Relationships' (WHO, 1998), and in the WHOQOL-BREF instrument as Domain III, 'Social Relationships' (WHO, 1998; WHOQOL Group, 1996, 1998). In these measures, personal relationships and social support are examined, respectively, to assess the extent of a person's feeling of companionship, love and support they desire from the intimate relationship(s) in their life, and how much a person feels the commitment, approval, and availability of practical assistance from family and friends (WHO, 1998).

Self-assessment of perceived social isolation is also considered an important part of the evidence base for health-related quality of life studies since it may influence participation and response in public health interventions (Hawthorne, 2006).

2.6.2.2 Global Quality of Life

Affective and cognitive components of subjective well-being, introduced in Section 2.5.1.3, are frequently captured together as a measure of global quality life using the well-known construct of life satisfaction (Diener, et al. 1985; Diener et al. 1991; Pavot & Diener, 1993, 2008; Pavot et al. 1991). An advantage of this construct is it

assesses the positive side of an individual's experience. Life satisfaction is included in this study as a measure of global well-being, to complement the foregoing domain-specific health-related quality of life variables.

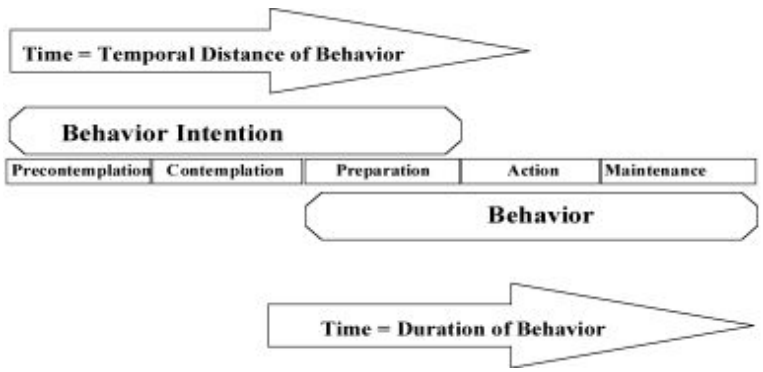
2.6.2.3 Health Behaviour Change

There are four major health behaviour change theories applicable to the intrapersonal level that can indicate individual characteristics influencing behaviour; the Health Belief Model (Hochbaum, 1958; Rosenstock, 1974, 1991, Rosenstock & Kirscht, 1974), the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the Theory of Planned Behaviour (Ajzen, 1991; Ajzen & Driver, 1991; Ajzen & Madden, 1986), and the Transtheoretical Model of Change (Prochaska & DiClemente, 1982, 1983).

The behaviour change model used in this study is the Transtheoretical Model (TTM), also known as the "Stages of Change" Model, selected for how it uniquely provide a baseline measure of a person's stage in decision-making for engagement in a behavioural activity (Prochaska & DiClemente, 1982, 1983; Prochaska et al. 1992; Prochaska et al. 1997; Prochaska & Velicer, 1997a, 1997b). The stage construct is the key organising construct of the model (Velicer et al. 1998), representing change occurring over time (Figure 2.6). The Stages of Change model thus describes a *process*, where people demonstrate progress along a continuum of varying degrees of readiness to change, and helps explain how people move towards making decisions and behaviour change in their everyday lives (Rollnick et al. 1999).

Figure 2.6 The Temporal Dimension as the Basis for the Stages of Change

(Velicer, Prochaska, Fava, Norman, & Redding, 1998)



Similar to the salutogenic conceptualisation of health on a continuum between illness and wellness (Antonovsky, 1987), the Transtheoretical Model also provides a mechanism for conceptualising a person's position on an activity continuum (Precontemplation, Contemplation, Preparation, Action, Maintenance). 'Level of engagement' in a behavioural activity can be measured temporally from thought to action when conceptualised through the TTM.

The model's focus on the decisional balance (Prochaska & DiClemente, 1997b; between intention and action helps identify problem behaviour and sets the stage for acquiring a positive behaviour. The goal is to target interventions for people to move from thought to preparation for change, and then to action and maintenance stages. Future interventions can then measure the efficacy of a proposed modification in behaviour on this activity continuum.

Evacuation preparedness was conceptualised as the primary preventive health strategy in this study. The level of engagement in evacuation preparedness for earthquake or tsunami is the proxy variable for this positive health-related or health-protective behaviour, measured along the Stages of Change continuum.

2.6.3 Contextual Theories for this Study

Context analysis is a method to analyse the environment in which a person operates. The foregoing theories focus primarily on the individual or intrapersonal level, yet health-protective behaviours also take place at an interpersonal level, within contextual effects partly defined by the physical environment and the social environment.

In this study context, the social environment is assessed through the construct of self-determination and the physical environment is assessed through the construct of risk perception. These are important factors to take into consideration, both to properly contextualise preparedness status and for appropriately designing any future interventions.

2.6.3.1 Social Environment

Self-determination theory (SDT) is a well-known psychological framework to study people's behaviour (Deci & Ryan, 1985, 2003; Ryan & Deci, 2000), based on the assumption that social environment influences the motivation, performance and well-being of individuals. The theory uses the concept of regulatory processes (autonomy versus control) to describe the quality of social environments.

For example, the degree to which people feel autonomous (i.e., self-determined) versus controlled in their motivated pursuits is hypothesised to relate to behavioural persistence. This study collects data on the level of personal autonomy, and the influence of autonomy on health-related reasons for engaging in preparedness behaviours, using measures based on Self-Determination Theory.

2.6.3.2 Physical Environment

Risk perception research is an interdisciplinary study of subjective concepts involving risk awareness and risk judgments, the determinants of perceived risk magnitude and risk acceptance, and differences in risk perception between groups (Rohrmann, 2003a, 2003b).

To be able to recognise disaster risk is to know what risk is ('risk identification') and to know what is *at* risk ('risk judgment'). This study uses the definition of risk as defined by the Australia/New Zealand Standard for Risk Management (*AS/NZS 4360:2004*):

> *"Risk is the chance of something happening that impacts on objectives. A risk is often specified in terms of an event or circumstance and the consequences that may flow from it. It is measured in terms of the consequences of an event and their likelihood. Risk may have a positive or negative impact."*

Risk identification thus involves a recognition of what can happen, where, when, why, and how. Once these parameters are assessed, the likelihood and

consequences can be analysed and evaluated as to whether the risk is accepted or action is taken to modify the risks for positive outcomes.

Risk is inherently perceptual, an interpretation of the world based on a combination of cognitive knowledge, affective beliefs, and experience. This study collects data on perceptions of risk, viewed as physical and personal vulnerability to disaster, integrating risk identification and risk judgments into a subjective personal assessment of exposure and consequences. Many researchers follow a psychometric paradigm of studying risk as a subjective concept of physical and psychosocial or personal vulnerability (Fischoff et al. 1978). Findings are often used to develop effective risk communication strategies, such as framing messages or targeting interventions to address barriers to the behaviour change desired.

Risk communication theory is a well-developed field of research in its own right. Although of great interest, extensive discussion of the theoretical basis is beyond the scope of this thesis. The reader is referred to the work of Slovic (Slovic, 1987, 1992, 2000; Slovic & Weber, 2002; Slovic et al. (2004), and others for additional insight.

2.6.3.2.1 Risk Perception – Physical Vulnerability

Physical vulnerability is conceptualised for this study as the perceived likelihood of personal exposure to a hazardous event (earthquake or tsunami), both in place and time. It involves risk identification and judgments about physical phenomena; the subject of risk is the risk for the state of the environment (Rohrmann, 2003a, 2003 b).

Perceptions of physical vulnerability involve a level of consideration or attention to the chance that a disaster with significant consequences *can happen* within the local landscape (location), within the time span of an individual's life (imminence), and that this chance creates a risk of being *personally exposed* to disaster (salience).

2.6.3.2.2 Risk Perception – Personal Vulnerability

Personal vulnerability is conceptualised as the perceived likelihood of experiencing the adverse consequences of a hazardous event at the individual level. It involves

perceptions of risk magnitude – the type and level of effects – and the subject of risk is the risk for people, well-being and assets (Rohrmann, 2003a, 2003b).

Perceptions of personal vulnerability involve interpretation of the severity of consequences and personal concern for being affected by those consequences. Personal vulnerability can be influenced by the type of consequences and their perceived persistence. They can also be moderated by prior experience with disaster. The impact of exposure may be direct of indirect, e.g., the degree or level of impact may be modified by direct personal experience or by personally witnessing the impact of disaster on others.

2.6.4 Theoretical Applications of this Study

A programme that takes action prior to the onset of a health problem to intercept its causation or to modify its course before people are involved is known in health care systems as primary prevention (Fertman & Allensworth, 2010). Health promotion is a cornerstone of primary prevention in health care. This is consistent with Cowen (2000), who argued for extending resilience from beyond 'adapting to distress' to a process of cultivating wellness as a matter of primary prevention: "*wellness must be a matter of prime concern at all times, not just when it fails*" (Cowen, 2000, page 80).

Norris and others (2007) built on Cowen's concept of wellness in primary prevention, and integrated high quality of life as a criterion in their definition of wellness for disaster readiness and recovery. They stress that, "*Wellness might actually be a 'higher bar' than has been used in resilience research, but it is an appropriate standard for concluding that adaptation to an altered environment has occurred."* (Norris et al. 2007, page 7). They further affirm the importance of recognising health as a continuum, stating, *"Cowen (2000) also notes wellness is a continuum. Individuals (and communities) show varying degrees of wellness before as well as after disasters, and this context must be taken into account in assessing postdisaster adaptation*." (Norris et al. 2007, page 7).

Primary prevention is accomplished both in the primary health care environment (e.g., general practitioner's office) through one-on-one health education, and outside the health care system through community health initiatives. Other common settings for primary prevention are through workplace health and safety initiatives, employee assistance programmes, insurance provider wellness campaigns, schools, and recreational sports or wellness facilities.

These are but a few examples of many possible environments, both within and outside the health sector, that provide natural opportunities for promoting disaster preparedness as a part of overall quality of life and wellness. Disaster preparedness can be incorporated into routine primary preventive care by general practitioners, specialists, patient educators and home health providers (e.g., Buckner, 2009) and outside the health care environment by community health educators, health & safety specialists, and other trained professionals.

This study provided a unique opportunity to explore quality of life and well-being as potential determinants of disaster preparedness in a preventive health context. By using multiple domains of well-being as natural model to represent the sweep and scale of health factors potentially affecting disaster preparedness, this study aims to expand the evidence base on the role of quality of life in building disaster-resilient processes and outcomes. This foundational knowledge can then be a resource for other disaster researchers, those who design disaster preparedness interventions and health promotion activities, or are responsible for development and implementation of health and emergency management policies.

CHAPTER 3. METHODS

The literature review revealed a need to consider the role of multi-dimensional quality of life (QoL) in disaster preparedness research, using QoL-specific assessment tools. These findings guided the development of the research design structure and specific research questions and objectives for this study.

Section 3.1, Research Design, presents the aims, research questions, and hypotheses developed for this study. **Section 3.2, Research Methodology**, presents the logic and measurement techniques selected for investigating the hypotheses. **Section 3.3, Data Collection**, reports on the scientific protocols and procedures followed for developing and administering the data collection instrument in this study. The strategy for obtaining a suitable survey population is described in **Section 3.4, Sampling**. In **Section 3.5, Quality Control**, the procedures employed to assure the validity and reliability of the data set are described. **Section 3.6, Data Management**, details the data handling techniques followed in preparation for statistical investigation. The analytical structure and statistical treatment of the data are discussed in **Section 3.7, Data Analysis**.

3.1 Research Design

This section discusses the research approach developed from the PhD theoretical framework and the study's core constructs, introduced in Chapter 2, Section 2.6. It describes how the study operationalises the constructs into measureable attributes and identifies the specific aims and hypotheses.

3.1.1 Research Aims

This research aims to assess prevalence and analyse the strengths of association among quality of life domains of well-being (conceptualised as "health-protective attitudes") and disaster evacuation kit preparedness (conceptualised as "health-protective behaviour"), observed in the general adult population of Wellington, New

Zealand, for an earthquake or tsunami disaster. These variables can serve as attributes in a personal strengths-based skill set (conceptualised as "health management resources") for developing disaster resilience as both a process and outcome.

3.1.2 Study Aims

The study aims were to:

1) Measure health-protective attitudes and behaviours in the study population.
    a. Measure the prevalence and distribution of quality of life.
        i. Collect data using a multi-dimensional set of health indictors, drawn from core domains of health-related quality of life (HrQoL) theory.
            1. Apply constructs for measuring physical, mental, emotional, spiritual, and social well-being.
        ii. Collect data using a global indicator of overall well-being, drawn from broad-spectrum quality of life theory.
            1. Apply the Sense of Coherence construct as both a global indicator of overall well-being and a domain-specific measure of emotional well-being.
            2. Apply the Life Satisfaction construct as a single global indicator of overall well-being, discrete from health-related quality of life.
    b. Measure the prevalence and distribution of preparedness for earthquake and tsunami.
        i. Collect data on evacuation kit preparedness through the primary indicator of the level of engagement in evacuation kit preparation activity.

2) Analyse the associations between quality of life and evacuation kit preparedness.
    a. Determine the direction and strength of associations among variables.

b. Determine the explanatory power of quality of life variables for evacuation kit preparedness.

3) Measure ancillary variables of interest for future analytical investigation.
    a. Measure secondary indicators of evacuation preparedness.
        i. Collect data on the level of engagement in other types of kit preparation activities and evacuation planning activities.
    b. Measure additional indicators of disaster preparedness.
        i. Collect data on the level of engagement in other attributes of earthquake and tsunami preparedness.
    c. Measure contextual effects for preparedness motivation in the social and physical environment.
        i. Collect data on indicators of self-determination.
        ii. Collect data on indicators of risk perception.
            1. Physical vulnerability.
            2. Personal vulnerability.

3.1.3 Research Questions

The research questions were:

1. What is the prevalence of selected quality of life (QoL) variables and evacuation kit preparedness?
2. Is there an association among QoL variables and evacuation kit preparedness?
3. Do QoL variables have explanatory power over evacuation kit preparedness? (Or, Which QoL factors predict evacuation kit preparedness?)
4. Does age and gender affect these explanatory relationships?

3.1.4 Hypotheses

The null hypothesis assumes there is no actual relationship between quality of life and evacuation kit preparedness.

H_O: *There is no significant difference in the quality of life level of those who are prepared and those who are not.*

The general alternative hypothesis suggests a potential outcome expected for this study, defined here as a positive correlation between quality of life variables and evacuation kit preparedness.

H_A: *Adults with higher quality of life will exhibit higher levels of engagement in evacuation kit preparedness behaviour.*

Six specific directional hypotheses (H_1-H_6) were generated to test for associations between each quality of life domain, as independent variables and evacuation kit preparedness, as the dependent variable. Each hypothesis was tested at two levels of measurement for the dependent variable: 1) dichotomous (nominal) categories of intention versus action, and 2) rank-ordered (ordinal) Stages of Change processes (Prochaska & DiClemente, 1982, 1983) of precontemplation, contemplation, preparation, action, maintenance.

H_1: *Adults with higher physical health status will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower physical health status.*

H_2: *Adults with higher mental health status will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower mental health status.*

H_3: *Adults with higher emotional well-being will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower emotional well-being.*

H_4: *Adults with higher spiritual well-being will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower spiritual well-being.*

H_5: *Adults with higher social well-being will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower social well-being.*

H_6: *Adults with higher life satisfaction will exhibit higher levels of engagement in evacuation kit preparedness behaviour than adults with lower life satisfaction.*

A separate explanatory hypothesis (H_7) was generated to test the degree of effect that quality of life (QoL) variables have on evacuation kit readiness:

H_7: *QoL will have explanatory power over evacuation kit preparedness behaviour.*

Two additional non-directional hypotheses (H_8-H_9) were generated to test for differences in any explanatory relationships by age and gender:

H_8: *The relationships between QoL and evacuation kit behaviour are affected by age.*

H_9: *The relationships between QoL and evacuation kit behaviour are affected by gender.*

3.2 Research Methodology

A quantitative epidemiological survey, using a cross-sectional study design, was selected to explore relationships among health-related quality of life and evacuation preparedness behaviour. The mode of administration was a postal survey.

Quantitative research is defined by Aliaga and Gunderson (2002) as a methodological approach for 'Explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics).' Epidemiology is defined by Peat (2002) as the study of populations in which the prevalence of health-related indicators and their relationships with health outcomes are measured at the population level using the best available methods.

Contemporary definitions of epidemiology tend to focus more specifically on the analysis of causal relationships between exposures and outcomes, however, these definitions can be suggestive of *a posteriori* conditions, i.e., measurement after exposure to an event, and often are focused on pathogenic agents and the prevalence of disease outcomes. This study takes an *a priori* approach, examining relationships between health-protective indicators and outcomes in a pre-event context, and thus the definition of Peat (2002) is especially well-suited to the preventive health perspective used here.

The following two sections briefly discuss the background and rationale for selecting quantitative methods and a cross-sectional epidemiological study design for this research investigation.

3.2.1 Epistemological Approach

All scientific research reflects a subjective belief about the nature of reality. This belief system drives both the epistemology (i.e., the operating theory of how knowledge is acquired), as well as the ways of knowing (i.e., the study design used for observing, measuring and collecting) that are considered appropriate for the research investigation. Conceptualising the research design structure is thus a

process of not only establishing the context and aims of a study, but also the logic and measurement techniques involved in examining the primary study aims.

Epidemiology uses a 'nomothetic model' for asking research questions, where there is a search for independent factors or determinants that can explain the variations in a class of conditions or events, and can be generalised to explain a dependent outcome in a population within a certain level of confidence. The aim is to logically describe phenomena and systematically study inferential relationships using quantitative methods, providing a sound evidence base of frequencies and associations for proposing effective strategies for health interventions.

Quantitative epidemiological methods pay particular attention to minimising possible sources of error such as bias and confounding, and are designed to generate sufficient statistical power to ensure that the results have not arisen by chance and are as precise as possible (Fletcher et al., 1996; Hulley et al., 2007). This is especially relevant for empirical investigations – particularly when assessing an individual's subjective perceptions – since the researcher can never be certain of 'truth', due to potential validity problems that can arise when examining associations among variables. As described by Hulley et al. (2007), *does the association represent real cause-and-effect, or is the outcome just an innocent bystander in a web of causation that involves other variables*?

Properly conducted studies that use quantitative epidemiological methods to numerically measure health-related indicators are able to provide the most reliable evidence base for designing and measuring the effectiveness of new interventions and health care practises, and do so with accuracy and precision (Peat, 2002). This pragmatic focus is thus the approach selected for the study.

3.2.2 Epidemiological Study Design

This study uses a cross-sectional epidemiologic study design to numerically and systematically collect and analyse data on health-related quality of life and evacuation preparedness behaviour.

Epidemiological study designs that involve two or more variables are organised based on whether they are observational, pseudo-experimental (or quasi-experimental), or experimental, with the distinction between the latter two depending on the presence of randomisation within multiple groups. They are further defined by techniques of measurement frequency (one time or more often), sequence (before or after), and number of groups. The associations among variables are usually investigated in a progressive way, moving along a hierarchy from observation to experimental treatment or intervention (Gomm et al., 2000; Hulley et al., 2007). This progression of study designs thus generally follows the relative strength of evidence for associations among variables (Fletcher et al., 1996; Gomm et al., 2000; Hulley et al., 2007; Peat, 2002):

3.2.2.1 Choice of Study Design

It is pragmatic and often more feasible to first observe and establish whether a relationship exists among variables of interest (Peat, 2002) before conducting experimental studies. Evidence for new interventions is usually first collected in observational designs (Hulley et al., 2007), which are seen as a good first step for a cohort study or randomised control trial because they can yield the prevalence of multiple variables of interest and detect the direction and strength of associations among variables.

A cross-sectional study design was selected for this PhD research because it offers a logical and efficient method of collecting a large of amount of data suitable for both descriptive and inferential analyses and would be capable of generating sufficient statistical power to be generalised to the adult population in Wellington. Further advantages are that:

- By observing and quantifying the prevalence of "*who has what*" at a set point in time, this cross-sectional study design offered the opportunity to measure attributes of the sample in a pre-disaster context and serve as a baseline source of information about the health status and preparedness habits of the population.

- By providing confirmation of the direction and strength of associations among variables of interest and allowing precise communication of results, these findings can provide a stronger foundation for data-driven decisions.

    - They can explain the significance of a variable's role in preparedness behaviour.
    - They can be useful for estimating the likelihood of future preparedness outcomes being influenced or determined by various factors.
    - They can be useful for comparison with future measurements following an intervention or change in disaster context.

From an administrative standpoint, the cross-sectional design also provided realistic and achievable parameters for data availability and access, timing and financial resources, and was considered to be the most suitable to the overall aims and scope of this PhD.

3.3 Data Collection

This study sought to use a robust methodological approach for data collection in order to achieve multiple goals: 1) provide a quick and efficient way of measuring a broad range of information that is not readily available through other means; 2) address a foundational research question regarding possible relationships or associations of interest; and 3) produce a statistically valid and reliable baseline data set on a large number of people through rigorous data analyses. This section discusses the choice of quantitative survey research as the method of data collection for this study, and reports on the scientific protocols and procedures for developing and administering the data collection instrument.

Section 3.3.1, Survey Research Objectives, discusses the strengths of quantitative survey research as the chosen method of data collection. **Section 3.3.2, Survey Design**, discusses the survey research and consultation process followed for the study, the selection of a self-administered postal questionnaire as the type of instrument used to collect data, and how the survey was formatted for presentation to the study sample. **Section 3.3.3, Survey Methods**, details the structure of the questionnaire and the measures used to operationalise the study constructs into survey questions for systematic collection of numerical data. The questionnaire uses a combination of validated psychometric scales, questions developed specifically for the study, and demographic questions drawn from the 2006 New Zealand Census. **Section 3.3.4, Survey Administration**, addresses the administrative and organisational management matters associated with conducting the survey, consistent with ethical standards and organisational practises appropriate for survey research.

3.3.1 Survey Research Objectives

A survey is a structured system for collecting information and provides primary source information obtained directly from individuals or groups (Fink, 1995b). Surveys encompass any measurement procedures that involve asking questions of respondents (Trochim, 2006). Unlike secondary sources such as written records, a

survey data set potentially represents the views of a whole community or group of interest.

The methodological goal of quantitative survey research is to generate reliable and valid data for the descriptive and inferential objectives of scientific research and to produce an accurate information base for data-driven decisions such as planning and policy development (Muijs, 2004). Much of the data that are gathered in health sciences research use quantitative survey methods to numerically measure health status, outcomes and demographic characteristics (Hulley et al., 2007; Peat, 2002). These methods can also be used for collecting data to describe, compare, or explain knowledge, attitudes, beliefs and behaviour, as well as socioeconomic and health status (Fink, 1995a; Trochim, 2006).

As a systematic data collection instrument, a quantitative survey has several defining features: the research problem is clearly delineated; information is obtained by asking individual questions; data gathering is systematic and well-defined; the purpose is to generate group-level summary statistics; and the results are generalisable to groups represented by individuals included in study (Dyrbye et al., 2007; Neumann, 2003; Salant & Dillman, 1994).

A well-designed quantitative survey also collects data in a uniform manner – asking each respondent the same questions in the same way so as to ensure that the answers are most influenced by respondent experience, rather than how the questions are worded. For many studies, the strength of the results thus depends on the quality of the survey instrument (Hulley, et. al, 2007).

3.3.2 Survey Design

Prior to selecting the survey type and preparing the survey instrument for this study, a broad range of survey design references were consulted to consider alternative approaches (e.g., Babbie, 1990, 2007; Bourque & Fielder, 1995; De Vaus, 2002; Fink, 1995a, 2006; Fletcher et al., 1996; Gomm et al., 2000; Hulley, et. al, 2007; Jamieson, 2002; Litwin, 1995; Neumann, 2003; Peat, 2002;; RDDirect, 2005; Rea &

Parker, 1997; Salant & Dillman, 1994; Trochim, 2006; Varkevisser et al., 2003). New Zealand survey design resources (e.g., Gough, 1991; Jamieson, 2002) and Australasian social science surveys from GNS Science were also reviewed (e.g., Becker et al. 2007a, 2007b; Davis et al. 2006; Leonard et al. 2004). The questionnaire developed for this study is based in part on the format of these GNS surveys for general consistency in appearance and, in some cases, in question design.

Formal training for the author was received through an academic career development workshop in "Effective Survey Design and Evaluation" at Mayo Clinic in Rochester, Minnesota, USA (Dyrbye et al., 2007). Multiple professionals with survey research expertise were also consulted throughout the survey design process for this study. These individuals included supervisory committee members Ray Kirk, PhD (Health Sciences Centre, University of Canterbury) and Jeff Sloan, PhD (Division of Biostatistics, Mayo Clinic Department of Health Science Research); external mentors Timothy Beebe, PhD (Mayo Clinic Survey Research Center); David Johnston, PhD (Massey University/GNS Science Joint Centre for Disaster Research), John McClure, PhD (School of Psychology, Victoria University of Wellington), Victor Montori, MD (Mayo Clinic Department of Internal Medicine), Kevin Ronan, PhD (School of Psychology and Sociology, Central Queensland University), Jennifer St. Sauver, PhD (Division of Epidemiology, Mayo Clinic Department of Health Sciences Research), and Kristin Vickers-Douglas, PhD (Mayo Clinic Department of Psychology and Psychiatry); and social science staff at GNS Science, Lower Hutt.

3.3.2.1 Survey Instrument Type

Self-administered questionnaires are one of the most frequently used methods for collecting data in quantitative research studies because the results are usually easily quantified for use in statistical analyses (Bourque & Fielder, 1995). Numerous factors pointed to a self-administered questionnaire being the most advantageous method of data collection for the study aims.

- The research question was well-defined and would not be changed or altered during the research process. All questions would be known in advance.

- There would be the opportunity to quantitatively measure critical constructs using validated psychometric scales that produce precise numerical data.

- Anonymity and confidentiality could be protected.

- A questionnaire is an efficient method of seeking input from a wide range and large number of people, at a relatively low cost.

- People could respond at their convenience, consult personal records if they found that helpful for any reason, and keep a copy of their completed survey for themselves if they desired.

- Self-completion reduces the opportunity for researcher- or interviewer-bias.

- Numerical data, obtained through standardised data collection procedures, would be easily applicable to correlational research.

This method of data collection was indicated as the mode of administration that best fit the research objectives, the most suitable environment for question completion, response rate goals, and the study budget and time frames.

3.3.2.2 Survey Presentation

The following subsections describe the elements, visual design, and topical orientation of the survey for the study. The study survey and cover letters are provided in Appendix 1.

3.3.2.2.1 Survey Elements

The complete survey packet used to collect data for this study consists of a one-page cover letter, a 14-page saddle-bound survey booklet (size A4), a one-page

study information sheet printed on the inside front cover of the survey booklet, and a pre-labelled Freepost reply envelope.

3.3.2.2.2 Survey Branding and Visual Design

The survey was presented with a cover letter introducing the respondent to the nature of the research and the study sponsors, with colour logos for the associated institutions at the top and the personal signature of the PhD candidate at the closing.

A full-page (A4) survey booklet format was selected to promote ease of use, with colour photographs placed on the front cover and back page to enhance professionalism and visual appeal. A study information sheet is located inside the front cover of the survey booklet.

Layout and design principles are used throughout the survey to create a response environment with a minimum of stress (e.g., integrating scenic black-and-white landscape photographs of the study area, providing adequate white space and line spacing on each page, using non-division of survey questions and sections across all pages, and including designated space on the back page of the survey booklet for open-ended comments). A clear and organised appearance provided a clean format to heighten the overall aesthetic of the entire survey packet.

3.3.2.2.3 Survey Recruitment/Study Orientation

The cover letter introduces the respondent to the primary aim of the thesis ("*We invite you to take part in this study focused on the role of health and well-being in emergency preparedness*") and discusses the study context of earthquake and tsunami evacuation planning *("this study has a special interest in earthquakes and tsunamis because these hazards can trigger a need for evacuation"*). It also notes the consistency of the research with the 2007 New Zealand National Civil Defence Emergency Management Strategy. Practical instructions on estimated completion times ("*about 30-60 minutes"*) and how to return the completed surveys were placed in the cover letter.

To foster a user-friendly perception of the survey topic, the front of the survey booklet presents a non-scientific title for the research study ("*The Wellington Disaster Prevention Study*"). A subtitle ("*Involving the community in strengthening emergency preparedness and promoting health, well-being and quality of life in Wellington, New Zealand*") aims to encourage a sense of community engagement. Word choices of 'prevention', 'strengthening' and 'promoting' were integrated purposefully into the title and subtitle to reflect the framing of the research context within the principles of primary preventive medicine, salutogenic theory and health promotion summarised in the literature review (Chapter 2).

The overall format and content of the survey is introduced narratively in familiar language to the respondent in the study information sheet:

> "*The questionnaire is divided into four sections asking your perspectives on: 1) the potential for disaster in Wellington and how you could be affected; 2) how you approach day-to-day life and your general health and well-being; 3) what you think and feel about preparing for and coping with an evacuation; and 4) what types of preparedness activities you might be considering doing.*"

The study information sheet also describes the population-level of interest, geographic distribution of the study sample, random selection of households, and inclusion criteria for participation ("*we suggest that the person who completes this questionnaire in your household is the adult (age 18 or over) who most recently had a birthday*"). Information is provided about how the results of the study will be reported, the probable practical and scientific outcomes, and the value of the respondent's contributions to the local community and to advancing the science of disaster research.

To increase the likelihood of survey content being understandable and valid, brief narratives were also provided as introductions or topical transitions for each survey section, along with clear and distinguishable instructions for question completion.

3.3.3 Survey Methods

This section describes the development of the survey content. Section 3.3.3.1 describes the organisational structure of the overall survey and the protocols followed for question and response structure. Section 3.3.3.2 describes the constructs measured by each question and specific measurement parameters.

3.3.3.1 Survey Construction

The four numbered survey sections in the survey booklet are arranged to broadly represent Bloom's taxonomy of learning (Bloom et al. 1956), which divides educational objectives into cognitive, affective and psychomotor or behavioural domains.

3.3.3.1.1 Organisational Structure

Organising survey sections by Bloom's taxonomy (1956) can be helpful for future design compatibility with health education and intervention designs and the goals of evaluation research. These questioning strategies can also assist the respondent in identifying needs and developing independent plans based on clarification of their own goals that can surface following question completion.

- Section 1 (pages 1-3) addresses the cognitive domain by collecting data on knowledge- or thought-based perceptions of potential natural hazards and respondent interpretation of their vulnerability to disaster.
- Section 2 (pages 4-8) is oriented toward the affective domain, with questions on self-reported health status and coping strengths. None of the questions are set in a disaster context, since the purpose of these questions is to measure baseline health and well-being, and form the health sciences foundation of the survey instrument.
- Section 3 (pages 9-10) contains a combination of cognitive and affective questions to probe opinion and hypotheticals from a disaster evacuation context.

- Section 4 (pages 11-12) focuses on the behavioural domain by assessing engagement in disaster preparedness activities.
- The survey concludes (pages 13-14) with an unnamed section containing questions on population characteristics.

Organising survey content by these domains also facilitates logical flow and regard for potential audience sensitivity on question topics: health-related affective questions are nested or 'book-ended' between more emotionally neutral questions of cognitive disaster risk perceptions and behavioural preparedness activities. Demographic questions are at the end of the survey.

3.3.3.1.2 Question Structure

Clearly-stated questions and response options are imperative to achieving systematic data collection that can answer specific research objectives and create confidence that a survey can be considered suitable for its intended purpose. Accordingly, survey content was designed at the individual item level in agreement with published quality assurance principles (Bourque & Fielder, 1995; Fink, 1995c; Fink, 2006; Neumann, 2003; Salant & Dillman, 1994).

Questions were constructed with appropriate style and wording for an audience of adult respondents using culturally conventional language, except where to do so would involve changing the validated language of a standardised psychometric scale. Question subject, time periods, and word choices were reviewed for specificity, precision, unambiguous meaning (e.g., question length, loaded or biased words or questions, two-edge or double-barrel questions, negative phrasing, sensitivity) and the availability of information or knowledge to answer the questions.

Most survey questions in this study are closed-ended. A close-ended question consists of a stem, which presents a problem (typically in the form of a statement, a question, or a situation) followed by a predefined or 'forced-choice' set of alternative responses (Fink, 2006).

Three open-ended questions gave respondents the option to provide qualitative, anecdotal information that elaborates on prior closed-ended questions and may inform future research objectives (e.g., Q13, Q32, and Q36).

3.3.3.1.3 Response Structure

The most common response formats used in the study questionnaire are ordinal scales, both rank-order and multi-point ('Likert') rating scales. On self-authored questions using Likert-scale response formats, a 5-point rating scale was selected to balance precision and response choice density. For consistency, standard practise was to assign a low-to-high labelling direction on both rank-order response options and Likert scales. Exceptions were made where a standardised scale specifies a high-to-low rating direction (e.g., Q14, Q19-21, and Q27-28).

Unlabelled mid-point results on Likert-scale questions are generally referred to in Chapter 4 ("Results") as "ambiguity." This word was chosen to indicate a neutral ranking of the respondent's level of agreement with the strength of the assertion presented by each item (e.g., neither agreeing nor disagreeing). It is standard practise in Likert scales to include a neutral mid-point. While the scale originator, Rensis Likert, originally labelled this point as 'undecided' (Likert, 1932), the more common version now is 'neither agree or disagree' (Johns, 2010). The purpose of this option is evidently to avoid forcing respondents into expressing agreement or disagreement when they may lack such a clear opinion (Johns, 2010).

Two questions in the study survey use semantic differential scales, a type of rating scale designed to measure the connotative meaning of concepts (Osgood et al., 1957, 1975). The respondent indicates where they rate themselves between a pair of bipolar descriptive statements (e.g., Q15 and Q16).

Multiple response question formats and skip patterns were avoided throughout the questionnaire to reduce respondent confusion about question style and relevance. Exceptions to this protocol are few:

- A multiple response format is used on one question (Q1) to provide a second choice. The number of selections was limited to two response choices because the question is fundamentally a question of highest likelihood, and offers the opportunity for a person to identify a particular secondary effect they consider highly probable as well.
- By their nature, some demographic variables also lent themselves to a multiple response format (e.g., ethnicity).
- Instructions were provided to skip questions on two items (Q38 & Q39), since the questions would potentially not be applicable for all respondents.

All closed-ended response options were carefully reviewed to determine if they were exhaustive (covering the appropriate range of response options); discrete (no overlap/duplication); brief (avoiding long check lists or an excessive number of response options); consistently ordered; and accurate (providing meaningful response options). Where relevant to the nature of the question, a response option comprising a tick box for "Other (please specify)" with a fill-in-the-black space was provided (e.g., Q1, Q33, Q38-40, Q44, Q46, Q52, and Q53).

Question and response formats, data types, variable types, and the level of measurement for each survey question are summarised in Appendix 2, Table A2.1.

3.3.3.2 Survey Measures

The survey instrument created for this study contains a total of fifty-six (56) numbered questions, obtained or derived from a wide range of resources: published validated psychometric scales from the health sciences literature and quality-of-life instrument databases; social science surveys on disaster in New Zealand and Australia (e.g., Becker et al. 2007a, 2007b; Davis et al. 2006; Leonard et al. 2004); questions developed specifically for the study; and demographic questions from the 2006 New Zealand Census. Descriptive findings for all 56 questions and inferential analyses using questions relevant to the primary study aims are reported on in Chapter 4.

The concepts these questions measure can be broadly grouped into 4 categories: health management resources for disaster, disaster risk perception, motivation for behaviour change, and population characteristics. The analytical focus of this PhD is on exploring relationships among two types of health management resources (Table 3.1) for use in the disaster context: the primary study constructs of 1) quality of life (health and well-being) and 2) health-protective behaviours (earthquake and tsunami evacuation preparedness). Ancillary constructs relating to the contextual concept of disaster risk perception and motivation for preparedness behaviour change are defined in the following sections and reported on descriptively but are beyond the inferential aims of this PhD and reserved for possible future analysis.

Table 3.1 Measures of Health Management Resources for Disaster

Concept	Operational Definition	Construct	Indicator or Domain	Measure or Specific Aspect	Survey Question
Health Management Resources (Protective Factors)	Health-Protective Attitudes (Personal Health and Well-Being/ Quality of Life)	Health-related Quality of Life	Social Well Being	FS (Hawthorne, 2006)	Q14
			Emotional Well Being	SOC13 (Antonovsky, 1987)	Q16
			Spiritual Well Being	SS20 (Boyd-Wilson et al. 2004, 2006)	Q17
			Physical Health Status	SF12(v1) (Ware et al. 1996)	Q19-28
			Mental Health Status	SF12(v1) (Ware et al. 1996)	
		Global Quality of Life	Global Life Satisfaction/ Subjective Well Being	SWLS (Diener et al. 1985)	Q29
	Health-Protective Behaviours (Personal Disaster Preparedness)	Earthquake and Tsunami Preparedness	Discussing Preparedness	With Social Network	Q35.1
				With Neighbourhood	Q35.2
			Seeking Preparedness Information	Risks & Consequences	Q35.3
				How to Prepare	Q35.4
				How to Respond	Q35.6
				How to Evacuate	Q35.7
			Taking Preparedness Actions	Earthquake	Q35.8
				Tsunami	Q35.9
			Evacuation Planning	Survival/Escape	Q35.10
				Evacuation/Dislocation	Q35.11
				Communications	Q35.12
			Evacuation Plan Testing	Evacuation Route	Q35.13
				Assembly Area	Q35.14
				Participated in Drill	Q35.15
			Evacuation Kit Readiness	Survival/Escape	Q35.16
				Evacuation/Dislocation	Q35.17
				Communications	Q35.18
				Kit Accessible	Q35.19

3.3.3.2.1 Health Management Resources for Disaster

Health management resources can be thought of as personal resources – a resilience "toolkit" – that can increase the ability to handle stress and thereby minimise disaster impacts. Health management resources are operationalised for this study into categories of health-protective attitudes, measured through quality of life factors, and health-protective behaviours, measured through the level of engagement in earthquake and tsunami preparedness activities (Table 3.1). Together these health resources can serve as protective factors and be part of an overall personal health management strategy for promoting resilient outcomes prior to, during, and following a disaster.

The next two subsections describe the selection of the quantitative measures used to operationalise the study constructs of quality of life and disaster preparedness.

3.3.3.2.1.1 Measures of Quality of Life

Beginning with Question 14 in Section 2 of the study survey, quality of life is assessed using measures of health-related quality of life ("HrQoL") in the domains of physical, mental, emotional, spiritual, and social well-being. Validated psychometric scales are used to quantitatively assess health in each construct by asking a series of questions linked to positive health and scoring the responses.

A large number of validated psychometric scales were considered for potential inclusion as global and domain-specific measures of quality of life. For analytical practicality, and to represent the conceptualisation of health as a multi-dimensional construct (WHOQOL Group, 1995, 1996, 1998), quality of life was measured in the study survey using a battery of scales selected to represent five HrQoL domains of well-being (physical, mental, emotional, spiritual and social). To provide a global, general (non-domain related) measure of subjective well-being and address the 'life satisfaction' component of the WHO-QoL definition (WHO, 1998), life satisfaction was also included as a single global measure of quality of life, bringing the total number of quality of life variables in the study to six.

This instrument battery is a de facto conceptual quality of life model, created to reflect the spirit of the WHO-QoL domains of well-being. There is no implication or intent to uncover any underlying structure within the set of instruments. The purpose was to yield data from each domain of well-being to test associations with preparedness behaviour.

The following scales were selected to represent individual domains of health-related quality of life in the study population (Table 3.1).

- Physical and mental health status are measured (Questions 19-28) using the Short Form Health Survey, 12-Item, Version 1 (SF12; Ware, Kosiniski & Keller, 1996). Access to the SF12 scale was through University of Canterbury licensed copy.
- Emotional well-being is measured (Question 16) using the 13-item Sense of Coherence scale (SOC13; Antonovsky, 1987, 1993), which operationalises the Sense of Coherence (SOC) construct (also known as the "Orientation to Life Questionnaire"). The SOC13 is in the public domain; permission to use the scale was not required for this study.
- Spiritual well-being (Question 17) is measured using 20-item Serenity Scale (SS20; Boyd-Wilson, Walkey & McClure, 2004, 2006). Permission to use the Serenity Scale was granted by the scale authors (Boyd-Wilson, B., McClure, J., pers. comm., 2008)
- Social well-being (Question 14) is measured using the 6-item Friendship Scale (FS; Hawthorne, 2006). Public domain access to the scale was confirmed by the scale author (Hawthorne, pers. comm. 2010).

Global quality of life is measured in this study (Question 19) using the 5-item Satisfaction with Life Scale (SWLS; Diener et al. 1985). The SWLS is in the public domain; permission to use the scale was not required for this study.

These scales are all validated psychometric measures designed to collect the essential defining information on health-related determinants of quality of life for this

study. The following subsections discuss scale selection for each domain, scale validity, and mode of measurement.

3.3.3.2.1.1.1 Physical and Mental Health Status

Physical and mental health status is measured in this study (Questions 19-28) using the Short Form Health Survey, 12-Item (SF12), Version 1 (Ware, Kosinski, & Keller, 1996).

Background

Several health indices were considered for use in this study, with a particular focus on two: The Short Form Health Survey (www.qualitymetric.com) and the EQ-5D Visual Analogue Scale **(**www.EuroQOL.org**)** are arguably the most well-known quality of life instruments for measuring subjective perceptions of physical and mental health status.

The Short Form Health Survey, typically administered in either a 12- or 36-item version, measures health in 8 dimensions (general health, physical functioning, role of physical functioning in daily activities, role of emotional functioning in daily activities, bodily pain, mental health, vitality, and social functioning) during the past 4 weeks. The EQ-5D scale (or "Health Thermometer") measures overall health satisfaction in physical and emotional domains of well-being and is assessed in the temporal moment. Both scales have been applied to disaster contexts (e.g., Adams & Boscarino, 2005; Abramson et al. 2008; Khoo & Smith, 2008; Sabucedo et al. 2010; Spinhoven & Verschuur, 2006).

The 12-item Short Form Health Survey, Version 1 (Ware et al. 1996) was selected for this study given its utility for reliable and separate scoring of physical and mental health status, established suitability for use New Zealand and Australian health research and practise (e.g., Sanderson & Andrews, 2002; Wilson, Tucker & Chittleborough, 2002), and brevity over the 36-item Short Form Health Survey.

Scale Validity

The SF12(v1) is a direct subset of the SF36, one of the most widely-used health surveys. The SF36 was part of the 2006/07 New Zealand Health Survey (MOH, 2008b, 2008c), a cross-sectional, nationally representative survey of 12,488 adults (15 years and over). The SF36 was found to be a valid and reliable measure of health-related quality of life for the New Zealand population (Scott et al. 1999).

Measurement

SF12 question and response formats are diverse in both nature and structure (e.g., Likert-type scales, dichotomous yes/no formats). Responses are scored into two summary values, "PCS" (Physical Component Summary) and "MCS" (Mental Component Summary). Possible score range is from 0 to 100, where a higher score indicates a better health status.

Norm-based scoring is recommended by the scale authors (Ware et al. 1998). In norm-based scoring, each component is scored to have the same average (50) and the same standard deviation (10). If a respondent's scale score is above 50, or a group mean score is above 50, health status is above the average. Normative data for the SF36 are also available for New Zealand populations (Scott et al., 1999).

3.3.3.2.1.1.2 Emotional Well-Being

Coping ability is measured in this study through the Sense of Coherence construct (Question 16), operationalised using the Orientation to Life questionnaire (Antonovsky 1987, 1993), more commonly known as the SOC scale.

Background

Several coping constructs and their measures of psychological well-being were reviewed and considered for this study (e.g., health locus of control, Wallston et al. 1976; optimism, Scheier et al. 1994; personal mastery, Perlin & Schooler, 1978; self-efficacy, Sherer et al., 1982, and Schwarzer & Jerusalem, 1995; self-esteem,

Rosenberg, 1965, and Robins et al. 2001). Individual psychological constructs can be determinants of health-protective behaviours and have been applied extensively in disaster research (*see* Norris et al. 2007). The intention in this study, however, was to examine dimensions of wellbeing rather than specific psychological states or traits.

SOC represents a more global life orientation and provides an excellent fit with the salutogenic context of this study. The SOC scale has been used in post-disaster timeframes as a measure of trauma assessment and resilience (e.g., Eriksson & Lundin, 1996; Almedom et al. 2005, 2007). This is the first known application of the SOC scale in a pre-event disaster timeframe.

Scale Validity

Antonovsky (1987, 1993) developed a 29-item Sense of Coherence scale, the SOC29, and the shorter 13-item version, the SOC13 scale, using Guttman facet theory. Both SOC29 and SOC13 demonstrate psychometric validity, reliability, feasibility, and cross-cultural applicability (Eriksson & Lindstrom, 2005). SOC scales have been used in at least 33 languages in 32 countries with positive results in several large population studies using data from the WHO MONICA (Multinational MONItoring of Trends and Determinants in Cardiovascular Disease) Project (Eriksson & Lindstrom, 2006; Nilsson et al. 2003).

For brevity, the SOC13 was selected for this study (Question 16). In a research synthesis of 127 studies conducted from 1992-2003 using the SOC13 scale, Eriksson (2007) reports high internal consistency with Cronbach's coefficient alpha measures ranging from 0.70 to 0.92. Test-retest correlation showed stability and ranged from 0.69-0.72. Robustness for using the 13-item version in this study context was confirmed by Eriksson (Eriksson, pers. comm. 2008).

Measurement

The SOC13 is self-administered and the timeframe of assessment is the temporal moment. The scale consists of 13 items; respondents are asked to select a

response on a seven-point semantic differential scale with two anchoring phrases. The 13-item scale contains three subscales of manageability (4 items), meaningfulness (4 items) and comprehensibility (5 items) in response to life. Respondents circle a number between 1 and 7 on a semantic differential scale with two anchoring phrases for each item. Five of the 13 items are formulated negatively and are reversed in scoring prior to simple summation. Possible score range is from 13 to 91. A high score expresses a strong SOC.

Antonovsky (1993) reported early normative data for the SOC13 but did not define the level of a 'normal' SOC. Eriksson & Lindstrom's systematic review (2005) tabulates SOC13 means ranging from 35.39 (SD 0.10) to 77.60 (SD 13.80) distributed across studies with a variety of sample sizes and population characteristics. They note that numerous studies define levels of low, moderate or high SOC; however no cut-off point or general pattern of divisions emerges since different researchers have used separate criteria and studies reflect a broad diversity of populations. While 'high' SOC appears to protect health, the lack of the level of a 'normal' SOC complicates the interpretation of the effect on health and thus Eriksson (2007) calls for further research before establishing norms or formal cut points.

3.3.3.2.1.1.3 Spiritual Well-Being

Non-religious spiritual well-being is measured in this study (Question 17) using the 20-item Serenity Scale (Boyd-Wilson, Walkey, & McClure, 2004, 2006).

Background

Spirituality instruments are used in a wide variety of populations for use in clinical settings and in assessing intervention outcomes (e.g., Elkins et al., 1988; Paloutzian & Ellison, 1982). Numerous studies have found that the construct of serenity, previously discussed in Chapter 2, Section 2.6.2.1.3, is a reliable measure of spiritual well-being (Kreitzer et al., 2009). The Serenity Scale, developed by Roberts & Aspy (1993), was selected for this study as a measure of non-religious aspects of spirituality. It appears to capture a dimension of spirituality – a state of acceptance, inner haven and trust – that is distinct from other spirituality instruments (Kreitzer et

al., 2009). The 20-item version of the Serenity Scale (SS20) was developed in a New Zealand population (Boyd-Wilson et al., 2004, 2006). This is the first known application of this scale in a disaster context.

Scale Validity

Sixty-five critical attributes of serenity were originally identified (Roberts & Cunningham, 1990) as the basis of the theoretical framework for the serenity construct and pilot-tested with a convenience sample of healthy university students. These attributes were subsequently examined in a study population aged 20 to 97 from varying income and educational levels (Roberts & Aspy, 1993), and further refinement produced a 40-item version (SSv2) with a high internal consistency reliability (Cronbach's alpha = 0.92).

The 40-item scale structure was further tested by Boyd-Wilson et al. (2004) in an independent sample of 378 university students; unidimensionality was clearly supported and a Cronbach's alpha of 0.88 was obtained. Kruse et al. (2005) also examined the 40-item Serenity Scale in adult male and female hospital volunteer workers, 50 to 80 years of age. Results demonstrated that the Serenity Scale measures a single construct and is a psychometrically sound measure of serenity in adults (Cronbach's alpha = 0.93).

Based on these findings, Boyd-Wilson et al. (2004, 2006) tested a short, single-factor scale on a sample of 178 university students and 114 members of the general population (total n=292), with ages ranged from 16 to 78 years old. An abbreviated 20-item scale was shown to be internally consistent with a Cronbach's alpha = 0.89. For reasons of brevity and cultural consistency, the 20-item Serenity Scale was selected for use in this study.

Measurement

The SS20 is a self-administered 20-item questionnaire that measures respondent status for a sustained state of inner peace in the temporal moment. Respondents are asked about how they cope with life's everyday challenges in a series of

narrative statements that describe a possible experience of serenity (e.g., “I am aware of an inner source of comfort, strength, and security”; “I accept situations I cannot change”; “I trust that everything happens as it should”), followed by a Likert-type frequency response scale. The 5-point scale ranges from 1 = never to 5 = always. Responses are scored by simple summation, with possible score range from 20 to 100. Previous research does not suggest specific norms or cut points. The higher the score, the greater the sense of serenity indicated.

3.3.3.2.1.1.4 Social Well-Being

The Friendship Scale (FS; Hawthorne, 2006), a 6-item measure of perceived social isolation, was selected for use in this study (Question 14) to measure social well-being.

Background

Numerous scales of social well-being were reviewed for consideration in this study (e.g., Broadhead et al. 1988; Hawthorne, 2006; Lubben & Gironda, 2004; Norbeck et al. 1981; Sarason et al. 1981; Sarason et al. 1987; Sherbourne & Stewart, 1991). Several factors (e.g., construct measurement, instrument length, design population, reliability, and mode of administration) were evaluated for their applicability to the study design.

The FS was selected to measure social well-being in this study due to the importance of parsimony (Dillman, 1978), excellent psychometric properties, applicability for large community-based studies, and cultural parallels between the design population in Australia and the New Zealand general adult population. This is the first known application of this scale in a disaster context.

Scale Validity

The FS has been found to be reliable (Cronbach’s alpha = .83, Hawthorne, 2006) for use in clinical, population and public health settings (Hawthorne, 2006). The FS was psychometrically validated in community prevalence studies of perceived social

isolation in Australian adult sample populations (*n=829*, Hawthorne, 2006; *n=3,015*, Hawthorne, 2008).

Measurement

The FS is a 6-item measure of perceived social isolation during the past 4 weeks. Three items probe the importance of actual social contacts and 3 items cover the feelings of loneliness, using 5-point Likert-type frequency response categories where 0 = almost always and 4 = not at all. Scoring is by simple summation following reverse scoring on items 1, 3, and 4. Possible score range is from 0 to 24. The lower the score, the greater the sense of social isolation indicated. A high score represents strong social connectedness.

Hawthorne (2006) established cut points for FS scores, categorised into 5 levels of perceived social isolation (0-11 = very isolated; 12-15 = isolated, 16-18 = some isolation, 19-21 = socially connected, 22-24 = very connected).

3.3.3.2.1.1.5 Subjective Well-Being/Life Satisfaction

The global well-being component of quality of life is measured in this study (Question 19) using the Satisfaction with Life Scale (SWLS; Diener, Emmon, Larsen, & Griffin 1985).

Background

Since its introduction in 1985, the SWLS (Diener et al. 1985) has been heavily used as a measure of subjective well-being (Pavot & Diener, 2008). Subjective well-being is defined as "*a person's cognitive and affective evaluations of his or her life*" (Diener et al. 2002, p. 63).

The SWLS is designed to measure the cognitive component of subjective well-being. (Pavot & Diener, 1993; Pavot et al., 1991). It does not assess affective or health domains of well-being but allows respondents to integrate them if they choose; it is recommended as a complement to scales that focus on emotional well-being

because it assesses an individuals' conscious evaluation or judgment of life satisfaction through their own criteria (Pavot & Diener, 1993). Global life satisfaction is theoretically predicted to depend on a comparison of life circumstances to one's standards (Pavot & Diener, 1993).

Scores on the SWLS have been shown to be an effective outcome measure for health-related quality of life research, and the SWLS has been demonstrated to be a useful indicator for the effectiveness of interventions (Pavot & Diener, 2008). Increasing numbers of researchers in clinical and counselling psychology use measures of subjective well-being in their assessments of distress and dysfunction (Pavot & Diener, 2008).

The SWLS was used in the 2010 Quality of Life Survey of New Zealand Cities (ACNielsen, 2011), which included Wellingtonians in its study sample. The SWLS has also been applied specifically to trauma studies (e.g., Durkin & Joseph, 2009) and post-event disaster research (e.g., Henderson, 2009; Karairmak, 2007; Tremblay et al. 2006; Vastfjall et al. 2008). This is the first known application of the SWLS in a pre-event disaster timeframe and context.

Scale Validity

The SWLS has favourable psychometric properties, including high internal consistency with Cronbach's alpha ranging from .79 to .89 (Pavot & Diener, 2008). It is suited for use with a wide range of ages and groups and is available for use in several languages.

Measurement

The SWLS measures the level of agreement with 5 statements of satisfaction with one's life (e.g., *The conditions of my life are excellent; So far I have gotten the important things I want in life*), with the assumption that a more positive evaluation is associated with a corresponding increase in the respondent's quality of life. Response options indicate agreement on a Likert-style response scale ranging from 1 = strongly disagree to 7 = strongly agree.

Scoring is typically by simple summation or alternatively by arithmetic mean. The possible range of the scale is from 5 to 35. A summated score of 20 represents the neutral point on the scale, the point at which the respondent is about equally satisfied and dissatisfied (Pavot & Diener, 1993). The higher the score the greater the judgment of life satisfaction indicated.

Normative data are available for diverse populations and cross-cultural samples (e.g., Pavot & Diener, 1993; Diener, 2000; Pavot & Diener, 2008). Cut points are suggested for scores at six levels (Pavot & Diener, 2008): 5-9 = extremely dissatisfied with life; 10-14 = dissatisfied; 15-19 = slightly dissatisfied; 20-25 = slightly satisfied; 25-30 = satisfied; and 31-35 = extremely satisfied. Means for most groups fall in the range of 23 to 28, or slightly satisfied to satisfied (Pavot & Diener, 1993).

3.3.3.2.1.1.6 Scale Presentation

The ordering strategy of nesting or 'book-ending' was used for scale presentation, by placing scales with higher potential for sensitivity (e.g., emotional and spiritual well-being) among those that might be perceived as more familiar or less intrusive. Section 2 of the study questionnaire thus begins with measures of social well-being. It is followed by a separate measure of personal autonomy (Q15), discussed later in this chapter, which was included at that juncture simply for page layout purposes. Next are the scales addressing emotional and spiritual well-being (Q16 and Q17, respectively).

Primary care provides a natural environment for being able to discuss the very personal and multi-dimensional aspects of overall health and well-being at an individual level, and can serve as a health predictor, health management strategy, and health-protective behaviour. Choosing to visit a primary care provider was explored through a dichotomous yes/no question by asking respondents if they have a regular GP (general practitioner, doctor) that they see on at least an annual (once-a-year) basis (Q18). This question is followed by the widely-used SF12 scale measuring physical and mental health status (Q19-Q28). Section 2 ends with the Satisfaction with Life Scale (Q19).

None of these questions are set in a disaster context, since the purpose of Section 2 in the survey is to measure baseline health and well-being and form the health sciences foundation of the study.

3.3.3.2.1.1.7 Significance of Health-Related Quality of Life

In Section 3, respondents are asked to contextualise their quality of life perceptions with respect to considering the possibility of an earthquake or tsunami in the Wellington Region. Question 34 assesses the perceived relevance of health-related quality of life factors for disaster resilience, by asking respondents to rate the extent that they think these factors would help them manage or cope with disaster evacuation in the Wellington Region.

Response options ranged from “not much” to “a great deal” on a 5-point Likert scale. The assumption with this evaluation response scale is that a more positive appraisal of a state, capacity or behaviour is associated with a corresponding increase in the respondent’s quality of life.

3.3.3.2.1.2 Measures of Health-Protective Behaviours

The following two subsections describe questions developed specifically for this survey, considering the possibility of an earthquake or tsunami in the Wellington Region.

3.3.3.2.1.2.1 Level of Disaster Preparedness

In Section 3, the respondent is first introduced to the topic of disaster preparedness with a single rating question asking their self-perception of overall personal preparedness to evacuate from home (Q30). Responses range from 1 = Very Well Prepared to 5 = Not At All Prepared.

In Section 4, Question 35, respondents complete closed-ended questions to rate their level of engagement (or ‘stage of change,’ after Prochaska & DiClemente,

1982, 1983), from 1 = I have not thought about this (*Precontemplation*), 2 = I have thought about this, but that's all (*Contemplation*), 3 = I intend to do this (*Preparation*), 4 = I have started doing this (*Action*), and 5 = I do (or maintain) this regularly (*Maintenance*). Nineteen items cover a broad range of disaster preparedness activities (Table 3.1). The last four items (Q35.16-36.19) specifically address the primary study outcome variable of 'Getaway Kit'. For the scope of this PhD, engagement in evacuation kit preparedness ("*Made a Home Getaway Kit"*) was selected as the primary behaviour of interest for inferential analyses.

Question 36 branches off from Question 35 as an open-ended planning exercise set in the hypothetical situation of an evacuation due to earthquake or tsunami. Respondents were asked to identify and prioritise the specific items they would consider essential to have in their personal 'Getaway Kit.' Questions 35 and 36 have additional value when viewed beyond data collection for this study: they serve as a planning exercise for people to think about what resources they might need, to sort out priorities, and to develop their own strategies for disaster preparedness in a hypothetical context. In this sense, both questions thus serve as a form of behavioural health intervention. Question 37 is a dichotomous yes/no question asking if the respondent has given any personal evacuation plans to contacts living outside the Wellington Region, in case of emergency.

3.3.3.2.1.2.2 Other Preparedness Aspects of Interest

Section 4 of the survey booklet concludes with a series of closed-ended defining and explanatory questions (Q37-Q41) on additional factors potentially affecting preparedness behaviour, and the rationale for engaging in these activities, e.g., workplace preparedness (Q38-39), media-motivated preparedness (Q40), and household role for preparedness (Q41).

3.3.3.2.2 Contextual Factors

Contextual factors in the social environment are measured using validated psychometric scales, further described in the next subsection. Questions follow

relating to risk perception and the physical environment, with a specific focus on the potential for disaster in Wellington and prior experience with disaster.

3.3.3.2.2.1 Social Environment – Self-Determination

While not a specific aim of this research study, collecting baseline data on what motivates people to self-manage or function in a self-determined way was seen as useful for designing and evaluating future disaster preparedness interventions. Motivation is conceptualised for this study as a process that leads to the intention to change behaviour. This motivation for "*behaving in a healthy way*" (Williams et al., 1996) can come from outside an individual ('external motivation') or within a person's internal value system ('internal motivation').

The Self-Determination Scale (SDS;after Deci & Ryan, 1985; Sheldon et al. 1996) is a short, 10-item scale divided into two 5-item subscales to assess awareness of oneself and perceived choice in one's actions. The 5-item Self-Determination Scale, Perceived Choice subscale (SDS-PC) was included in this study (Question 15) as a baseline measure of individual differences in the extent to which people tend to feel a sense of personal choice (internal autonomy) vs. control (external regulation) with respect to overall personal behaviour.

Further examination of perceived choice, set in the context of health-protective reasons for engaging in disaster preparedness behaviour, is explored for baseline purposes (Question 31) using the 15-item Treatment Self-Regulation Questionnaire (TSRQ15; Ryan & Connell, 1989; Williams et al. 1996, 2002). Question 31 is followed by a branching open-ended probing question (Q32) asking about any additional health-related reasons for engaging in evacuation preparedness.

Background

Both the SDS-PC and TSRQ15 scales are grounded in self-determination theory (SDT), a well-known psychological framework to study people's behaviour (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000). SDT is based on the assumption that social environment influences the motivation, self-management, and well-being of

individuals. For example, the degree to which people feel autonomous (i.e., self-determined) versus controlled in their motivated pursuits is hypothesised to be associated with behavioural persistence (Williams et al., 1996; Pelletier et al., 2001). Permission to use the SDS-PC and TSRQ15 was granted by the authors via website registration (Edward L. Deci & Richard M. Ryan, 2008, http://www.psych.rochester.edu/SDT/questionnaires.php). This is the first known application of these scales in a disaster context.

Scale Validity

The SDS-PC has good internal consistency with Cronbach's alphas ranging from .85 to .93 in numerous samples. Levesque et al. (2007) reports that the internal consistency of the TSRQ subscales are acceptable, with most alpha values >0.73.

Measurement

SDS-PC uses a visual analogue scaling methodology with participants asked to estimate which of two statements feels more true of them (e.g., Statement A = *I do what I do because it interests me*; Statement B = *I do what I do because I have to*). Response options are precoded from 1 to 5 between the anchor points of Statement A and B. Scores for the SDS-PC are reversed and then summated; possible score range is from 5-25. The higher the score, the greater the perceived personal autonomy indicated.

TSRQ15 has 15 statements of reasons for participating in a health-protective behaviour programme, quantified through three subscales of regulatory style: autonomous, controlled, and amotivated. In this study, respondents are asked why they would engage in evacuation preparedness behaviour (e.g., *The reason I would prepare is…*). Examples of reasons provided by the scale are: *because I feel that I want to take responsibility for my own health* (autonomous regulation); *because I feel pressure from others to do so* (controlled regulation); and *because it is easier to do what I am told than think about it* (amotivation). Each reason is rated on a 7-point Likert-type scale, indicating the level of agreement ranging from 1 = not true at all to

7 = very true. Scores for the subscales are averaged. Typically the subscale scores are used separately but they can be combined into a Relative Autonomy Index.

Both the SDS-PC and TSRQ15 scales are self-administered and the timeframe of assessment is the temporal moment.

3.3.3.2.2.2 Physical Environment – Risk Perception

The survey booklet also contains thirteen numbered questions (Q1-Q13) on the respondent's interpretation of their personal vulnerability to disaster in the Wellington Region. The first four questions address personal risk identification from local natural hazards (Q1-Q2) and earthquake and tsunami (Q3-4). They are closed-ended questions to define the respondent's cognitive perception and level of awareness of their physical vulnerability to disaster. The next five questions focus on risk judgments or evaluations of potential personal consequences from earthquake- and tsunami-triggered disaster (Q5-9), followed by four questions about personal experience with disaster and personal history of evacuation (Q10-Q13). Questions 5 through 12 are closed-ended probing questions to explore subjective opinions and personal experiences, supplemented by open-ended anecdotal information in Question 13. In some cases, respondents used Question 13 as an organising exercise to construct or convey meaning from their personal experience with disaster. Opening the survey with these questions about disaster risk and experience establishes the environmental context of the study.

Section 3 (page 10) contains 1 further question (Q33) relating to personal vulnerability, where the respondent is asked to rate how much concern they have that an earthquake or tsunami disaster will require evacuation from the Wellington Region.

3.3.3.2.3 Population Characteristics

The remainder of the survey instrument (pages 13-14) contains twelve questions (Q42-Q53) on population characteristics. A section heading and 'demographics' title was intentionally omitted to promote flow from the prior section into these questions.

A brief narrative introduction explains that answers will be interpreted only at the population-level and reassures respondents of the confidentiality of their personal information. These questions were designed to collect data that would be considered compatible with other demographic studies and restricted topics to those that would not convey insensitivity to personal circumstances of respondent (e.g., omitting questions on marital or economic status).

All questions relating to the personal demographic attributes of the respondents (Q42-Q53) are closed-ended defining questions. The intent of these questions is to determine group-level categorization of the sample population and establish general trends for representative and comparative purposes. An explanation of these reasons and a reassurance of confidentiality in the survey narrative are provided immediately preceding this last section on population characteristics.

Statistics New Zealand collects demographic data in every 5-year census according to established classifications and statistical standards (Statistics New Zealand, 2011). Demographic data collected for this study were drawn from those used in the 2006 Statistics New Zealand national census and coded for consistency.

3.3.3.2.3.1 Age, Gender, and Ethnicity

For this study, it was not considered necessary or appropriate to ask a direct question on age. *Age* classifications (Q48) are aggregated into 4 response options (1=18-24 years, 2=25-44 years, 3=45-64 years, 4=65 years and over), based on the 'Persons 15 years and over' standard output set used for cross-tabulations Statistics New Zealand: The minimum age required for study participation is 18 years of age.

Gender (Q49) is a flat classification with two categories, male and female (Statistics New Zealand, 2011). In keeping with international practise, no provision is made in this study for other categories. Gender, along with age, is frequently used to produce national and sub-national population estimates and projections, and in cross-tabulations to compare social outcomes.

The statistical standard for *ethnicity* (Q53) defines ethnicity as "the ethnic group or groups that people identify with or feel they belong to (Statistics New Zealand, 2011). Ethnicity is a measure of cultural affiliation, as opposed to race, ancestry, nationality or citizenship. Ethnicity is self perceived and people can belong to more than one ethnic group." Statistics New Zealand recommends a minimum of three response options to meet data collection standards for ethnicity. The study survey provides five ethnicity response options (1=Māori, 2=Pacific Peoples, 3=New Zealand European, 4=Asian, and 5=Other). The response option 'Other' is open-ended to allow the respondent to self-identify at a more detailed level.

To avoid forced-choice responses to one ethnic affiliation, the question on ethnicity is written in the study survey as a multiple-response item. Where further ethnic self-identification was given under response option 5, responses were recoded using Statistics New Zealand Level 3 output groups and aggregated as appropriate into the numeric values for the Level 2 output groups applied to response options 1-4. After creating a multiple-response set, the results were then aggregated using Level 1 output groups to yield descriptive frequencies.

3.3.3.2.3.2 Qualifications, Employment, and Social Role

A *qualification* is a formally recognised award for educational or training attainment (Statistics New Zealand, 2011). Qualifications achieved in education and training are used in combination with other factors in making social comparisons. In Question 50, the respondent was asked to select their highest educational qualification from a list of response options for school and post-school levels, consistent with the New Zealand Register of Quality Assured Qualifications ("NZ Register" or NZREG). In this study, qualification level serves as a proxy for literacy and income level, which may affect comprehension and availability of financial resources for engaging in preparedness activities.

Question 51 captures information on whether respondents are working for pay. This question has multiple response options, since an individual can have more than one type of *employment status* for pay. It cannot be used to approximate income from

retirement or other non-employment sources, but may provide an indication of time resources available for engaging in preparedness activities.

For Question 52, the intent was to detect information on *social role*, both for those with employment income and those not working for pay (e.g., full-time homemaker, stay-at-home parent, student, retired, disabled, other social role). Again, this question has multiple response options, since an individual can have more than one social role with or without pay.

3.3.3.2.3.3 Household Composition and Dependents

Two questions (Question 44 and 45) collect data on the level of social responsibility a respondent potentially has for others in the household (as a proxy for the respondent's ability to self-manage the experience of disaster).

Firstly, the Statistics New Zealand classification of *household composition* (Question 44) is used to describe the attributes of this dimension of social life. Household composition is a derived variable that classifies all households according to the relationships between the people in them, and whether there is a family nucleus present or not (Statistics New Zealand, 2011). Households are hierarchically classified according to the presence, number and type of family nuclei, and the presence of related and unrelated people.

The eight classification options from Question 44 were collapsed into three household composition groups of one-family households, multi-person households, and one-person households. This was done because of a large amount of dispersion in the number of respondents (n=154) living amongst 4 different household types (living as single parents, with related family with or without children, or with unrelated people).

Secondly, respondents were asked how many *dependent children* under 18 years of age live in the household (Q45).

3.3.3.2.3.4 Tenure of Household, Years at Residence, Years in Suburb, and Transience

The length of time a respondent has lived in their current place of residence provides information on population migration. It can also form a basis for projecting regional social welfare needs. These data are collected by Statistics New Zealand as *years at usual residence*. Respondents were asked length of residence (Question 42), length of residence in the respondent's suburb/area (Question 43), and intent to remain in the same neighbourhood for two years (Question 47). As a group these items can serve as indicators of both population stability and potential availability for future longitudinal or interventional study designs. For Questions 42 and 43, data are collected in four rank-order intervals and then dichotomised into categories of 5 years or less and greater than 5 years. Question 47 is presented with dichotomous 'Yes' and 'No' response options.

In Question 46, home ownership or *tenure of household* is used as a proxy for permanent residency and level of social responsibility in the study area. Tenure of household is a key social and economic indicator found within demographic classifications used by Statistics New Zealand. It is a derived variable that classifies households in private dwellings according to whether the respondent household rents, owns, or holds the dwelling in a family trust, and if payment is made by the household for the right to reside in the dwelling. Recoding was necessary for three cases (#747, 1310, and 1386) from the 'Other" response category to match precodes for owners and renters. The 13 remaining cases in the 'Other' response category comprise a mixture of respondents living with family or in family-owned homes (where family trust or payment arrangements could not be determined) (n=9), a Housing New Zealand dwelling (n=1), an employer-provided dwelling (n=1), and a Vicarage (n=1).

3.3.4 Survey Administration

This section documents the administrative matters associated with conducting the survey.

3.3.4.1 Ethical Procedures

Ethics notifications and approval were sought and obtained from the Human Ethics Committees at Massey University and University of Canterbury. In fulfilment of the principles of informed consent, our survey documents address all requirements stated in the authorizations provided by both higher education institutions (Appendix 3). The study cover letter and information sheet explain the voluntary nature of consent to participate and the principles of anonymity and confidentiality that apply to the respondent's data. The applicable research ethics procedures were summarised in the cover letter and information sheet, and the PhD candidate was identified as the principal researcher. The study information sheet lists contact details for the PhD candidate, PhD supervision committee members, and a research ethics administrator.

3.3.4.2 Organisational Procedures

Several administrative and organisational management tasks involving numerous individuals were performed prior to administering the survey, with some tasks continuing on through the field data collection phase.

3.3.4.2.1 Survey Production and Administration Timeline

Following pre- and pilot-testing of the survey from July through August 2008 and subsequent revision (described further in Section 3.5, Quality Control), the survey instrument was proofed for layout, design, and typing errors by the PhD candidate and GNS Science social science staff in September and October 2008. Freepost reply envelopes printed with the GNS Science logo and return address, along with GNS Science outgoing postal envelopes, were ordered by GNS Science clerical staff, and the survey was submitted to a graphics and printing vendor in late October 2008.

Also in October 2008, unique ID codes were assigned by trained GNS clerical staff to each street address collected and listed in the sampling frame (*see* Section 3.4,

Sampling). These data were recorded in an Excel spreadsheet and used to generate mailing labels for the survey packets.

The surveys were delivered to GNS Science by the vendor in early November 2008. The PhD candidate and trained clerical staff subsequently hand-stamped each survey with a numerical imprint of the unique ID code in the lower right corner of each survey cover and sealed survey packets into a flat mailing envelope printed with the GNS Science colour logo and return address in the upper left-hand corner for posting.

3.3.4.2.2 Survey Distribution

The survey packets were posted to all households in the sampling frame over a 5-day period between Thursday, 6 November 2008 and Monday, 10 November 2008. A follow-up cover letter (Appendix 1) and second copy of the survey was posted to all households in the sampling frame during the week of Monday, 8 December 2008. The follow-up letter requested a response by Friday, 19 December 2008. This survey administration schedule allowed for a 6-week time period for respondents to complete the survey.

A University Post-Graduate Project Research Grant from the Earthquake Commission provided $10,000 toward covering the direct costs of survey production, printing and posting.

3.3.4.2.3 Processing Returned Surveys

As surveys were returned by respondents, GNS clerical staff updated the Excel spreadsheet to reflect the timing of the reply, with “Reply 1” indicating a return prior to the second posting, or “Reply 2” for delivery after the seconding posting. The last survey returned by a respondent was delivered to GNS Science on 26 March 2009, concluding a 20-week field data collection period for the survey. All hard-copy replies of the survey are centrally archived in secure file cabinet storage at GNS Science in Avalon, Lower Hutt, New Zealand.

3.4 Sampling

Measurement error can lead to producing survey results that are not representative (without internal validity, due to observational error) or not generalisable or comparable to a wider population (lacking external validity, due to sampling error). The target population for the study is the general adult population in Wellington, New Zealand. A reliable sample was obtained through a multi-stage cluster probability sampling plan. This section discusses the selection methods used for obtaining a sample that is suitable for generalising findings from the survey population to this target population.

3.4.1 Population and Area-Based Frame

The target population is the population of interest, or the population the study aims to represent. The unit of analysis for this study was defined as individuals from the general adult population (18+ years) in Wellington, New Zealand. Sampling from the general adult population provides the broadest base for future stratification of study results by demographic characteristics, while at the same time simplifying the selection criteria and potentially maximizing study participation rates. By studying a target population in the community environment instead of the health care environment, there is also a higher relative likelihood that the sample represents 'the community of walking well' (Peat, 2002). This is in alignment with the aims of primary prevention (Fletcher et al., 1996) and the PhD health promotion context introduced in Chapters 1 and 2.

An area-based sampling frame was selected within an isolated physiographic region of eastern Wellington. This region was chosen for its combination of vulnerabilities due to its coastal exposure and location east of the Wellington Fault (Figure 3.1): it has a broad range of natural hazards (earthquake, tsunami, seiche, liquefaction, landslide and wildfire); potential geographic isolation due to limited road access; and potential for public utility 'lifeline' disruption. Collectively these factors create a potential for mass evacuations and domestic disaster displacement from earthquake

and tsunami that is conceivably greater than elsewhere in Wellington. All residents of this region thus form a naturally-occurring constituency of an “at-risk” population.

In the photograph below (Figure 3.1), the area-based frame is visible as the “H”-shaped area between the white arrows, encompassing the elongate peninsula extending into Wellington’s Inner Harbour and out into Cook Strait, the isthmus connecting the peninsula to the lower North Island, and the ridgeline adjoining the isthmus. The Wellington Fault is indicated by the white dashed and solid line transecting the photograph.

Figure 3.1 Aerial View of the Wellington Region, Area-Based Study Frame and Wellington Fault

Photo courtesy of Jim Cousins, GNS Science

3.4.2 Sample Design

A sampled survey asks a sample portion of a target population to respond to survey questions (Trochim, 2006; Hampton & Vilela, 2007). If the sample is carefully chosen, the results for the sample will reflect the results that would be expected if the entire target population was surveyed. The sample can then be said to represent the target population. Almost all surveys rely on sampling to identify a portion of the population in which to study the characteristics under investigation (Fink, 2006; Fink, 1995e; Hampton & Vilela, 2007).

Selecting a robust sampling design is foundational for representativeness and generalisability of the study results. Probability sampling is the gold standard for ensuring generalisability and is widely used to obtain a representative sample (Hawthorne & Elliott, 2005; Hulley et al., 2007; Peat, 2002). It uses a random process to guarantee that each unit of the population has a specified chance of being included in the sample. This scientific approach provides a rigorous basis for estimating the precision with which phenomena observed in the sample represent those in the population, and for computing statistical significance and confidence intervals (Hulley et al., 2007).

Administrative economy dictated a multi-stage cluster sampling plan for this study. A cluster sample is a random sample of natural groupings (clusters) of individuals in the population, and is very useful when it is impractical to list and sample from all elements of the target population (Hulley et al., 2007). The multi-stage sampling plan for this study was carefully designed to achieve a sample size that would adequately balance the study goals of accuracy (large enough to control random error and representative enough to allow generalisability) and preserve administrative efficiency (acceptable cost both in time and money).

Community surveys often use a two-stage cluster sample: a random sample is drawn from blocks enumerated on a map and a field team visits the blocks in the sample, lists all the addresses in each, and selects a subsample for study by a

second random process. This sample is then used to generate a mailing list of addresses to receive the survey instrument (postal questionnaire) developed to collect data for the study. The protocol for the sampling plan in this study was as follows:

Stage 1. Selection of Suburbs from the Area-Based Frame

From a jurisdictional and census standpoint, the area-based frame generally encompasses the suburbs of Wellington's Eastern Ward and the suburb of Oriental Bay (Figure 3.2). A sample of 6 suburbs from the area-based frame was selected as the accessible population: Oriental Bay, Roseneath, Hataitai, Lyall Bay, Miramar North and Seatoun. Collectively they reflect the variety of geographic, geologic and socio-economic conditions found throughout the area.

Figure 3.2 Wellington Suburbs within the Area-Based Frame for the Study

Image Source: Statistics New Zealand

Stage 2. Selection of Households within the Sample Frame.

The unit of observation for the study was defined as the household. The sample frame was then defined as all households contained within the boundaries of the 2006 Statistics New Zealand Census maps for the 6 suburbs. The sample list was developed by physically recording household addresses in the field, using a systematic sampling interval of every 2nd to 3rd household on every street within the Census map boundaries for each suburb. Unoccupied households were skipped, as were households with letter boxes requesting no unsolicited mail. This yielded an accessible population with a total sample size of n=2451.

Stage 3. Selection of Study Participants within Households.

The study questionnaire was posted to all households on the sample list. One eligible adult was sought from each selected household to be a member of the study population. To randomise within the household, the study cover letter requested that the person who complete the questionnaire be the adult (age 18 or over) who most recently had a birthday. Thus, through methodologically robust methods of simple random cluster sampling, a probability sample was obtained for unit analysis of data at the level of one adult individual per household.

3.5 Quality Control

Two major sets of inference must be taken into account when determining the level of confidence about the conclusions drawn in a quantitative research investigation (Hulley et al., 2007): 1) the internal validity, or the degree to which the study accurately assesses the concepts measured; and 2) the external validity (also called generalisability), or the degree to which these conclusions can be appropriately applied to people and events outside the study. This section discusses the protocols followed for developing an internally valid survey instrument with reliable (consistent) measures, and reports on the bias analysis conducted to address the limits of the study generalisability.

3.5.1 Internal Validity and Reliability

The precision of a variable in measuring a construct and meeting standards of data accuracy is quantitatively described by psychometric properties of internal validity and reliability (Muijs, 2004).

3.5.1.1 Measuring Survey Validity

Survey validity means that a measure accurately reflects the *concept* it is intended to measure (Babbie, 2007). It also represents the *degree or extent* to which a measure quantifies what it is supposed to and does not measure what it is not supposed to (Fletcher et al., 1996; Muijs, 2004).

With valid survey measures, the respondent will know what questions and answers mean (face validity). The question will be appropriate for the intended measurement purpose (content validity); it will consistently produce meaningful relationships that are tested and observed with other similar constructs (construct validity); and it will reflect specific, measurable criteria (criterion validity) that favourably correlate with scores on other measures through a combination of concurrence and predictive capacity (Litwin, 1995; Pallant, 2007; Streiner & Norman, 2003).

3.5.1.1.1 Pilot Testing and Peer Review

A draft of the survey instrument was pilot-tested for face validity between July and August 2008 on a small sample from the general population with similar demographic characteristics to the target population. Factors of interest in the pilot test included: the ease with which the survey form could be understood and used, word clarity, question comprehension, suitability of response options, potential cultural issues, the consistency with which responses were properly recorded, and timing the completion of the instrument (Fink, 2006; Hulley et al., 2007; Jamieson, 2002).

During the same period as pilot-testing, the survey was pre-tested with members of the PhD supervisory committee, external mentors at Victoria University of Wellington and Mayo Clinic College of Medicine, and GNS Science social science colleagues for their peer review on content validity, construct validity, and criterion validity.

Debriefing sessions were held with individuals from both the pre-testing and pilot testing groups to obtain feedback on ambiguities, difficult questions, and what could be improved. Feasibility of survey length was cited as the most common concern. In both the peer review and pilot test, survey completion time ranged from approximately 30 minutes to 75 minutes. Some suggestions were also made to change the internal item ordering, response labelling, word choice, and content of standardised scales.

After the pre- and pilot-tests, the survey was re-assessed in August 2008 for question necessity and options were explored for using abbreviated versions of standardised scales or alternate language. Potential scale issues were researched through literature review and personal communication with scale authors and researchers (M. Eriksson, pers. comm., August 2008; E. Deci, pers. comm., July 2008). Based on the advice of these researchers, the 13-item Sense of Coherence scale was selected over the 29-item version (Antonovsky, 1987), and scale ordering and word choice intact on all scales was left intact to preserve scale validity and reliability.

Additional revisions were made in September 2008 to shorten the survey, improve response structures and alternative choices, ensure the correctness of question numbering, maintain logical sequencing, and improve overall survey language and appearance. The final draft was approved for printing and distribution by the PhD supervisory committee in October 2008. (*See* Section 3.3.4 for additional information on the survey production and administration timeline.)

3.5.1.2 Measuring Survey Reliability

Survey reliability is a measure of the *reproducibility* of the data gathered (Dyrbye et al., 2007). Using validated psychometric scales increases the likelihood of producing survey results that are both valid and reliable (Fink, 2006).

A psychometric scale is an instrument or method that measures a construct by using an aggregation of question sub items that cluster together, and then scores the qualitative attributes of a construct as a single item or variable (Pallant, 2007). Reliability is thus the quality of a scale that suggests that the same data would have been collected each time in repeated observations of the same phenomenon by using the same instrument (Babbie, 2007).

Reliability can be assessed for scale variables using internal consistency, an indicator of how well the different items that make up the scale are all measuring the same underlying construct or attribute (Pallant, 2007). Internal consistency is most commonly measured by calculating a statistic known as Cronbach's coefficient alpha (Antonius, 2007). This statistic provides an indication of the average correlation among all of the items combined to make up a single scale. Generally, alpha coefficient ranges in value from 0 to 1 with higher values indicating greater reliability (Bland & Altman, 1997). Nunnally (1978) and DeVellis (2003) recommend an alpha value above 0.7.

Psychometric reliability is particularly important for producing a truly satisfactory survey of health-related quality of life (Fink, 2006). This study uses validated psychometric scales for measurement of all primary health-related quality of life variables.

3.5.1.2.1.1 Internal Consistency

Scale authors and researchers have reported good internal consistency (Cronbach's alphas above 0.7) for each of the validated psychometric instruments used in the survey (*see* Section 3.3.3.2). Within the study sample, calculations of Cronbach's alphas yield values above 0.8 for these scales (*see* Chapter 4, Table 4.9). These results indicate strong reliability and thus a high degree of freedom from random measurement error, which also supports the generalisability of the findings from the sample population to the target population.

Below the interval or scale level of measurement, many surveyors do not evaluate internal consistency because they are not going to be combining several individual questions or items to measure one attitude or characteristic (Fink, 2006). Instead, they are interested in the group responses to these individual items. This is especially the case when each item reflects a separate or discrete perception, attitude, or behaviour.

The outcomes of interest in this PhD thesis are the associations between the validated health-related QoL scale variables and the level of participation in a select number of health-protective preparedness behaviours. These behaviours are measured at the ordinal level of measurement and represent independent and discrete elements or items. Therefore, rather than trying to come up with a new psychometric standard that quantifies an overall preparedness score or other metric, internal consistency was not considered appropriate for evaluation at the individual question or item level.

3.5.2 External Validity

External validity is the degree to which the results of a study with a sample of subjects can be generalised to make statements about a much larger population of subjects (Trochim, 2006). The ability to generalise from the sample to the target population is critically dependent on representativeness. A sample is representative

to the extent that it has the same distribution of characteristics as the population from which it was selected. In population research, a study shows good representativeness if the subjects are selected with a sampling procedure that produces a genuine random sample. This was accomplished for the study through multi-stage cluster randomisation (see prior discussion in Section 3.4, Sampling). A bias analysis was further conducted to assess if the sample is representative of the target population (*see* Section 4.1.1).

For external validity, the sample size (number of surveys distributed) must also be adequate for producing a response rate (number of cases of respondents) with sufficient statistical power for generalising to the number of people in the target population, and to other similar populations. The item response rate (the number of valid responses to individual questions) also affects the external validity of individual questions in the survey data set. Survey and item non-response can reduce the effective sample size, affecting the statistical power to generalise to larger populations and to detect change between different groups or interventions (Edwards et al., 2002). A low response rate can still yield a representative sample, however, if there is a small difference between the characteristics of respondents and non-respondents (Beebe, 2007). Conversely, high response rates can yield an unrepresentative sample (high non-response bias) when there are dramatic differences between respondents and non-respondents. Bias can thus be introduced if the analysis fails to take into account non-random reasons for non-response and produces incorrect conclusions.

3.5.2.1 Study Procedures

This section reports on obtaining a valid sample size, calculating survey response rates, and validating respondent data at the item level.

3.5.2.1.1 Sample Size Estimation

The population of interest for this study is the usually resident civilian adult population (18+ years) living in permanent private dwellings in Wellington, New

Zealand. The target population is approximately 141,105 adults, according to the 2006 New Zealand Census of Population and Dwellings.

On-line sample size calculators (*Power And Precision™; Mayo Clinic Division of Biostatistics website)* were used obtain a minimum recommended sample size for statistical similarity in population characteristics with a +/- 5% margin of error at a 95% confidence level. These calculations indicated a need for up to 384 survey respondents, requiring posting to 1277 people to achieve a 30% response rate.

To further reduce the potential for sampling error and coverage error, and to analyse with a greater degree of statistical reliability, a larger sample was sought by expanding the systematic sampling interval of every 2nd to 3rd household to every street within the Census map boundaries for each suburb (*see* prior discussion in Section 3.4, Sampling). This yielded a total sample size of 2451 households.

3.5.2.1.2 Survey Response Rate

The survey response rate is n=695 (28.4% of the total posted, or 695 out of 2451). This response rate is consistent with expectations for natural hazard research surveys administered without remuneration in New Zealand *(pers. comm. with PhD Supervision Committee, 2009).*

An additional 61 out of 2451 questionnaires (2.5% of the total posted) were returned blank and are not included in the final count of n=695.

- Most of the blank returned questionnaires (49 out of 61) were unopened survey packets stamped by New Zealand Post to indicate an undeliverable postal address ('Not Known' n= 2; 'Gone No Address' n=11; 'No Such Number' n=29; 'Insufficient Address' n=4; 'Redirection Expired' n=2; 'No Delivery Point' n=1).
- Twelve (12 out of 61) questionnaires were returned by the householder.
    - Five were returned blank by the householder without any markings (Unique ID Code #327, 344, 345, 970, and 1299).

- Four attached notes expressing regret but indicated life circumstances precluded their participation (Unique ID Codes #1069, 1564, 1894, and 2112).
- Three noted individual opposition to participating in the study. Reasons cited were design considerations (Unique ID Code #710), 'not interested' (Unique ID Code #1823), and timing (code rendered unidentifiable).

Table A4.1 presents the number of cases of respondents in the study, tabulated by proportion within each suburb of the sampling frame.

3.5.2.1.3 Statistical Power

Statistical power was calculated for the response rate of 28.4% using basic and long established power analysis procedures *(pers. communication with Jeff Sloan, PhD, Mayo Clinic Division of Biostatistics, 2009; Power And Precision™; Mayo Clinic Division of Biostatistics website)*. For any proportion reported on the total sample, the results will be accurate to within 3.8 percentage points with 95% confidence. For any mean reported on the total sample, it will be accurate to within 3.8% of the standard deviation. For example, if 40% of the sample reports "yes" in response to any given question, then we have a confidence of 95% that the true population value falls between $\pm$3.8 of 40% (or, 36.2%-43.8% of the population would respond "yes" to that same question).

For correlation coefficients calculated between two variables on the total sample, there is 80% power to detect a true correlation coefficient of 0.11 or greater. This is a small effect size, indicating that all but the smallest of correlation coefficients can be detected.

Comparing two groups equally split among the 695 observations (347 observations in each sample) will provide: 1) A two-sample t-test with 80% power to detect a difference in mean scores of 21% times the standard deviation. This is also a small effect size (Cohen, 1988). 2) An equality of proportions test with 80% power for a

Fisher's exact test to detect a difference of 11% between the proportions in each sample.

The sound sampling procedures, together with satisfactory response rates and sufficient statistical power, indicate that the results of this study can be generalised with a high level of confidence that they are correct.

3.5.2.1.4 Item Response Rate

Item response rate is a count of the actual number or percentage of valid responses to each question item, adjusted for any incomplete or missing data. It provides an indication of how well the survey 'worked' for collecting data on measures of interest and the utility of generalising item-level results to the target population.

Missing data at the item level are unavoidable in epidemiological and clinical research (Sterne et al., 2009) because it is rare to obtain complete data from every participant. They are also a common occurrence in quality-of-life assessments that make comparisons between groups or test the efficacy of different interventions (Huntington and Dueck, 2005).

Results for 7 numerical questions in the study survey (Questions 2, 9, 16, 17, 31, 35, and 52) had missing values at a level requiring missing values analysis prior to consideration for statistical analysis. Methods for handling missing data are further described in Section 3.6.4. Frequency counts and percentages for missing values at the individual variable level and suitability for quantitative analyses are tabulated in Appendix A2.2.

3.5.2.1.5 Additional Strategies for Decreasing Survey Non-Response Bias

Protocols and procedures for developing the study survey were compared with forty strategies on increasing survey response rates (Edwards, et. al, 2002) evaluated in a systematic review. Table 3.2 lists these strategies and the following bullets summarise key points from the non-response bias analyses.

- **Incentive:** Because of project budget limitations, no financial remuneration was provided for study participation.
    - The study cover letter and information sheet appealed to the altruism of the survey recipient.
    - Concurrent with survey administration, the GNS Science public information officer and staff photographer prepared and distributed a press release to Wellington media outlets. The purpose of this press release was to generate media interest that could raise public awareness and about the study topic and encourage participation from the study population through informal 'pre-notification' media messages. This media strategy led to radio broadcast and newspaper stories, including an interview aired on the Radio New Zealand national news programme "Checkpoint" and a print article in a weekly newspaper, The Wellingtonian.
- **Length:** The 14-page questionnaire could be considered lengthy by some standards. However, because the study design sought to develop a strong baseline data set and involved several multiple-item validated scales, the supervision committee approved this level of data collection.
- **Appearance, Delivery, and Contact:** The survey design for this study met the majority of the positive strategies listed under the categories of survey appearance, delivery and contact (Table A2.3). Where it diverged in procedure it was consistent with standard practise for natural hazards social science research by GNS Science and within project scope.
- **Content:** The questionnaire met all strategies on content proposed by Edwards et al. (2002) that are noted to reduce survey non-response, except where the nature of the research (attitudinal; involving potentially sensitive questions) indicated otherwise, or where questions were designed in conformance to GNS Science norms for natural hazards social science research.
- **Origin:** Respondent reactions to the survey were potentially controlled by the type of investigation; the sponsoring organisations (University of Canterbury, Massey University, Central Queensland University, GNS Science, and the

Earthquake Commission); and the ethnicity of the PhD candidate and her supervisors.

- **Communication:** Credible and supportive language was used throughout the cover letter, follow up letter, study information sheet and entire survey to promote a desire to participate in the study and to increase survey and item response rate (Appendix 1). To reduce the occurrence of unanswered questions, instructions were included within the questionnaire encouraging item completion and placed a special emphasis on full completion of the validated psychometric scales.

Prior to distribution, the survey design and contents were further reviewed for consistency with strategies for design and distribution that are known to increase response rates and reduce survey non-response bias *(pers. comm. with Timothy Beebe, PhD, Director of the Mayo Clinic Survey Research Center, 2008; Gowan PhD Supervisory Committee, 2008).*

Table 3.2. Strategies for Increasing Response Rates to Postal Questionnaires

	Strategy	Effects on Response (Edwards, et. al., 2002)	Study Survey (Gowan, 2011)
	Incentive provided		
1	Monetary incentive *v* no incentive	(+)	–
2	Incentive with questionnaire *v* incentive on return	(+)	n/a
3	Non-monetary incentive *v* no incentive	(+)	–
	Length		
4	Shorter *v* longer questionnaire	(+)	–
	Appearance		
5	Brown envelope *v* white	(+)	–
6	Coloured ink *v* standard	(+)	✔
7	Folder or booklet *v* stapled pages	(+)	✔
8	More personalised *v* less personalised	(+)	✔
9	Identifying feature on return *v* none	(+)	✔
10	Coloured paper *v* white	(+)	–
	Delivery		
11	Recorded delivery *v* standard	(+)	–
12	Stamped return envelope *v* business reply or franked	(+)	–
13	Outward delivery to work address *v* home address	(+)	–
14	First class outward mailing *v* other class	(+)	✔
15	Pre-paid return envelope *v* not pre-paid	(+)	✔
16	Stamped outward envelope *v* franked	(-)	✔
17	Commemorative stamp *v* ordinary stamp	(-)	n/a
	Contact		
18	Pre-contact *v* no precontact	(+)	–
19	Followup *v* no followup	(+)	✔
20	Postal followup including questionnaire *v* postal followup excluding questionnaire	(+)	✔
21	Mention of followup contact *v* none	(+)	–
22	Pre-contact by telephone *v* post	(-)	n/a
	Content		
23	More interesting *v* less interesting questionnaire	(+)	✔
24	User-friendly questionnaire *v* standard	(+)	✔
25	Factual questions only *v* factual and attitudinal	(+)	–
26	More relevant questions first *v* other items first	(+)	✔
27	Demographic items first *v* other items first	(+)	–
28	"Don't Know" boxes included *v* not included	(+)	✔
29	Sensitive questions included *v* no sensitive question	(-)	✔
30	Most general question first *v* last	(-)	–
	Origin		
31	University sponsorship or other source *v* other organisation	(+)	✔
32	Sent by more senior or more well-known person *v* less senior or less well known	(+)	–
33	Ethnically unidentifiable name/white name *v* other name	(+)	✔
	Communication		
34	Explanation for not participating requested *v* not requested	(+)	–
35	Appeal stresses benefit to respondent *v* other	(+)	✔
36	Appeal stresses benefit to sponsor *v* other	n/a	✔
37	Appeal stresses benefit to society *v* other	n/a	✔
38	Response deadline given *v* no deadline	n/a	✔
39	Instructions given *v* not given	(-)	✔
40	Choice to opt out from study given *v* none	(-)	✔

Key
(+) Response higher with first category
(-) Response lower with first category

3.6 Data Management

In addition to using valid and reliable questions and appropriate sampling strategies, data management procedures must also stand up to the test of providing a sound scientific basis for analyzing the data set as a whole. This section reports on the systematic integrity of the data set by describing the conventions and protocols for data organisation and management.

These procedures are described in the subsections below as follows: **3.6.1 Data Coding,** transforming narrative survey questions and answers into numerical data suitable for quantitative statistical analysis; **3.6.2 Data Processing**, constructing the master data file and screening the data for any unusual situations; **3.6.3 Data Transformation/Processing**, additional preparation of data for analysis; **3.6.4 Data Validation** checking the accuracy of data entry and exploring the meaning and significance of missing data., and **3.6.5, Data Security**.

3.6.1 Data Coding

Each self-administered postal survey returned by an individual represents a potential "case" (or "observation") with responses that can be converted from raw data into a working data file for statistical analysis. Coding is the process by which numerical values are assigned to quantify all raw data – the words, phrases, figures, and symbols recorded as responses – in order to prepare the survey results for quantitative statistical analysis (Fink, 2006).

Prior to coding and entering the raw survey data into an electronic database, the PhD candidate received training through the New Zealand Social Statistics Research Network in the use of SPSS (Statistical Package for the Social Sciences) computer software at a week-long course offered by Victoria University of Wellington.

Subsequently, a survey codebook was created to document how each survey construct was operationalised, named, labelled, and coded into numerical data as SPSS variables. The survey codebook, together with the survey instrument, formed

an operations manual for constructing an electronic version of the survey data set. An SPSS master data file was then created to electronically store all survey data using Statistical Package for the Social Sciences (SPSS) GradPack software (version 17).

The study survey contains both quantitative and qualitative data. Quantitative variables and scales with numerical values were formatted with pre-coded tick boxes for each response option listed in the survey. Most qualitative variables were not coded; these string data underwent content analysis and were aggregated into summary categories and counts (*see* Section 3.6.3.5.3, Screening Qualitative Data).

3.6.2 Data Processing

Three primary steps were followed in preparing the SPSS coding conventions to process all survey data into the SPSS master data file.

- *Step 1. Define Variables.* Each question item ("*variable*") was defined with a conceptual or categorical name, and then assigned an abbreviated "*variable name*" (mnemonic) and "*variable label*" (descriptive phrase).

- *Step 2. Define and Assign Variable Values and Types.* Data-typing and scoring conventions were prepared for handling each response or answer item. These conventions summarise coding instructions for entering, formatting, and converting respondent data in SPSS.
  - Most "*variable values*" replicate the pre-coded numbers printed next to survey response options. For answers that did not match a precode or stay within the scope of the response options, the convention was to disqualify the response by applying a numeric user-defined missing value of "707". For items that were left blank, an SPSS system-defined missing value of "." was applied.
  - Most "*variable types*" in this survey are numeric variables. Exceptions are fill-in-the-blank string variables (e.g., Q13, Q32, Q36, Q56) and fill-in-the-

blank ‘other’ response options accompanying Q1, Q33, Q35.9, Q38, Q39, Q40, Q44, Q46, Q52, and Q53 (string variables).

- There are no monetary or date variables in this study.

- *Step 3. Define Measurement Types.* A measurement scale was assigned for each answer item. The “*level of measurement*” refers to the relationship among the values that are assigned to the attributes for a variable. It also describes the analytical role or function of each variable in any statistical analyses. SPSS provides three labels for the four levels of measurement: nominal, ordinal, and scale (encompassing both interval and ratio).

The specific characters or qualities being measured from all 56 numbered survey questions (Q1-Q56) comprise 214 separate items, each thus forming a discrete SPSS variable (194 numeric variables and 20 text or ‘string’ variables) defined by several attributes: variable mnemonic, narrative label, variable value, data type, and level of measurement.

After establishing the structure of the master data file by defining each variable for the electronic data base in the SPSS ‘Variable View’ window, respondent data from the 695 returned hard-copy surveys were entered in the SPSS ‘Data View’ window. Each case number (“unique ID”) is represented by a row and each variable is represented by a column. For consistency of interpretation, the PhD candidate solely entered all raw data from every hard-copy survey into the electronic master data file.

3.6.2.1 Handling of Unusual Situations

Six (6) cases out of the 695 total cases required special handling. Determining how to treat these case-specific situations was a consensus decision reached in discussions between the PhD candidate, senior supervisor Ray Kirk, PhD, and co-supervisor Jeff Sloan, PhD.

- *Case 269:* In the comment space for Question 56, a respondent stated, “my husband tired of this survey on the first page, so I finished it. It would give

you more information if you knew what personality types were answering." Because both individuals reside in one household, and the level of randomisation was household not individual, all data recorded for this unique ID were treated as belonging to one valid case.

- *Case 758:* An undetected printing error resulted in posting this survey with a blank page on page 13, normally containing questions 42-51. We are unaware of any other surveys with missing pages. All data completed by the respondent on the other pages of this survey were entered and this unique ID was considered as a valid case for those measures.
- *Case 1528:* Two completed surveys were returned for this unique ID code. Differences in gender, age, family type, and number of dependents clearly indicated these two surveys were completed by two different individuals. One respondent indicated that the length of time they lived in the residence was between 0-1 years, whereas the other indicated 1-3 years. Because the household might have changed hands between the first and second survey posting, both cases were retained as valid and recoded into the master data file as unique ID codes 15281 and 15282.
- *ID code removed:* Two completed surveys were modified by respondents in such a way that the unique ID code was missing. One respondent cut off the code stamp from bottom right-hand corner of the front cover. The other removed the survey cover page and information sheet printed on the inside of the front cover, thus removing the code stamp along with it. Both cases were retained as valid and recoded as unique ID codes 3001 and 3002, respectively.
- *Other Cases:* In processing returned surveys, blank opposing pages were episodically found, suggesting these pages might have stuck together and caused the respondent to unintentionally skip questions as they worked their way through the survey booklet. Other respondents appeared to have skipped specific topical sections or portions of sections within the survey, perhaps due to time or other personal preference. No tally was made of the final number of these cases, since it is not the aim of this study to create a new and validated unidimensional survey instrument for global scoring purposes. Overcoming these types of errors might be facilitated in the future

through instructions that specifically request that the respondent check that each item and every page for completion prior to returning their survey.

3.6.3 Data Transformation/Processing

Data transformation procedures (e.g., recoding, scale scoring, reducing or collapsing the number of response options into groups or dichotomised categorical variables, multiple response option processing) were necessary for a large number of 214 SPSS variables derived from the 56 questions n the survey.

The result was a final number of 99 study variables (92 quantitative and 7 qualitative variables). Each of these 99 study variables can be considered as a potential research question, subject to appropriate validation of their metrics. These variables are tabulated by their distinct variable item number and their suitability for quantitative analysis is indicated in Appendix 2, Table A2.2.

3.6.3.1 Recoding

Ten questions (Q1, Q33, Q35.9, Q38, Q39, Q40, Q44, Q46, Q52, and Q53) provide open-ended 'other' response options to allow the respondent to self-identify their answer at a more detailed level. Where appropriate, these 'other' answers were coded with pre-coded variable values for the forced-choice response options, and then aggregated to derive the total count and percentage for each pre-code value. Where self-identified answers did not match pre-coded response options, additional variable labels were created for these items and total count and percentage was reported separately.

3.6.3.2 Scale Scoring

A scale is an aggregation of question items that cluster together and can be scored as a single item (Pallant, 2007). The study questionnaire includes seven validated scales (Q14, Q15, Q16, Q17, Q19-28, Q29, and Q31) comprising 76 items. The

values for scale items in the master data file were recalculated according to published author instructions for scoring each validated instrument.

3.6.3.3 Dichotomisation and Aggregation

All 19 items in Question 35 were dichotomised for purposes of inferential analysis. One demographic question (Q44) required aggregation of the response options into a smaller number of discrete categories to provide consistency with Statistics New Zealand classifications.

3.6.3.4 Multiple Response Variables

Multiple response questions shed light on whether other forced-choice options adequately cover all responses that respondents want to give. Since the answer to each response option in this question type does not preclude an answer for the others, the responses are not mutually exclusive. Nine survey questions provide the respondent with the option to select more than one answer. All nine questions (Q1, Q10, Q11, Q38, Q39, Q40, Q51, Q52, and Q53) involve distinct categorical variables measuring qualitative attributes on a nominal (unordered) scale.

Each of these response options was regarded, for the purpose of SPSS coding and data entry, as a sub-item (or elementary variable) of an overarching multiple-response variable. Sub-items were created under each variable and responses entered with a dichotomous 1 (= Yes) or 2 (= No).

A multiple response set was then generated in SPSS, which creates a ‘new’ variable based on the responses to the existing set of variables. The results for each ‘new’ multiple response variable, indicating the number of times a set of responses occurs, were then used to produce accurate counts and frequencies.

3.6.3.5 Screening Procedures

Assumptions about the nature and distribution of data are implicit in the theory underlying statistical methods. Violation of these assumptions can result in

erroneous interpretations. Study data were appropriately screened as described below for assumptions about the population from which the sample has been drawn.

3.6.3.5.1 Screening Quantitative Data for Normality

Many statistical techniques assume that the probability distribution of scores for the dependent variable is 'normal' (Pallant, 2007). In normal distributions, 99% of the observations fall within +/- 3 standard deviations of the mean (Fink, 1995f), forming a symmetrical, bell-shaped curve with the greatest frequency of scores in the middle and smaller frequencies towards the extremes. Some authors recommend mathematically transforming non-normal distributions of dependent variables, in order to better meet the assumptions of parametric statistical analyses that require normally distributed scores (Tabachnick & Fidell, 2007).

Assessing the normality of the dependent variable (Question 35) and transforming it is not particularly meaningful in this study. The underlying nature of this construct is to determine stage of behaviour along a continuum of action. This continuous random variable is progressively represented by a numeric value falling within a particular interval along a "stage of change" scale, ranked from the lowest level of activity (1= precontemplation) to the highest level of activity (5=maintenance).

In this study, the primary interest in examining the shape and symmetry of the distribution on the dependent variable is to visually communicate the behavioural patterns of preparedness in the sample. The distribution would be expected to be skewed and does not necessarily indicate a problem with the measure.

3.6.3.5.2 Screening Quantitative Data for Outliers

Many statistical techniques are also sensitive to outliers (Fink, 1995a; Antonius, 2007; Pallant, 2007). When outliers are present, the main analysis can be conducted twice: with and without the outlier. In this way, the effects of the outlier can be determined and the results used in deciding how to handle the outlier. Data were screened for outliers but were not found at any level requiring special handling.

3.6.3.5.3 Screening Qualitative Data

Three open-ended survey questions (Q13, Q32, and Q36) have no inherent numerical values but can be described qualitatively according to patterns that emerge from the respondent's narrative answers. While these questions are not part of the specific aims of this quantitative baseline survey, they provide anecdotal perspective that enriches the data set and may have provided an opportunity for the respondent to feel more personally involved as a study participant. These responses were reviewed for any thematic patterns via content analysis, especially regarding commonalities in attitudes and insights gained from their personal values and experiences, and are summarised in Chapter 4, Results, along with quantitative findings.

The last three survey questions (Q54-56) provide respondents with the opportunity to indicate any interest in future contact or follow-up study participation, and to offer any comments on the survey. These data were reviewed and noted for future reference.

3.6.4 Data Validation

Errors of observation (non-sampling error) can affect the interpretation of a measurement, lead to incorrect conclusions, and mar representativeness. In addition to the procedures followed for establishing internal and external validity (*see* prior discussion in Section 3.5), the data were reviewed for data processing errors and question incompleteness.

3.6.4.1 Error Checks

During data processing, each case was verified for data entry errors immediately after completing data entry from each hard-copy survey. The values entered in each cell of the master data file were compared with the respondent's original questionnaire to verify the accuracy of data processing.

To further screen the data and identify any additional errors needing correction, numeric counts were produced on all data in the master data file. First, the unique ID codes of each respondent were tabulated in an SPSS output file and were cross-checked with archived original hard copies to confirm correct ID coding. Next, frequency tables were prepared to display the minimum and maximum values for all variables. Each variable was then reviewed for out-of-range values (i.e., values outside the range of assigned precodes for each response item). To ensure reliable data and consistent interpretation, a sample of the data was recoded.

These error checks were conducted in September 2009, immediately following completion of data entry. Twelve data entry errors were detected. They were corrected by retrieving the original questionnaires from hard-copy file storage and re-entering the actual response code in the SPSS master data file. These tests were conducted again in December 2009 following minor revisions to coding protocols (to simplify the handling of missing data); one error was found and corrected. The master data set was thus established as "clean" and free of any incorrect cell entries or out-of-range coding entries.

3.6.4.2 Missing Values

When respondents completely skip or partially complete a survey question, the resulting incomplete data ('missing data') can present a potential for non-response bias in the survey results (Dyrbye et al., 2007). Awareness of the extent to which missing data may potentially undermine the validity of research results is an essential part of assessing data integrity. Missing data at the item level can result from unanswered questions, ambiguous responses (unidentifiable or indiscernible), or answers that are outside the scope of the response options.

3.6.4.2.1 Definition and Significance

A variety of standards exist for defining the extent and statistical significance of missing data or 'missingness'. The statistical standard from the US National Center for Education Statistics states: *"A unit or item response rate less than 85 percent*

must be evaluated for the potential magnitude of non-response bias before the data or any analysis using the data may be released." (NCES Standard 4-4-1).

Another widely accepted convention with a more conservative random-error cutpoint is cited by Pallant (2007) at a missing data count of ≤ 5% (95% response rate) :*"Where the data set for a measured variable contains few missing values (roughly less than 5% of the total number of cases), these values can be considered to be 'missing at random' and thus do not introduce bias."*

For this study, a standard was set for statistical significance of missingness at the ≤ 5% threshold (35 or more respondents out of 695 total respondents) for randomness.

3.6.4.2.2 Causes and Types of Missing Data

Multiple reasons exist for unanswered questionnaire items: the respondent might skip or not state their answer to the question because they do not understand the question or response options; they do not actually know the answer; they miss the questions (e.g., do not see the question or the response options), or they do not want to answer (e.g., refuse to answer for whatever reason).

When missingness reaches a level higher than that considered to be due to chance, it is important to investigate why (Pallant, 2007). The scientific validity of the results for the survey question will depend on how many of those respondents who failed to complete the question actually did so by chance, and how many actually did so deliberately. Throughout the literature (Huntington & Dueck, 2005; Little & Rubin, 2002; Schafer, 1997), the distinction between missingness by chance or deliberate intent is described as two general types of missing data: ignorable and nonignorable.

- With ignorable missing data, the reason that response data for a given variable are missing is *unrelated* to the actual data value that the respondent might have provided, had they completed the question. The difference between the unreported value and the potential true value is random.

- With nonignorable missing data, the reason that response data are missing is because of some form of systematic bias against the question. The difference between the unreported value and what the respondent might have provided, had they completed the question, is nonrandom. Reporting any results for the question might introduce nonrandom ('systematic') bias to the overall findings.

In certain cases, statistical methods allow consideration of whether to replace missing data with plausible estimates, i.e., the researcher 'imputes' or attributes an answer value to the question on behalf of the respondent. Imputation is permitted because a risk of systematic bias exists with either including or excluding cases with missing data (Sterne et al. 2009), especially in cases with partial responses. The level of risk depends on the reasons why the data are missing.

3.6.4.2.3 Missing Data Classifications

The different reasons for missing values are commonly classified (Little and Rubin, 2002) as: missing not at random (MNAR), missing completely at random (MCAR), and missing at random (MAR). The responsibility rests on the data analyst to assess the reason for missing data and the likelihood of systematic bias being a serious concern. Unfortunately, it is not possible to completely distinguish between ignorable and nonignorable missing data using observed data. The genuine explanation for item non-response and the significance of missing data thus necessarily involve subjective interpretation.

For example, nonrandom influences or systemic differences include events such as a respondent not finding a part of a question applicable to their circumstances; refusing to answer a question due to style or sensitive nature of a question; or altering the response format (e.g., a respondent doesn't agree with the hierarchy of forced-choice response options and develops their own protocol). These data are considered MNAR because even after the observed data are taken into account, systematic differences remain between the missing values and the observed values (Sterne et al., 2009). The pattern of missingness is such that the missing values cannot be reliably predicted from other dataset variables. These are 'nonignorable'

cases of missing data and should not be included in analyses with other cases where the question was answered properly.

If data are missing completely at random (MCAR) due to events such as the pages of a questionnaire sticking together, a page missing due to photocopying errors, or the respondent losing the survey or forgetting pages, they are likely to be rare occurrences which will not introduce substantive bias to the results (Fairclough, 1998; King et al, 2001; Huntington & Dueck, 2005). In these cases, the pattern of missing values does not depend on the observed data values; there are no systematic differences between what would be the data values for the missing cases and those reported for the observed cases. The missing data can be considered 'ignorable' and are not suggestive of systematic bias; they do not compromise the validity of analyses.

The meaning of missing values may be only an assumption, however, and not an actual property of what the true data value would be if the respondent answered the question (e.g., a respondent may have skipped over one or two psychometric scale items inadvertently in haste or fatigue, or might not indicate a level of preparedness activity because they haven't considered engaging in the activity at any level whatsoever). When any difference between missing values and observed values might be explained by differences in observed data only, or is unlikely to be due to systematic differences between a respondent's missing value and the true data value, it is plausible that data are missing at random (MAR). Like MCAR data, MAR data can be considered 'ignorable' and do not compromise the validity of analyses. MAR data can be examined for their suitability of estimating the missing values through imputational procedures (McArdle, 1994; Schafer & Olsen, 1998). 'Missing at random', however, is an assumption that justifies the analysis, rather than a property of the data itself (Sterne et al. 2009).

3.6.4.2.4 Study Procedures

Consistent with the data processing procedures outlined in the beginning of this Section, the SPSS system-defined missing value code of "." was applied when

skipped questions or any ambiguity about the intent of the respondent's marking was encountered (e.g., indiscernible markings, more than one response to single-response variables). If the marking fell outside the scope of response choices, a *user-defined missing value* code of "707" was recoded. One exception to this coding protocol was made: on Question 16, the respondent was asked to circle a number on a semantic differential scale. In four cases (Case ID #245, 467, 1635, 2052), respondents clearly drew a deliberate circle around two adjacent scale numbers to indicate a range. In these cases the interpolated mid-point value was entered into the data set (e.g., value range of 2 to 3 recorded as 2.5).

User-defined missing values are preserved in the electronic master data set for any future consideration. Prior to statistical analyses, however, user-defined missing values were recoded to system-defined missing values in separate analytical data files for non-scale variables. This was done to avoid any possibility of the former being seen as valid cases and distorting the data. For the validated psychometric scales containing multiple items, appropriate SPSS syntax was included for calculating missing values.

Missing values analysis does not apply to seven (7) numbered survey questions (Q13, 32, 36, 38, 39, 40, 45). For six (6) of the 7 questions (all except Q36), the respondent would logically skip the question if it did not apply to their personal circumstances. Three (3) are qualitative string variables (Q13, 32, 36). Consideration of missing values on these questions is therefore inappropriate for missing values analysis and/or outside the scope of the PhD thesis analytical plan. Using descriptive results for these foregoing questions in quantitative analyses would be inappropriate in this study design and cannot be used to generalise from the sample population to the target population.

Missing values for each of the eligible quantitative variables, and their suitability for quantitative analyses based on the $\leq$ 5% threshold, are listed in Appendix 2, Table A2.2. Analysis of the significance and meaning of these results for variables that exceed this threshold is further discussed in Chapter 4, Results.

3.6.5 Data Security

In addition to the secure storage of the original hard-copy surveys, as described in Section 3.3.4, multiple precautions are being taken to preserve the integrity of the electronic data set and protect it from accidental or intentional modification.

Firstly, to assure vital information remains consistent, complete and accurate, a master data file was created and handled solely by the PhD candidate, as described in Sections 3.6.1-3.6.4. Once the data set was declared "clean" and all data processing and validation tasks were complete, the master data base was "frozen" in January 2010. All statistical analyses were carried out on this data set.

This master data base is securely stored on the network drive of the PhD candidate at the University of Canterbury Health Sciences Centre in Christchurch, New Zealand. The master data file was also transferred to a secure off-site network drive belonging to the PhD candidate at Mayo Clinic College of Medicine, Department of Health Sciences Research, in Rochester, Minnesota, USA, to facilitate restoration of corrupted or lost data for recovery purposes.

Password-protected copies of the master data base are also maintained on the PhD candidate's personal computer. For multiple redundancies, the data base was copied to private external media storage.

To maintain security, information access control for the master data file was shared solely with the PhD candidate's senior supervisor, Professor Ray Kirk at the University of Canterbury Health Sciences Centre.

3.7 Data Analysis

The analytical approach to measuring prevalence and associations among the selected health indicators, and the processes for reducing inferential error and controlling for real associations are described here.

3.7.1 Analytical Structure

This study examines the nature and distribution of health-related phenomena at a population level through cross-sectional research and reports on it on as rigorously as possible. The analytical approach to measuring prevalence and associations among the primary health indicators for this study uses descriptive statistics and inferential methods of comparing groups, correlation analysis and regression analysis. The data collected from this study yield results of association into the relative understanding of health-related attitudes and behaviours in this disaster context and controlled for age and gender.

For analytical practicality, and to represent the conceptualisation of health as a multi-dimensional construct, quality of life was measured in the study survey using five health-related quality of life (HrQoL) scales (*see* Section 3.3.3). These scales were selected to represent multiple domains of well-being (physical, mental, emotional, spiritual and social). Life satisfaction was included as a single global measure of quality of life, bringing the total number of quality of life variables in the study to six.

For the scope of this PhD, the primary behavioural domain of interest was evacuation kit preparedness ("*Made a Home Getaway Kit*"). This domain was measured descriptively in the study survey through four types of evacuation kit activities: 1) assembling items for survival/escape; 2) assembling items for evacuation/dislocation; 3) assembling items for communications; and 4) placing items in an accessible spot, ready for evacuation.

Inferential analyses focused on relationships between quality of life and the specific health-protective behaviour of assembling items for evacuation/displacement, i.e.,

those items that are unique to facilitating resilience during an actual disaster evacuation experience ("evacuation kit activity").

The inferential analytic questions of interest thus became:

1. Are scores on health-related quality of life (HrQoL) associated with scores on evacuation kit activity?
2. Are scores on life satisfaction associated with scores on evacuation kit activity?
3. Are quality of life scales associated with each other?
4. Are there significant differences in scores on quality of life and evacuation kit activity due to the effects of age and gender?
5. How well do the scores on HrQoL and life satisfaction explain scores on evacuation kit activity?
    a. How much variance in the level evacuation kit activity can be explained by these scores?
    b. Which QoL factor contributes the most to explaining evacuation kit activity?
    c. Does removing the effects of age and gender change these findings?
    d. How do model results compare when evacuation kit activity is dichotomised from 5 levels (Stages of Change) into 2 levels (intention and action)?

3.7.2 Functional Purpose of the Survey Questions for the PhD Thesis

The type of information collected and the functional purpose of each question for the analytical aims of the PhD thesis is summarised in Table 3.3. The following bullet points further describe the purposes of relevant questions for inferential analyses:

- Analytic Questions 1, 2 and 3 (above) are addressed using data from 14 survey questions (Q14, Q16, Q17, Q19-28, Q29, and Q35.17).
    - These primary aims are measured by correlational research between the 6 independent scale variables representing quality of life (Q14, FS; Q16, SOC13; Q17, SS20; Q19-28, SF12 PCS and SF12 MCS; Q29,

SWLS) and 1 dependent ordinal variable (Q35.17) representing evacuation kit activity.

- Correlational analyses were also conducted for these 6 independent scale variables with 18 other dependent ordinal variables (Q35.1-.16, Q35.18-.19) of disaster preparedness. This includes the variables representing the 3 other types of "*Made a Home Getaway Kit*" activities discussed in the preceding section (Q35.16, Q35.18, Q35.19).

- Analytic Question 4 is addressed using data from the 14 independent variables and 1 dependent variable (Q35.17) listed above with age (Q48) and gender (Q49).
  - Significant differences between groups are assessed using parametric and non-parametric techniques, selected depending on the number of variables and level of measurement.
- Four survey questions (Q15, Q18, Q31, and Q34) provide descriptive data on additional independent variables of interest from a health promotion context. They are beyond the inferential analytical scope of the PhD, but were included in the survey for their potential relevance to health-related behaviour change intervention designs.
  - Questions 15 and 31 are scales based on self-determination theory and health-related motivation to change.
  - Question 18 provides background information on access to primary health care.
  - Question 34 is a personal needs assessment drilled down to the individual domains of health and well-being; descriptive results provide possible situational guidance for designing intervention outcomes.
- Twenty-four additional survey questions collect descriptive data on supplemental disaster research variables that are also beyond the scope of the PhD analytical aims. These are the quantitative and qualitative data previously described on participant knowledge of natural hazards; perceptions of disaster consequences, disaster experience, and personal resources; and disaster preparedness activities beyond the PhD analytical dependent variables of evacuation kit preparedness.

Table 3.3. Survey Questions and Functional Purpose for Analysis

	Question	Question Construct/Domain	Question Source	Analytical Treatment
Survey Section 1. Cognitions Risk Factors *Physical Environment* Risk Perceptions: Risk Identification & Judgment	Q1-4 Q5-9 Q10-Q13	Physical vulnerability to disaster Personal vulnerability to disaster Personal experience with disaster	Self-authored*	Univariate (where applicable)
Survey Section 2. Attitudes Protective Factors *Intrapersonal Environment* Health Management Resources: Personal Health and Well-Being (Quality-of-Life)	Q14	Social well-being – Hawthorne Friends Scale ('FS')	Hawthorne (2006)	Univariate Bivariate Multivariate
	Q15	Personal autonomy – Self-Determination Scale ('SDS-PC')	Deci and Ryan (1985)	Univariate
	Q16	Emotional well-being – Sense of Coherence Scale ('SOC13')	Antonovsky (1987, 1993)	Univariate Bivariate Multivariate
	Q17	Spiritual well-being – Serenity Scale ('SS20')	Boyd-Wilson, Walkey, & McClure (2004, 2006)	Univariate Bivariate Multivariate
	Q18	Annual visit to GP	Self-authored	Univariate
	Q19-Q28	Physical and mental health well-being – SF12 (v1) General Health Status ('SF12')	Ware, Kosinski, & Keller (1996)	Univariate Bivariate Multivariate
	Q29	Subjective well-being – Satisfaction with Life Scale ('SWLS')	Diener, Emmons, Larsen, and Griffin (1985)	Univariate Bivariate Multivariate
Survey Section 3. Attitudes Protective Factors *Intrapersonal Environment* Other Personal Resources: Evacuation Readiness	Q30	Evacuation preparedness level	Self-authored*	Univariate
	Q31	Evacuation preparedness, health-related – Treatment Self-Regulation Scale ('TSRQ15')	Ryan & Connell (1989); Williams et al (1996)	Univariate
	Q32	Evacuation preparedness reasons, other	Self-authored	Qualitative
	Q33	Evacuation concern	Self-authored*	Univariate
	Q34	Evacuation coping resources	Self-authored*	Univariate
Survey Section 4. Behaviours Protective Factors *Intrapersonal Environment* Health Management Resources: Personal Disaster Preparedness	Q35.1- Q35.15	Personal preparedness activities	Self-authored*	Univariate, Bivariate
	Q35.16- Q35.19	Personal preparedness activities – 'Getaway Kit' Behaviours	Self-authored*	Univariate Bivariate Multivariate
	Q36 Q37 Q38-Q39 Q40 Q41	Priority 'Getaway Kit' Items Shared personal evacuation plans Workplace evacuation preparedness News-related evacuation preparedness Household preparedness role	Self-authored*	Univariate (where applicable)
Survey Section 5. Demographics	Q42-Q53	Population characteristics	Self-authored*, Statistics New Zealand	Univariate Bivariate Multivariate (where applicable)

* Some questions are adapted in part from GNS Science social science surveys (e.g., Becker, et al. 2007a, 2007b; Davis et al. 2006; Leonard et al. 2004)

3.7.3 Descriptive Statistics

Descriptive statistics describe the characteristics of the sample and the distribution of the data. The level of measurement, or the relationship among the values that are assigned to attributes of a categorical or continuous variable, is indicated for each variable in Appendix 2, Table A2.1. The level of measurement then guided decisions about appropriate statistical treatment for each question.

3.7.3.1 Univariate Analysis

Counts and frequencies were obtained for all variables measured on nominal and ordinal scales. Summary statistics such as mean and standard deviation were collected for variables measured on numerical scales. Missing values and suitability for quantitative analyses are reported in Appendix 2, Table A2.2. Baseline frequencies and means (where appropriate) for all variables in the study questionnaire are summarised in Chapter 4, Descriptive Results.

3.7.4 Inferential Statistics

The analysis plan called for conducting bivariate and multivariate analyses to explore the overall strength and form of relationships between quality of life and evacuation kit activity.

3.7.4.1 Bivariate Analysis

Bivariate analyses were performed to compare groups (Table 3.4) and to detect and describe the strength and direction of any interrelationships between quality of life variables and between quality of life and evacuation kit activities.

3.7.4.1.1 Statistical Techniques to Compare Groups

- An independent-samples t-test was conducted at an alpha level of $p = .05$ (two-tailed) to determine if there is a significant difference in mean quality of

life scores for males and females. Effect size was calculated using eta squared and classified according to .01 = small effect, .06 = moderate effect, .14 = large effect (Cohen, 1988).

- A one-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of age on quality of life mean scores at an alpha level of *p* = .05 (two-tailed). Respondents were divided into four groups according to their age (18-24 years; 25-44 years; 45-64 years; 65 years and above). Effect size was calculated using eta squared and classified according to .01 = small effect, .06 = moderate effect, .14 = large effect (Cohen, 1988).

- A chi-square test for independence compared the observed frequencies or proportion of cases for inactive and active conditions of kit preparation, by both age and gender. The statistical significance of any differences between groups was measured at an alpha level of *p* = .05 (two-tailed). Effect size for age was calculated using Cramer's V and classified according to the criteria (Cramér, 1946) of .06 = small effect, .17 = medium effect and .29 = large effect. Effect size for gender was calculated using phi and classified according to Cohen's (1988) criteria of .10 = small effect, .30 = medium effect and .50 = large effect.

Table 3.4 Bivariate Analysis Plan – Comparing Groups

		Independent	**Statistical Test**	**Aim**
		Nominal		
Dependent	**Nominal**	Kit Activity * Gender	Chi Square Test for Independence	Compare Proportions
		Kit Activity * Age		
	Continuous	Quality of Life * Gender	Independent Samples T-Test	Compare Means
		Quality of Life * Age	1-way ANOVA	

- An independent-samples t-test was also conducted to compare quality of life scores by evacuation kit activity (intention and action conditions) for each domain of well-being. Effect size was calculated using eta squared and classified according to .01 = small effect, .06 = moderate effect, .14 = large effect (Cohen, 1988).

3.7.4.1.2 Correlational Analysis

Although no causal relationships can be established in cross-sectional designs (Fletcher et al., 1996), correlational research facilitates the parallel investigation of several different independent variables on the same set of dependent variables (Cohen & Manion, 1994). Where sufficiently high correlations among variables are found, correlational research paves the way for regression analysis to determine the predictive ability of a set of variables on a specific outcome (Antonius, 2007; Field, 2000; Pallant, 2007).

- The relationships between quality of life variables were first analysed for possible redundancy or overlap in the constructs they measure. Pearson product-moment correlation coefficients (*r*, range -1.0 to 1.0) and 2-tailed tests of statistical significance (*p* value of *r*) were computed to explore intercorrelations between scale pairings. A threshold of $r = .75$ indicates redundancy (Nunnally & Bernstein, 1994, pg. 132), with p values $< .05$ (two-tailed) are considered statistically significant.

- Pearson product-moment correlation coefficients (*r*, range -1.0 to 1.0) and 1-tailed tests of statistical significance ($p < .05$) were then computed to explore which quality of life variables are associated with evacuation kit activity.

3.7.4.2 Multivariate Analysis

Multivariate analyses were conducted to test the explanatory power of quality of life variables on kit activity, and to assess the relative contribution of each quality of life variable to kit activity.

3.7.4.2.1 Standard Multiple Regression

Standard multiple regressions were conducted to simultaneously calculate how well quality of life explains the variance in evacuation kit activity. Two separate standard multiple regression models were run (SMR1 and SMR2); one with the five HrQoL scales (SF12-PCS, SF12-MCS, SOC13, SS20, and FS) and one with the 5 scales plus the life satisfaction scale (SWLS). Scores from these scales are the continuous independent variables. Evacuation kit activity, as measured by the 5 levels of precontemplation, contemplation, intention, action, maintenance (Prochaska & DiClemente, 1982, 1983), is the continuous dependent variable.

3.7.4.2.2 Hierarchical Multiple Linear Regression

Hierarchical multiple linear regressions were next performed sequentially to determine the effect of quality of life on kit activity once the effects of age and gender are removed. The full model (HRM1) contains the above continuous independent variables (the five HrQoL scales), plus the categorical independent variables of age and gender, and one continuous dependent variable (5 levels of evacuation kit activity). Age and gender were entered into the regression as Block 1, followed by the HrQoL scales as Block 2. In a separate run of the regression (HMR2), life satisfaction was entered as Block 3.

3.7.4.2.3 Logistic Regression

Logistic regression was also performed to test how well quality of life explains the variance in kit activity when this health-protective behaviour is treated as a categorical dependent variable. Consistent with prior analyses, two regressions were performed (LR1 and LR2), with and without life satisfaction included as a continuous independent variable. The full model contains the above continuous variables (HrQoL scales, SWLS) and categorical predictors (age, gender), and one categorical outcome (kit activity dichotomised into intention and action).

3.7.4.2.4 Stepwise Multiple Regression

Confirmatory analyses were conducted using stepwise multiple regression (ordinary least squares regression, forward selection) and stepwise logistic regression to compare results with the above models and determine which quality of life variables make statistically significant unique contributions to kit activity. Two separate stepwise regressions were computed for both the continuous (OLSR1 and OLSR2) and dichotomous (LR3 and LR4) outcome variables; one with age, gender, and the five HrQoL scales, and the other with these variables plus life satisfaction. SPSS was allowed to select which variables it entered based on a set of statistical criteria (Probability-of-F-to enter <= .050, Probability-of-F-to-remove >= .100).

All models were tested to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homogeneity of variance (homoscedasticity). The alpha level for all tests of statistical significance was .05.

CHAPTER 4. RESULTS

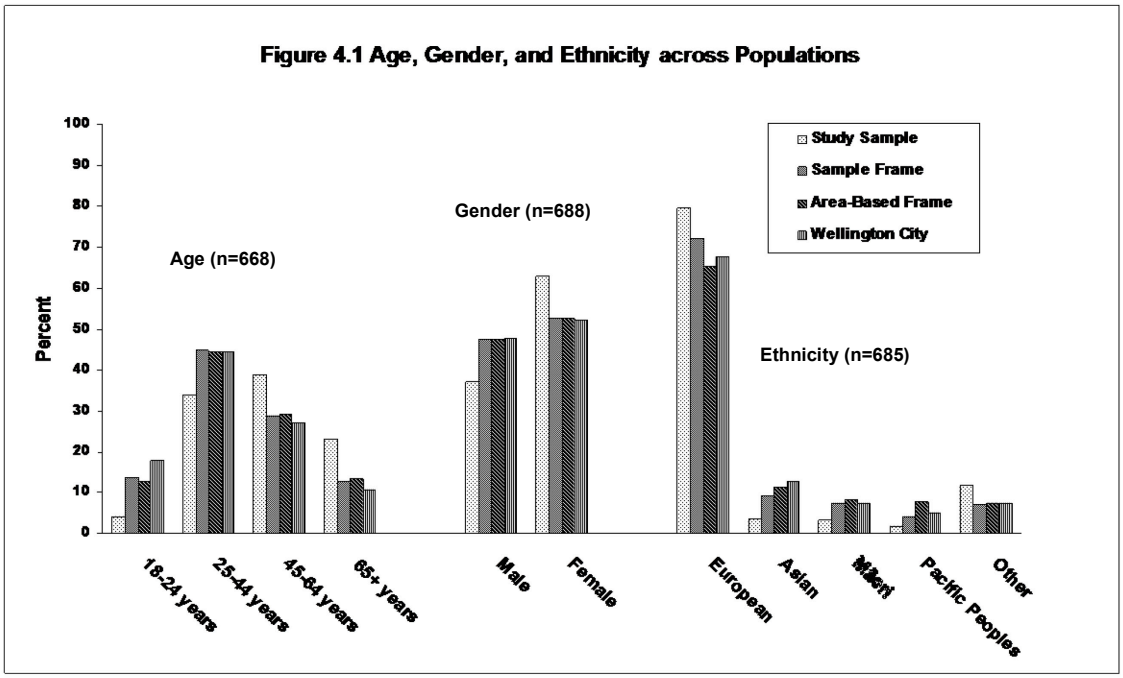
4.1 Descriptive Results

4.1.1 Population Characteristics

The following four subsections describe the population characteristics of the sample by age, gender, and ethnicity; household composition and dependents; population mobility; and qualifications, labour force status, and social role. Table 4.1a and 4.1b also summarise these data.

4.1.1.1 Age, Gender, Ethnicity

The study sample is reasonably representative of the distributions observed in age, gender, and ethnicity across the sample frame, area-based frame, and target population (Figure 4.1; Table A4.1). The demographic parallels between the sample frame, area-based frame, and target population of Wellington City are clearly shown by the similar height of the bars with dark patterns and stripes. The lighter stipple pattern shows slight variations from these levels within the study sample.



- Within the study sample, age is normally distributed, with the largest number (n=268) of respondents in the 45-64 years age range, making up 39.0% of the sample. This is followed by 33.9% in the 25-44 years range, 23.1% in 65 years and over, and 4.1% in the 18-24 years range (Figure 4.2, Table 4.1a).

    - When the sample is compared to the sampling frame (Figure 4.3) and the target population (Figure 4.4), the 18-24 years group in the sample is slightly underrepresented (9-14% less, respectively). The 65 years and over age group in the sample is slightly overrepresented (10-12% greater, respectively). In all three of these populations, those between 25-64 years of age comprise nearly three-quarters of the total.
    - The person in the household who most recently had a birthday was asked to complete the survey. This method was used to prevent self-selection by the participants.

- Females comprise 62.9% of respondents (Figure 4.5, Table 4.1a). There are about 10% more women in the sample than in the sampling frame (Figure 4.6) and in the target population (Figure 4.7).

- Ethnicity is a self-perceived measure and people can belong to more than one ethnic group. New Zealand European is the dominant ethnicity (79.4%) in the study sample (Figure 4.8, Table 4.1a), with others describing themselves as Asian (3.5%), Māori (3.4%), Pacific Peoples (1.8%), or other (11.8%).

    - The sample appears to be slightly more homogenous and European than the sample frame (Figure 4.9) and target population (Figure 4.10)[9]. There are fewer Asian, Māori, and Pacific Peoples (ranging from approximately 2-9%), and more Europeans (about 7-12%, respectively) and 'Other' (approximately 4-5%).

[9] Comparative interpretations for ethnicity are approximate because the sample reflects an adult population (18 years and over), while the sampling frame and target population distributions include those 15-17 years of age. It is reasonable to assume that 15-17 year olds would appear in the same proportions in the sample.

Figure 4.2 Age Distribution - Study Sample

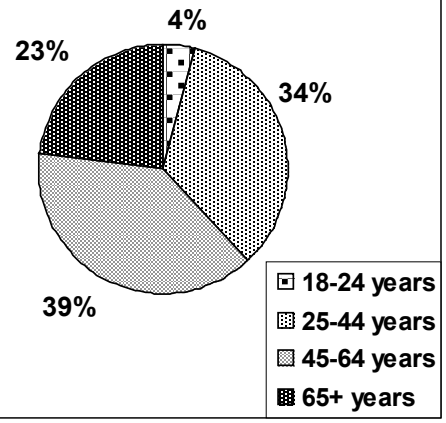


Figure 4.5 Gender Distribution - Study Sample

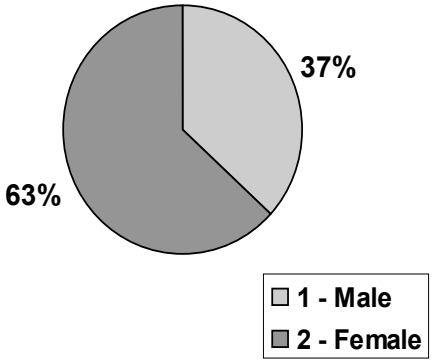


Figure 4.3 Age Distribution - Sample Frame

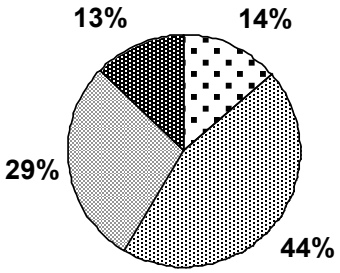


Figure 4.6 Gender Distribution - Sample Frame

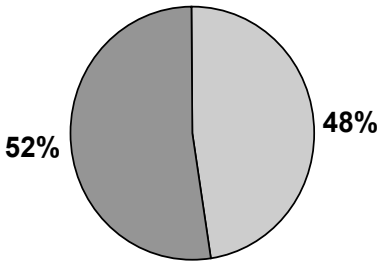


Figure 4.4 Age Distribution - Wellington City

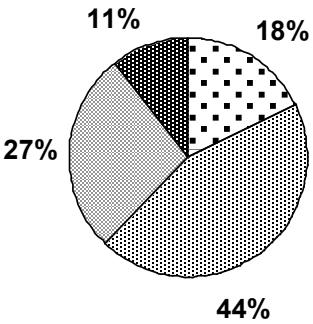


Figure 4.7 Gender Distribution - Wellington City

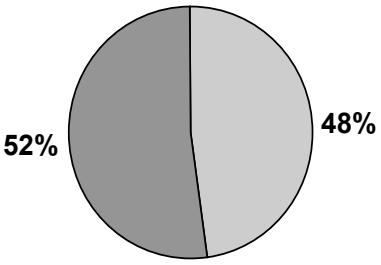


Figure 4.8 Ethnic Distribution - Study Sample

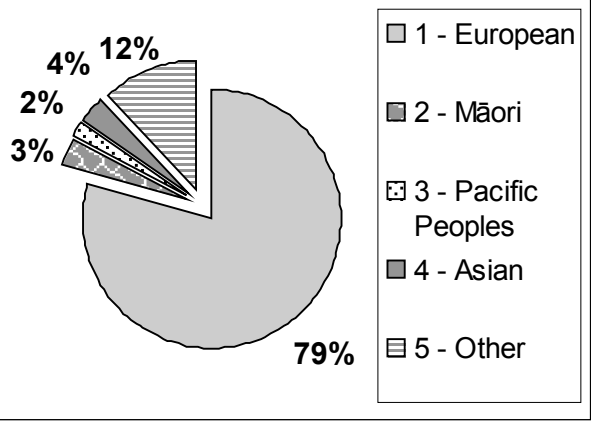


Figure 4.9 Ethnic Distribution - Sample Frame

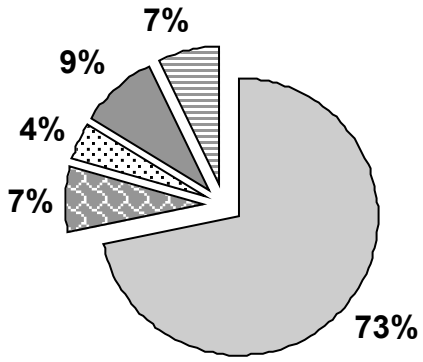


Figure 4.10 Ethnic Distribution - Wellington City

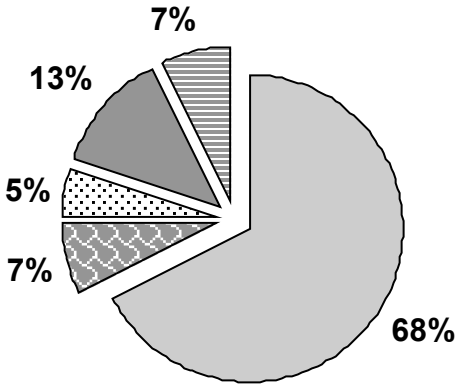


Table 4.1a Study Sample Characteristics – Key Demographic Indicators

Demographic Indicator	Count (n)	Valid Percent (%)
Age (n=688)		
18-24 Years	28	4%
25-44 Years	233	34%
45-64 Years	268	39%
65+ Years	159	23%
Missing n	7	-
Gender (n=688)		
Female	433	63%
Male	255	37%
Missing n	7	-
Ethnicity (Level 1) (n=685)*		
European	563	79%
Asian	25	4%
Māori	24	3%
Pacific Peoples	13	2%
Other	84	12%
Missing n	10	-
Household Composition (n=684)		
One-Family Household	380	56%
One-Person Household	153	22%
Other Multi-Person Household	151	22%
Missing n	11	-
Child Dependency Status (n=622)		
No Dependents	412	66%
At Least One Dependent	210	34%
Missing n	73	-
Number of Dependent Children (n=622)		
0	412	66%
1	84	14%
2	86	14%
3	33	5%
4	5	1%
5	2	0.3%
Missing n	73	-

*Multiple response question

4.1.1.2 Household Composition and Dependents

- Slightly more than half of the sample (55.6%) is in one-family households (Table 4.1b). The rest are split between multi-person households (22.1%) and one-person households (22.4%).
- Two-thirds (66.2%) of the respondents are without dependent children in the household (Table 4.1b). The remainder (33.8%) has at least 1 identified

dependent, with roughly equal percentages have one dependent (13.5%) or two dependents (13.8%). Only 6.4% of the sample has 3 or more dependents.

- Collectively a majority of the households in the study sample are one-family households and without dependent children.

4.1.1.3 Population Mobility

- Most (77.3%) own their homes or are buying to live in it (Table 4.1b). Renters comprise 20.5%. A small fraction (2.2%) is 'Other'.
- The majority of residents have lived at their residence for > 5 years (53.9%).
- Nearly two-thirds (62.9%) have lived in the same suburb for > 5 years.
- Most (91.1%) stated intent to remain in their neighbourhood for two years.
- Collectively these findings for population mobility indicators describe a stable population in the study sample.

4.1.1.4 Qualifications, Employment, and Social Role

- The most common educational level obtained is University undergraduate degree (35.2%), followed by trade certificate or other diploma (24.8%), postgraduate degree (18.6%), high school qualifications (16.4%), and no school qualifications (4.8%).
- Respondents can belong to more than one employment category. Nearly three-quarters (74%) of the respondents are employed for pay; 26% of the sample are not working for pay at present. About 39% are employed full-time for pay, 19% part-time for pay, and 17% self-employed for pay.
- Respondents can also fulfil multiple social roles. While the results suggest a possible tendency in the sample toward respondents who have stay-at-home social roles, this question was ultimately answered poorly and has substantial missing data. Results are thus reported in Table 4.1b but should not be considered reliable and no further analyses were done. The missing data issue likely can be resolved in future studies by breaking down the multiple-

response question format into a series of closed-ended dichotomous ("yes/no") questions for each social role.

- Collectively the study sample is well-educated and most respondents are working for pay.

Table 4.1b Study Sample Characteristics – Other Social Indicators

Social Indicator	Count (n)	Valid Percent (%)
Qualifications (n=681)		
No School Qualifications	33	5%
High School Qualifications (Level 1-3)	112	16%
Trade Certificate, Professional Certificate or Diploma (Level 4-6)	169	25%
University Undergraduate Degree (Level 7)	240	35%
University Postgraduate Degree (Level 8-10)	127	19%
Missing n	14	-
Employment (n=674)*		
Self-Employed for Pay	117	17%
Employed Full-Time for Pay	262	39%
Employed Part-Time for Pay	128	19%
Not Working for Pay at Present	178	26%
Missing n	21	-
Social Role (n=435)*		
Retired	156	32%
Full-time homemaker	76	16%
Stay-at-home parent	39	8%
Disabled	17	3%
In school	12	3%
Other social role	186	38%
Missing n	260	-
Tenure of Household (n=684)		
Own It or Buying to Live In It	529	77%
Rent	140	20%
Other	15	2%
Missing n	11	-
Years at Usual Residence (n=687)		
0-5 Years	317	46%
More Than 5 Years	370	54%
Missing n	8	-
Years in Suburb (n=688)		
0-5 Years	255	37%
More Than 5 Years	433	63%
Missing n	7	-
Intent to Remain in Neighbourhood for Two Years (n=683)		
Yes	622	91%
No	61	9%
Missing n	12	-

*Multiple response question

4.1.2. Risk Perception

This section reports on self-appraisal by the study participants on their personal risk of disaster exposure and consequences. Understanding subjective perceptions of risk is important because risk identification and risk judgment can be motivators for preparedness.

4.1.2.1. Perceptions of Physical Vulnerability to Risk

The probability or likelihood of a disastrous event in space and time, and how salient a person considers an event might be in the overall context of their lives, are addressed in this section.

4.1.2.1.1 Perceived Probability of Risk – Location

To understand the level of attention within the sample that an earthquake or tsunami can significantly affect Wellington, respondents were asked to identify the two hazard types they believe are most likely to trigger a disaster in the Wellington Region (Question 1). The study survey provides eight response options listing hazard types of current worldwide concern and relevant to New Zealand (earthquake, fire, flood, landslide, pandemic flu, terrorism, tsunami, and volcanic eruption) in multiple-response format. An open-ended response option was provided for the respondent to further choose and identify an "Other" hazard type.

- Earthquake and tsunami are the two most frequent choices that respondents identify as the hazard types most likely to trigger a disaster in the Wellington Region.
    - Nearly all (97.5%) of the respondents identified earthquake as one of their two choices for the type of hazard most likely to trigger a disaster in the Wellington Region.
    - About half (52.1%) identified tsunami as one of their two choices.
    - About one-fifth (19.2%) included landslides, followed by pandemic flu (9.3%), flood (8.6%), and fire (4%).

- About 1% selected volcanic eruption (1.2%), terrorism (.9%), or “Other” (.7%).

Relative risk for six specific types of natural hazards (fault rupture, ground shaking, liquefaction, tsunami, landslides, and wildfire) present in Wellington have been identified and mapped by the Greater Wellington Regional Council. Respondents were asked to indicate their awareness of their exposure to each of these risks where they live and work (Question 2). Response options were “yes”, “no”, or “don’t know.”

- A majority of respondents report knowledge on the presence or absence of natural hazards at both their home and work locations. There was substantial missing data (up to 35%) and other issues that adversely affect generalisability of these data.
    - For example, it is unknown whether respondents researched the location of their homes and workplaces on the Greater Wellington Regional Council hazard maps or acquired hazard information from other sources; whether respondent workplace is located within the study area; or whether missing data are due to logically skipping the workplace portion of the question for other reasons.

4.1.2.1.2 Perceived Probability of Risk – Salience

To understand the level of interpretation by the sample that the chance of earthquake or tsunami in Wellington is relevant or significant to their lives, respondents were asked (Question 3) to identify how often they think about an earthquake or tsunami affecting Wellington. Response options were daily, 2-6 times a week, once a week, once a month, a few times a year, or never.

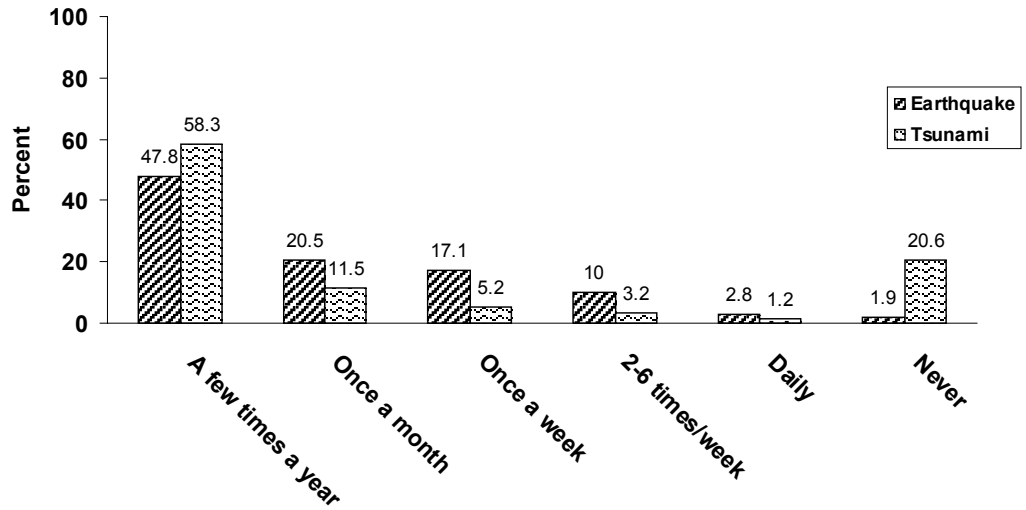
- Nearly all (97.2%) state that they think about an earthquake happening in Wellington. 1.9% report they never do.

- About half (47.8%) think about earthquake a few times a year, followed by once a month (20.5%), once a week (17.1%), 2-6 times per week (10%), and daily (2.8%).

- Most (79.4%) state that they think about a tsunami happening in Wellington. 20.6% report they never do.
  - 58.3% think about tsunami a few times a year, followed by once a month (11.5%), once a week (5.2%), 2-6 times per week (3.2%), and daily (1.2%).

Figure 4.11 portrays how about half the people in the study think about earthquake or tsunami a few times a year, but then the number of people who think about these events drops sharply as the frequency of thought increases. The bar graphs also show how there is a marked difference in the proportion of those who never think about earthquake (one in fifty) versus never think about tsunami (one in five).

Figure 4.11 Frequency of Thinking About Earthquake and Tsunami in Wellington



4.1.2.1.3 Perceived Probability of Risk – Imminence

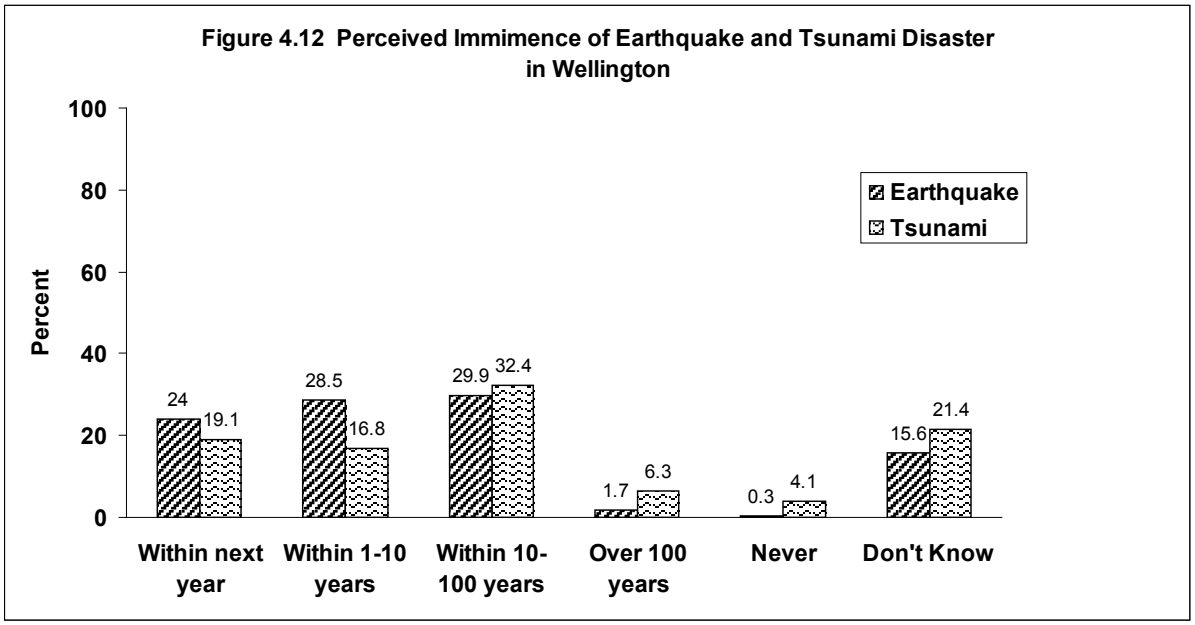
Perceptions of the chance an earthquake- or tsunami-triggered disaster could occur in any given year were measured by asking respondents (Question 4) to select a timeframe of potential imminence, or the soonest they think disaster could strike.

Response options were within the next year, within the next 1-10 years, within 10-100 years, in over 100 years, never, or don't know.

- Most (84.1%) assigned a timeframe for when they think an earthquake could next trigger a disaster in Wellington. 15.6% reported "don't know." 0.3% said "never."
    - About one-third (29.9%) chose within 10-100 years, followed by within 1-10 years (28.5%), within the next year (24%), and in over 100 years (1.7%).
- About three-quarters (74.6%) assigned a timeframe for tsunami. 21.4% reported "don't know." 4.1% said "never."
    - About one-third (32.4%) chose within 10-100 years, followed by within the next year (19.1%), within 1-10 years (16.8%), and in over 100 years (6.3%).

Considering the reality that earthquake and tsunami can strike Wellington at any time, these results show (Figure 4.12) suggest a low level of recognition of how imminent a disaster could be. At the same time, the data also show widespread acceptance that an earthquake or tsunami disaster could occur in Wellington within a human lifetime.

Figure 4.12 Perceived Immimence of Earthquake and Tsunami Disaster in Wellington



4.1.2.2 Perceptions of Personal Vulnerability to Risk

Respondents were asked several questions on their perceptions of direct and indirect effects due to disaster. For this study, direct effects are categorised as physical damage or loss to property and adverse effects on personal health and safety. Indirect effects are categorised as adverse effects on day-to-day life (daily activities, social network, mobility, income, and required evacuation). The likelihood and persistence of personally experiencing these disaster consequences, and level of concern for potential consequences, are addressed in this section.

4.1.2.2.1 Disaster Consequences

Respondents were asked to rate the likelihood of direct and indirect effects from an earthquake or tsunami in the Wellington Region (Question 5). Response format is a 5-point Likert scale with endpoints of 1 = "not very likely" and 5 = "very likely."

At least one in three people believe it is very likely they will be personally affected by an earthquake or tsunami in the Wellington Region in every category of direct and indirect effects measured in the study (Figure 4.13). Over one in four people also believe that evacuation due to an earthquake or tsunami in the Wellington Region is also very likely (Figure 4.13).

Figure 4.13 Perceived Likelihood of being Personally Affected by Earthquake or Tsunami in Wellington

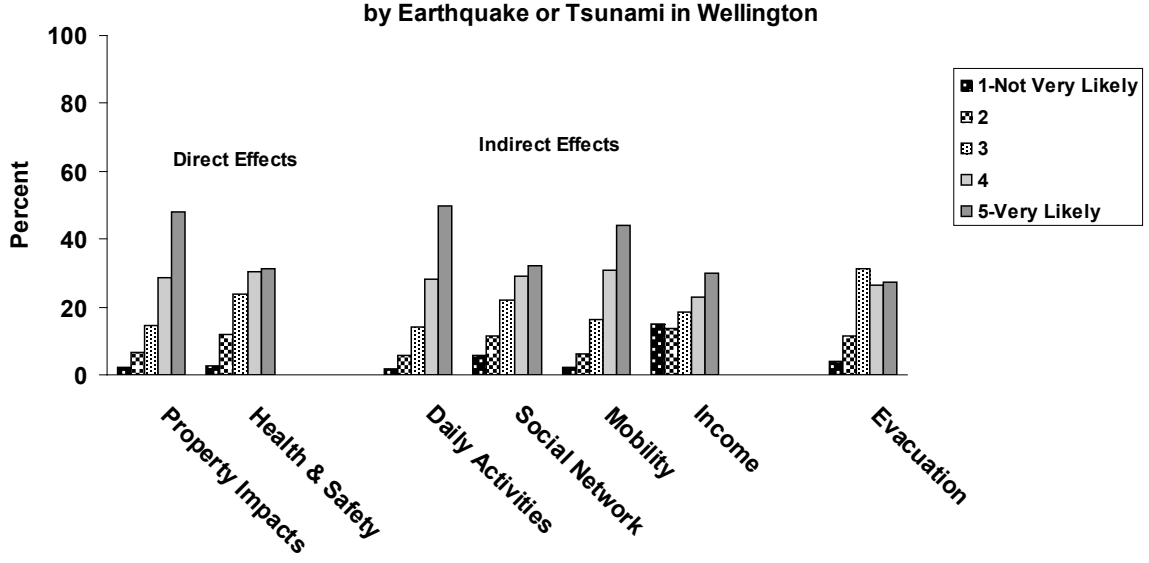


Table 4.2 provides additional detail on the results displayed graphically in Figure 4.13 and summarised as follows:

- Nearly half (49.8%) think adverse effects on daily activities will be “very likely” (response option 5), followed by property (48.0%), mobility (44.0%), social network (32.0%), health and safety (31.3%), and income (30.0%).
- The adverse effects that respondents most frequently cite to be at least ”likely” (response options 4-5) are effects on daily activities (78.1%), followed by property (76.8%), mobility (75.0%), health and safety (61.6%), social network (61.1%), and income (52.9%).
- Respondents report the greatest ambiguity (23.7%) on the likelihood of effects on health and safety, and the least ambiguity (14.2%) on effects being present for daily activities (response option 3).
- The adverse effects that respondents most frequently cite to be at least “not likely” (response options 1-2) are effects on income (28.5%), followed by social network (17.0%), health and safety 14.7%), property (8.6%), mobility (8.5%), and daily activities (7.6%).
- The adverse effect most frequently cited to be “not very likely” is income (14.8%), followed by social network (5.7%), health and safety (2.5%), mobility (2.4%), property (2.1%), and daily activities (1.8%).

Table 4.2 Personal Vulnerability – Likelihood of Direct and Indirect Effects

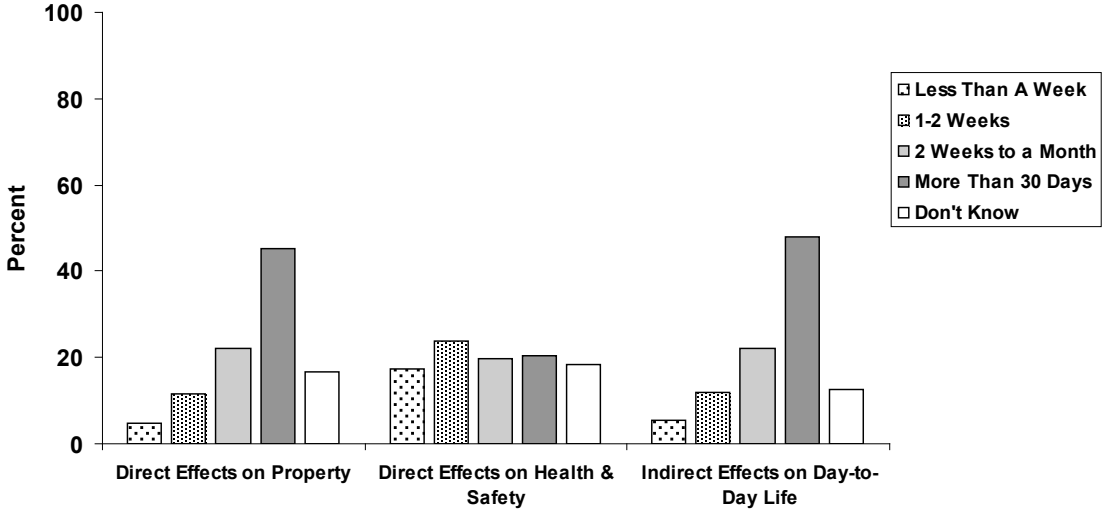
Type of Effect	**1 Not very likely**		**2**		**3**		**4**		**5 Very likely**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Direct Effects										
Property (n=671)	14	2.1	44	6.6	98	14.6	193	28.8	322	**48.0**
Health & Safety (n=667)	17	2.5	81	12.1	158	23.7	202	30.3	209	**31.3**
Indirect Effects										
Daily Activities (n=667)	12	1.8	39	5.8	95	14.2	189	28.3	332	**49.8**
Social Network (n=666)	38	5.7	75	11.3	146	21.9	194	29.1	213	**32.0**
Mobility (n=668)	16	2.4	41	6.1	110	16.5	207	31.0	294	**44.0**
Income (n=663)	98	14.8	91	13.7	123	18.6	152	22.9	199	**30.0**
Require Evacuation (n=662)	26	3.9	76	11.5	206	**31.1**	174	26.3	180	27.2

- Slightly more than half (53.5%) said they think evacuation will be at least likely (response options 4-5).

- Nearly one-third (31.1%) of respondents report ambiguity on the likelihood of evacuation (response option 3).
- Less than one-quarter (15.4%) state evacuation is at least not likely (response options 1-2).
- Only a small fraction (3.9%) think evacuation is "not very likely" (response option 1).

To understand perceptions regarding the persistence or duration of disaster consequences, respondents were asked to select a timeframe (less than a week, 1-2 weeks, 2 weeks to a month, more than 30 days) or "don't know" for how long they think they would experience direct or indirect effects (Questions 6, 7, and 8). Most respondents assigned a timeframe for the duration or persistence of adverse effects from earthquake or tsunami (Figure 4.14, Table 4.3).

Figure 4.14 Perceived Persistence of Earthquake or Tsunami Effects in Wellington



The dark bars on the composite histogram shown above indicate that about one out of two people believe their property and day-to-day life will be affected for more than 30 days. Significantly fewer people, about one out of five, perceive that their health and safety will be affected for more than a month.

- About half (48.0%) anticipate impacts on their day-to-day life for greater than 30 days, followed by 2 weeks to a month (22.0%), 1-2 weeks (11.9%), and less than a week (5.6%).
- Nearly half (45.2%) anticipate property impacts for greater than 30 days, followed by 2 weeks to a month (22.1%), 1-2 weeks (11.5%), and less than a week (4.6%).
- About one-quarter (23.7%) anticipate personal health and safety impacts for 1-2 weeks, followed by greater than 30 days (20.5%), 2 weeks to a month (19.7%), and less than a week (17.5%).

Table 4.3 Personal Vulnerability – Persistence of Direct and Indirect Effects

Type of Effect	Less than a week		1-2 weeks		2 weeks to a month		More than 30 days		Don't know	
	n	%	n	%	n	%	n	%	n	%
Direct Effects – Property (n=671)	31	4.6	77	11.5	148	22.1	303	**45.2**	112	16.7
Direct Effects – Health & Safety (n=674)	118	17.5	160	**23.7**	133	19.7	138	20.5	125	18.5
Indirect Effects – Day-to-day life (n=673)	38	5.6	80	11.9	148	22.0	323	**48.0**	84	12.5

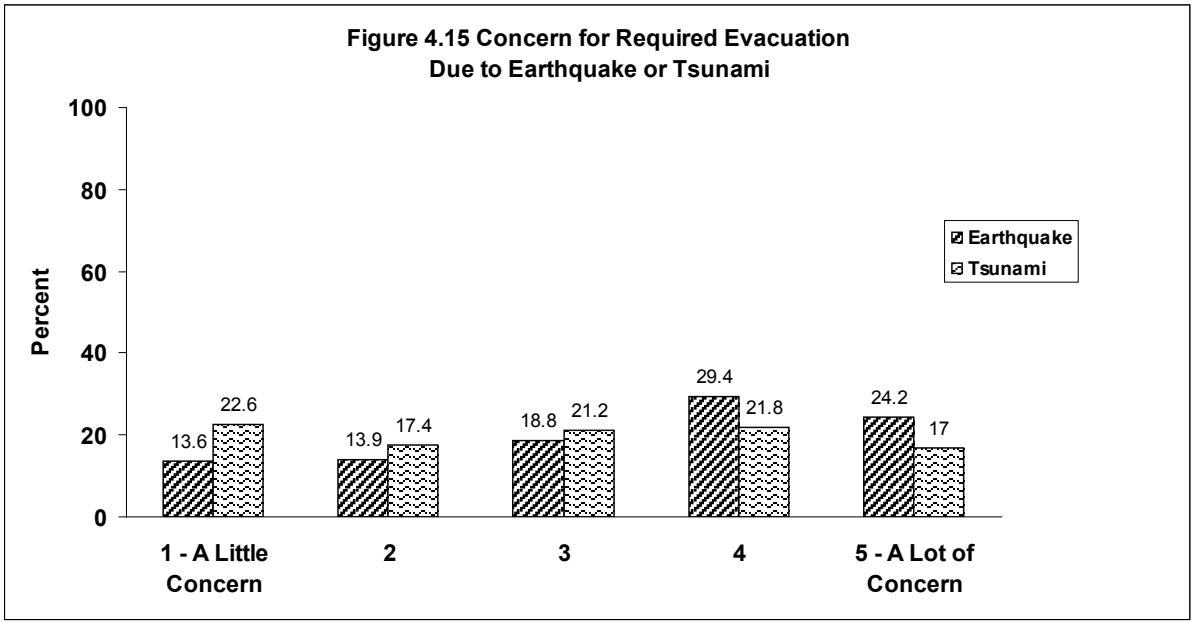
4.1.2.2.2 Concern for Disaster Consequences

Respondents were asked to rate their biggest worry or concern, in terms of personal impact on property, personal health and safety, and day-to-day life, by ranking these categories from 1 = "highest" to 3 = "lowest" (Question 9). Personal health and safety appears to rank as the greatest worry or concern by a ratio of 4:1 over property and by a ratio of 9:1 over day-to-day life (Table 4.4). Due to high levels of missing data (over 20%), these results are not reliable for further reporting or analysis and are not generalisable to larger populations.

Table 4.4 Personal Vulnerability – Concern for Direct and Indirect Effects

Type of Effect	1 Highest		2		3 Lowest	
	n	%	n	%	n	%
Direct Effects – Property (n=501)	107	21.4	211	30.4	183	**36.5**
Direct Effects – Health & Safety (n=552)	424	**76.8**	94	17.0	34	6.2
Indirect Effects – Day-to-day life (n=508)	47	9.3	196	38.6	265	**52.2**

Respondents were also asked to rate their level of concern for required evacuation from the Wellington Region due to earthquake and tsunami (Question 33) on a 5-point Likert scale with endpoints of 1 = “a little concern” and 5 = “a lot of concern.” Concern for evacuation is broadly distributed, as evidenced by Figure 4.15. Of those who express moderately high to high levels of concern (4-5), a larger proportion is focused on earthquake evacuation than tsunami.



Results further detailed in Table 4.5 indicate that about half have at least some concern for required evacuation due to earthquake, and about four in ten express concerns for tsunami evacuation. Of those who indicate concern for an “other” type of disaster (n=116), less than one-fifth (16.4%) state they have “a lot of concern.” Fire is the most frequently cited “other” type of disaster presenting concern (n = 24).

Table 4.5 Personal Vulnerability – Concern for Required Evacuation

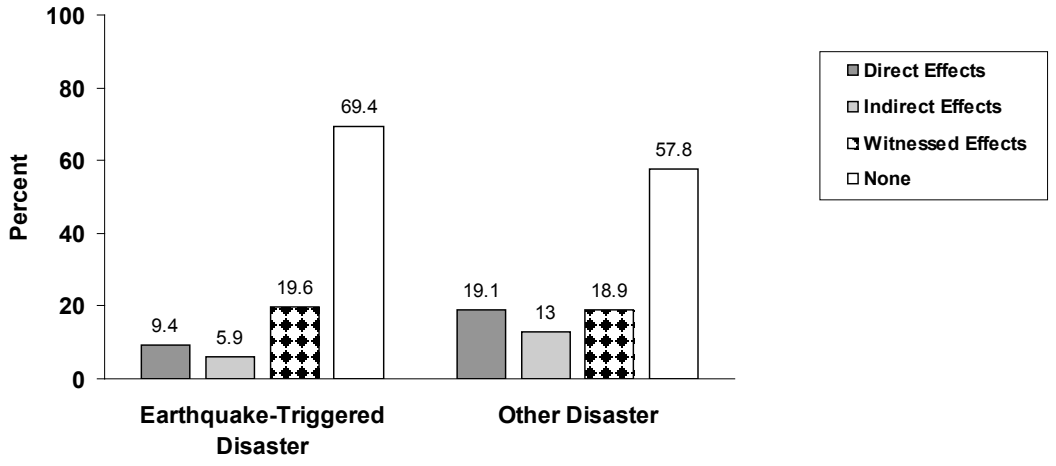
Type of Disaster	1 A little concern		2		3		4		5 A lot of concern	
	n	%	n	%	n	%	n	%	n	%
Earthquake (n=674)	92	13.6	94	13.9	127	18.8	198	**29.4**	163	24.2
Tsunami (n=665)	150	**22.6**	116	17.4	141	21.2	145	21.8	113	17.0
Other (n=116)	29	**25.0**	18	15.5	25	21.6	25	21.6	19	16.4

4.1.2.2.3 Disaster Experience

Personal experience with disaster is measured in categories of direct effects, indirect effects, witnessed effects on others, and none (Questions 10 and 11). A multiple response format is provided, so that a person who has had been affected in more than one way by disaster can reflect this experience.

The white bars on Figure 4.16 show that the majority of people in the study have no direct experience with disaster of any type. Those who have witnessed the effects of disaster on others and those who have been directly affected by disaster are slightly larger in proportion than those who have been indirectly affected.

Figure 4.16 Personal Disaster Experience



- Over two-thirds (69.4%) report no experience with an earthquake-triggered disaster (earthquake, tsunami, or secondary effects of earthquake-triggered landslide or fire). About one-fifth (19.6%) state they have personally witnessed direct or indirect effects on others. 9.4% have experienced direct effects on their property or personal health and safety. 5.9% have experienced indirect effects on their day-to-day life.
- Over half (57.8%) report no experience with any other types of personal disaster. Close to one-fifth have experienced direct effects (19.1%) or

witnessed effects on others (18.9%). 13.0% have experienced indirect effects on their day-to-day life.

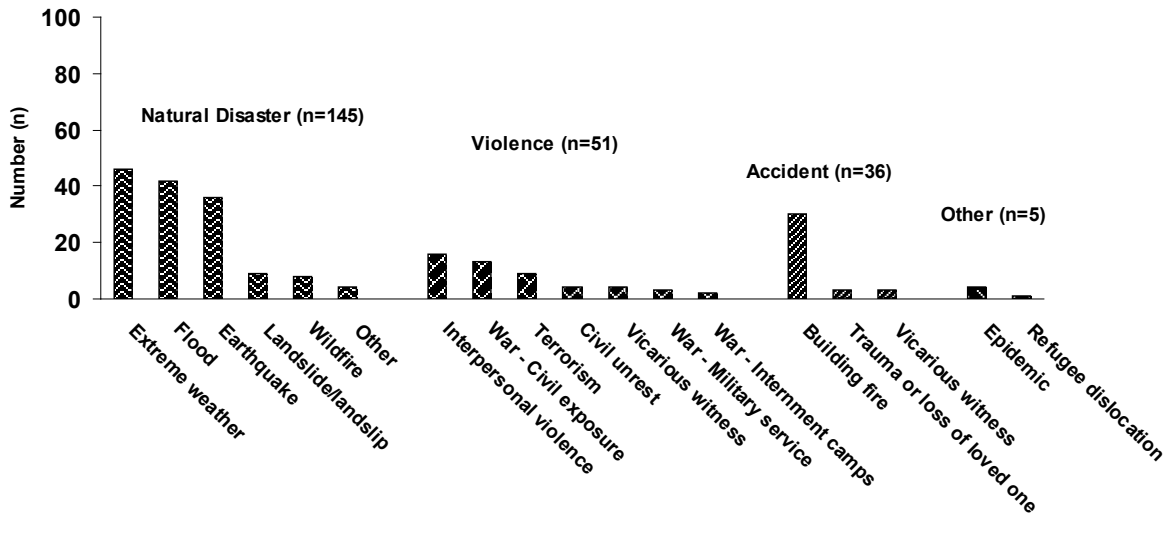
Personal experience with having to evacuate due to a disaster of any type is explored (Question 12) with a dichotomous ("yes" or "no") response format.

- Most (87.5%) have never had to evacuate due to a disaster of any type.

Respondents were also asked for their anecdotal perspectives on any personal disaster experience (disaster type, most significant personal impact, and most helpful type of coping resources) using an open-ended response format (Question 13). Qualitative string data underwent content analysis and were aggregated into summary categories and counts.

Respondents report exposure to 237 prior disasters (Figure 4.17). Some experienced more than one disaster. A few report witnessing effects on others as spontaneous volunteers (rescue; assisting emergency responders), in professional response roles (e.g., crisis intervention; clinical psychological intervention), or in supporting loved ones (e.g., recovery from attempted suicide). A striking array of life-threatening events and daunting circumstances were reported, experienced around the world in both ordinary and extraordinary times (Table 4.6).

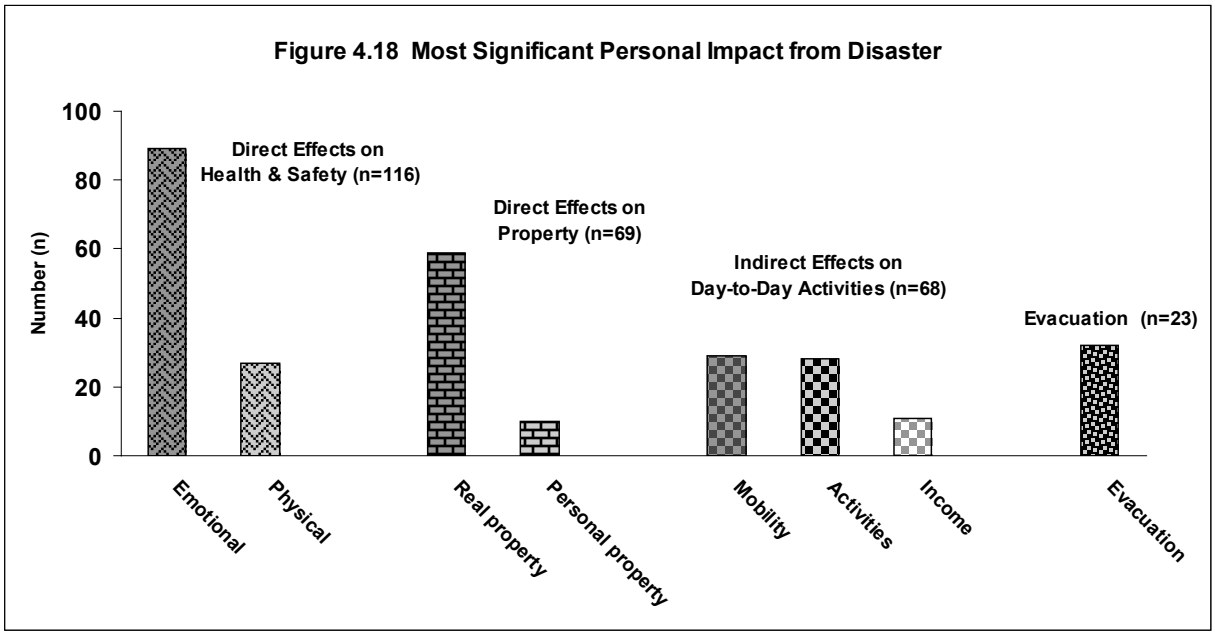
Figure 4.17 Type of Disaster Experienced or Witnessed



- Natural disaster (n=145), violence (n=51) and accidents (n=36) comprise the three main types of experiences reported.
    - The three most commonly cited types of natural disaster experienced are extreme weather events, flooding, and earthquake. Experiences of landslides, wildfire (bushfire, forest fire), volcanic eruption, and tsunami were also reported.
    - The three most commonly cited types of violence experienced are war, interpersonal violence, and terrorism.
    - The three most commonly cited types of accidents experienced are building fires, accidental trauma or death of a loved one, and witnessing accidental trauma or death. Epidemic and dislocation due to refugee resettlement were also reported.

Figure 4.18 illustrates the types of personal impacts reported (n=276). Respondents generously shared very personal insights from significant hardship and painful suffering during some of their most difficult life moments (Table 4.7).

Figure 4.18 Most Significant Personal Impact from Disaster



Consistent with categories established for other survey questions on risk perceptions and judgments, data were aggregated into direct effects on health and safety

(n=116), direct effects on property (n=69), indirect effects on day-to-day activities (n=68), and evacuation (n=23).

- Personal impact on health and safety surpasses impact on property and day-to-day activities by nearly a 2:1 ratio.
- Within the category of health and safety, emotional impact (n=89) exceeds physical impact (n=27) by nearly a 3:1 ratio.

In terms of what helped people cope the most, responses were aggregated into categories generally consistent with the study constructs of health-related quality of life ("HrQoL") and health management resources (Table 4.8). All anecdotal data on disaster impacts and coping resources that are reported herein, however, should not be considered for quantitative inferential analyses without further study.

The most helpful coping resources reported (n=326) were in the categories of personal health resources (n=87), institutional support (n=55), and personal actions (n=33). Figure 4.19 portrays the relative importance of intangible quality of life factors over all other types of resources. Social network support – presented in Figure 4.19 as subcategories of family, friends, neighbours and community – emerges as the most helpful factor for coping with prior disaster experience.

Figure 4.19 Most Helpful Coping Resource for Disaster

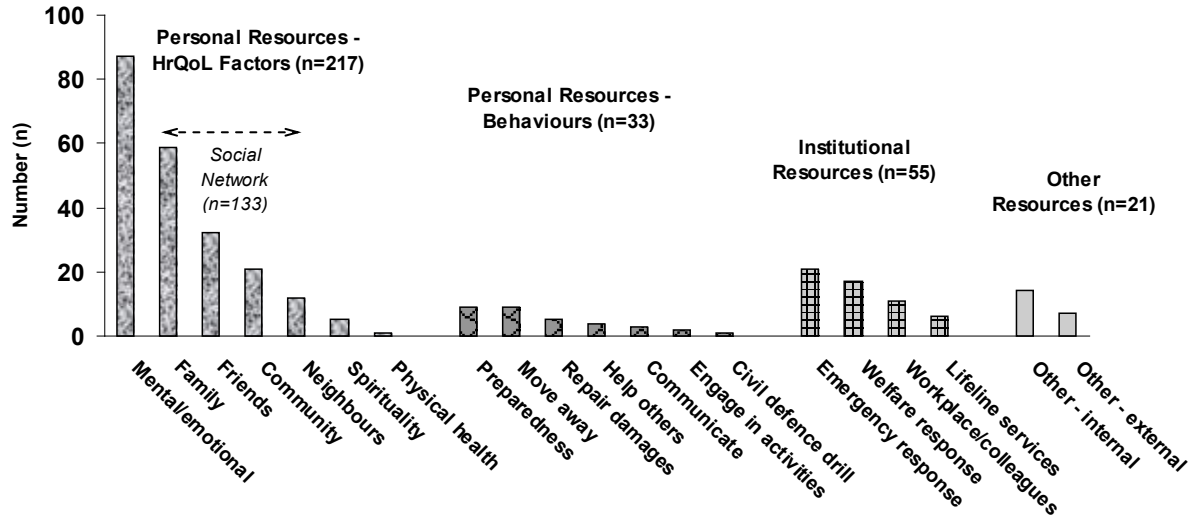


Table 4.6 Personal Vulnerability – Disaster Experience, by Disaster Type

Disaster Type	Event Type	Count (n)	Examples
Natural Disaster (n=145)	Extreme weather event	46	1968 Wahine Storm in Wellington, 1972 Hurricane Bebe, 1987 UK Gales, 1988 Cyclone Bola, 2004 Manila Super Typhoon; other cyclones, hurricanes, tornado, and typhoons
	Flood	42	Australia, New Zealand (Gisborne, Mautaura, 1977 & 2005 Hutt Valley, 1983 North Otago, 2004 Manawatu), Australia, Sri Lanka, 1995 New Orleans, USA; other
	Earthquake	36	New Zealand (1939 Murchison, 1942 Wairarapa, 1968 Inangahua, 1987 Kawerau/Edgcumbe, 1993 Fiordland), 1981 Samoa, 1985 Mexico City, 1989 San Francisco (Loma Prieta), 1995 Kobe, 2001 Seattle, other earthquakes in New Zealand, New Guinea and Central America (unspecified year)
	Landslide/landslip	9	Affecting residence
	Wildfire	8	Bushfires in Australia (Sydney, New South Wales).
	Other	4	Volcanic eruption (2), tsunami (1), vicarious witness (1)
Violence (n=51)	Interpersonal violence	16	Armed robbery, arson, burglary, domestic violence, family murder, sexual assault; other
	War – Civil exposure	13	World War II airs raids and bombing raids; bombardment of a kibbutz in Israel; Gulf War; other
	Terrorism	9	1983 Sri Lanka; 9/11 in New York City and Washington, D.C.; 2005 London; 2007 London bombings; hotel bomb scare; plane hijack; other
	Civil unrest	4	Anti-Sikh riots in India; attempted military coup in Kenya; crowd stampede; election riots in Sri Lanka; other
	Vicarious witness	4	Refugees from Cambodia, Ethiopia; survivors of South Asian Tsunami; survivors of interpersonal violence
	War – Military service	3	WWII infantry battle; ship torpedoed; other
	War – Internment camps	2	WWII concentration camps in Europe and internment camps in Japan
Accident (n=36)	Building fire	30	House fires; apartment/flat fires; high-rise building fire; other
	Accidental trauma or death	3	Motor vehicle accident; loss of children through accidents
	Vicarious witness	3	Motor vehicle/pedestrian collision; train collision; bicycle accident; outdoor recreation accidents; workplace accidents
Other (n=5)	Epidemic	4	Poliomyelitis, SARS
	Dislocation	1	Refugee resettlement
	TOTAL	**237**	

Table 4.7 Personal Vulnerability – Disaster Experience, by Impact*

Type of Effect	Type of Impact	Count (n)	Examples
Direct Effects on Health and Safety (n=116)	Emotional	89	Everything changed, thank God I had my mother with me, I learned a lot about human nature. My bed went from one end of the room to the other, I was scared and screaming. I was a young student nurse on night duty alone in ward when earthquake struck; have never lost my fear & each earthquake I experience takes me back to that night. How dare they do this to me ("shock") but get on with it. When transport continued had "fear" of it happening again. Apprehension – waiting for the next one! Separated from parents, could not return home for some time, home alone. Scared stiff, but able to live in 2 rooms of house and everyone in suburb helped each other. Parent delayed in coming home. My mother was in the Napier earthquake and reacted with panic to even mild earthquakes through my childhood. Was a child at the time; parents anxiety. Shock of seeing so much effort & money smouldering in a heap of debris. Not feeling safe in my own home. Watched people being killed. Two colleagues killed. Lost 2 friends. I witnessed the Wahine in distress and called 111; this was the first police knew of the pending disaster. Fear of trees/wires coming down. The dramatic realisation that mankind is impotent against the forces of nature. Loss of personal confidence & security. Losing my feeling and emotions after it happened. Divorce, losing a baby. Fear of safety. Lost friends. Personal injury to friends. As clinician experienced vicariously effects on individual of man made (war) and physical disasters. Lost 2 family members. Lost my son. Witnessing the destruction, seeing people had died, buildings we were in hours before collapsed – the 'what might have been.' Emotional – it was 70 seconds long and increased in severity as it went; thought I was going to die; I could not walk – too much adrenalin; now I have a huge startle effect when there is even a small earthquake. Feelings of helplessness. Feelings of hopelessness. Anxiety. I rescued a friend who was stranded.
	Physical	27	Couldn't go outside because of volcanic ash making it difficult to breathe. Minor cuts and bruises, lack of human vision for 1 hour approx. Personal safety. Endangered my life. Impacted my health (asthma) and correspondingly my mobility because of ash making it difficult to breathe. Mum throwing me out window and trees coming out of ground.

Table 4.7 Personal Vulnerability – Disaster Experience, by Impact* (continued)

Type of Effect	Type of Impact	Count (n)	Examples
Direct Effects on Property (n=69)	Real property	59	Shed blew down. Roof crashed into spare bedroom window, most of glass landed on bed, no one in bed thank goodness. House destroyed. House wrecked. House uninhabitable, took six months to repair. House badly damaged. House damaged, friend's house badly damaged. Friend's houses destroyed. Boarding school damaged. House flooded. Water damage inside home. Nearly every house in neighbourhood lost its chimney. House damage – chimneys, roof, furniture. Cracked fireplace. Cracks in walls. Roof destroyed. Lost part of roof. House exposed to external debris from other homes losing their roofs. Out buildings destroyed, house had to be dug out of mud. Deck destroyed. House frontage flattened. Verandah torn off. Shed was destroyed & had to be rebuilt as well as a new garage. Destroyed our driveway. Tree landed on our carport, a power line came down over our driveway prohibiting vehicle access, another came down and hit a sheep, killing it. Loss of farm animals. Loss of cattle (income). Lost back section. Left behind a complete ruins and lack of vegetation. Garden under water. Widespread loss of property and destruction of local habitats. Flood to property. Section was flooded.
	Personal Property	10	Home and possessions destroyed. Possessions lost. Lost car. Destroyed everything in carport & carport. Car ruined. Car flooded. Car got hit by falling debris (made of steel). Loss of my bike. Damage to personal property. Items fell off shelves and broke.
Indirect Effects on Day to Day Activity (n=68)	Mobility	29	Extremely limited mobility. All access to work life removed – no transportation, life "culturally" changed overnight. City brought to a halt. Restricted movement around the city. City transport shut down. Local motorways down. Road closures. Roads and bridges all around washed out. Blocked vehicle access. Involved in a car accident. Could not get home from work. Unable to go to work. Difficult to get to work – public transportation affected. Not able to go to house. Stranded. Housebound. Stay inside, no travel. Cut off from the outside world. No access out of region. Stuck in the country. Delayed departure from country. Delayed travel home. Used another route to travel. Took lots of detours, could not get off airplane. Could not travel to town/shops/work. Had to delay travel home due to condition of roads.

Table 4.7 Personal Vulnerability – Disaster Experience, by Impact* (continued)

Type of Effect	Type of Impact	Count (n)	Examples
Indirect Effects on Day to Day Activity (n=68)	Activities	28	Disruption due to damage to infrastructure. Lights went out. No power/water for a period of days. Sewers compromised. No water supply. Restricted ability to get food & water. Boiling water and unable to shop for supplies or leave house or flush toilet. Laundry was wrecked and had to do laundry elsewhere. Had to share our house with neighbours who lost theirs. Restricted usual leisure activities. Interrupted overseas holiday and worked for disaster relief. Disruption to school. School closed. Missed school. Had to repair school classrooms. Disruption to normal routine. Disruption of work while building dried.
	Income	11	Out of work. Loss of income. Change of job. Time off work. Affected business activity. Disruption to work, routine. Downturn in stock market led to job loss.
Evacuation (n=23)	Evacuation	23	Property damaged resulting in evacuation from our house. Had to evacuate house in middle of night. House destroyed had to move out. Had to move to temporary house. Need to evacuate and move to safer premises with family. House damaged, had to leave and unable to return until house cleared by inspectors after repairs completed. Evacuation from house until land surveyed and OK given to return home (30 hours). Had to move out for 3 days while carpet dried. Damage to property, had to move out for 5 months. Emergency evacuation of workplace and central city. Having to be relocated for 9 months. House destroyed – had to be relocated in a different part of the country.
	TOTAL	**285**	

* Numbers approximate due to overlap within some reports and categorical similarities (e.g., boiling water is a disruption to day-to-day activities and also a physical health & safety issue).

Table 4.8 Personal Vulnerability – Disaster Experience, by Coping Resource

Coping Resource Type		Count (n)	Examples
Personal Health Management Resources (n=250)	Personal Resources – Health-related Quality of Life Factors (n=217)	87	Mental/emotional resources
		59	Social network – family
		32	Social network – friends
		21	Social network – community
		12	Social network – neighbours
		5	Spiritual resources
		1	Physical health
	Personal Resources – Behaviours (n=33)	9	Readiness – DYI
		9	Recovery – move
		5	Recovery – repair
		4	Recovery – help others
		3	Response – communicate
		2	Recovery – other (e.g., be "busy", play guitar)
		1	Readiness – civil defence drill
Community Resources (n=55)	Institutional resources (n=55)	21	Emergency response
		17	Welfare
		11	Workplace/colleagues
		6	Utility/lifeline services
Other (n=21)	Other resources, non-specified (n=21)	14	Other resources – internal
		7	Other resources – external
	TOTAL	**326**	

4.1.3 Health Management Resources for Disaster

This section examines respondent self-reports on the level of personal health management resources available for changing the consequences of and coping with disaster, through assessment of quality of life factors and disaster preparedness activities.

4.1.3.1 Quality of Life Indicators

The reliability of scale scores for the sample was checked by calculating Cronbach's coefficient of internal consistency among scale items. All scales exceed the threshold of Cronbach's alpha > .7, indicating good internal consistency and in fact exceed the threshold of 0.8 which is considered indicative of a mature assessment measure (Table 4.9).

Table 4.9 Quality of Life – Scale Reliability

Quality of Life Domain (Scale Name)	Cronbach's Alpha (α)
Social Well-Being (FS)	0.816
Emotional Well-Being (SOC13)	0.843
Spiritual Well-Being (SS20)	0.920
Physical Health Status (SF12 PCS)	0.832
Mental Health Status (SF12 MCS)	0.832
Global Well-Being (SWLS)	0.908

Descriptive statistics were applied to obtain counts, frequencies, and means for all domains of well-being and are reported in the following section.

4.1.3.1.1 Multi-dimensional Health Status

- Respondents tend toward higher levels of well-being in every domain of quality of life (Table 4.10).
    - Social well-being (FS) scores ($\bar{x}$ = 20.4, SD 4.0) indicate a tendency to be "socially connected," according to cut points established by Hawthorne (2006).

- Emotional well-being (SOC13) scores ($\overline{x}$ = 68.8, SD 11.1) are distributed along a continuum without natural cut points. No categories appear to be truly mutually exclusive and exhaustive. Without clear and well-defined categories of low, moderate, and high, this makes justifying dichotomous (high, low) or trichotomous (high, moderate, low) levels difficult to do and would adversely affect statistical power.

- Respondents tend to report higher spiritual well-being (SS20) scores ($\overline{x}$ = 68.7, SD 12.4).
- Respondents are slightly above the norm of 50 for mean physical health status (PCS) scores ($\overline{x}$ =50.2, SD 9.4).
- Respondents are slightly above the norm of 50 for mean mental health status (MCS) scores ($\overline{x}$ = 51.3, SD 8.5).
- Respondents tend to report higher global well-being (SWLS) scores ($\overline{x}$ = 25.1, SD 6.8).

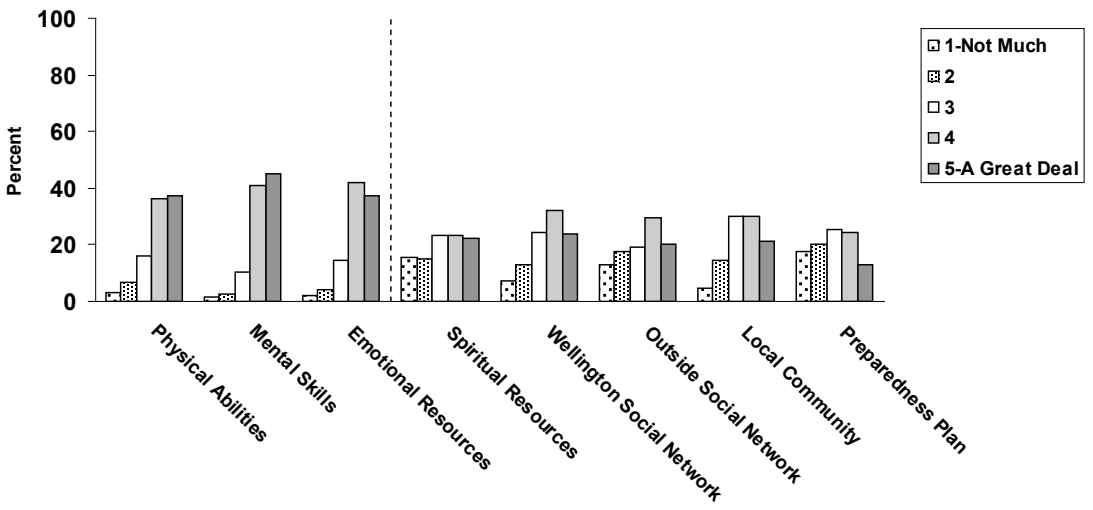
Table 4.10 Quality of Life - Descriptive Statistics

Quality of Life Domain (Scale Name)	Response Rate n	Response Rate %	Possible range	Sample range	Sample mean	Standard deviation
Social Well-Being (FS)	661	95.1	0-24	3-24	**20.4**	4.0
Emotional Well-Being (SOC13)	674	97.0	13-91	31-91	**68.8**	11.1
Spiritual Well-Being (SS20)	660	95.0	20-100	34-100	**68.7**	12.4
Physical Health Status (SF12 PCS)	662	95.3	0-100	16-67	**50.2**	9.4
Mental Health Status (SF12 MCS)	662	95.3	0-100	16-67	**51.3**	8.5
Global Well-Being (SWLS)	675	97.1	5-35	5-35	**25.1**	6.8

4.1.3.1.1.1 Significance of Health-related Quality of Life Factors

More than one out of three people indicated strong belief their physical abilities, mental skills, and emotional resources will help them significantly for managing or coping with disaster evacuation in Wellington (Table 4.11). Figure 4.20 shows the prevalence of scores in the range of response option 4-5 (scale range 1-5) for these three coping resources. Results are more broadly distributed for how highly people appraise the value of spiritual resources, social networks, community resources, and preparedness planning, as indicated by the histograms to the right of the dashed line on Figure 4.20.

Figure 4.20 Perceived Value of Personal Resources for Coping with Evacuation



- The resources most frequently anticipated to help "a great deal" with evacuation are mental skills (45.1%). This evaluation is followed by equal confidence in physical abilities (37.4%) and emotional resources (37.4%). In this category (response option 5), lesser weight is progressively placed on social network in Wellington (23.6%), spiritual resources (22.5%), local community (21.0%), and social network outside of Wellington (20.2%).
- People report the greatest ambiguity (29.8%) regarding the value of the local community in coping with disaster, and the least ambiguity (10.5%) for mental skills (response option 3).
- The resources that are most frequently anticipated to help "not much" (response option 1) are spiritual resources (15.7%), followed by social network outside Wellington (13.2%), social network in Wellington (7.2%), local community (4.6%), physical abilities (3.3%), emotional resources 2.3%), and mental skills (1.3%).
- Slightly over one-third (37%) tend towards higher levels of appraisal that their current preparedness plan will help them manage or cope with evacuation.
    - Only 12.7% think their current preparedness plan will help them "a great deal."

Table 4.11 Perceived Value of Personal Resources for Coping with Evacuation

Response / Type of Resource	1 Not much		2		3		4		5 A great deal	
	n	%	n	%	n	%	n	%	n	%
My physical abilities (n=668)	22	3.3	46	6.9	108	16.2	242	36.2	250	**37.4**
My mental skills (n=669)	9	1.3	16	2.4	70	10.5	272	40.7	302	**45.1**
My emotional resources (n=666)	15	2.3	28	4.2	95	14.3	279	**41.9**	249	**37.4**
My spiritual resources (n=661)	104	15.7	100	15.1	154	**23.3**	154	**23.3**	149	22.5
My social network in Wellington (n=665)	48	7.2	86	12.9	161	24.2	213	**32.0**	157	23.6
My social network outside Wellington (n=669)	88	13.2	119	17.8	130	19.4	197	**29.4**	135	20.2
My local community (n=667)	31	4.6	97	14.5	199	29.8	200	**30.0**	140	21.0
My current preparedness plan (n=667)	116	17.4	134	20.1	170	**25.5**	162	24.3	85	12.7

4.1.3.1.2 Access to Primary Health Care

Nearly all (87.5%) respondents have a regular GP that they see at least on an annual (year-to-year) basis.

4.1.3.2 Health-Protective Behavioural Indicators

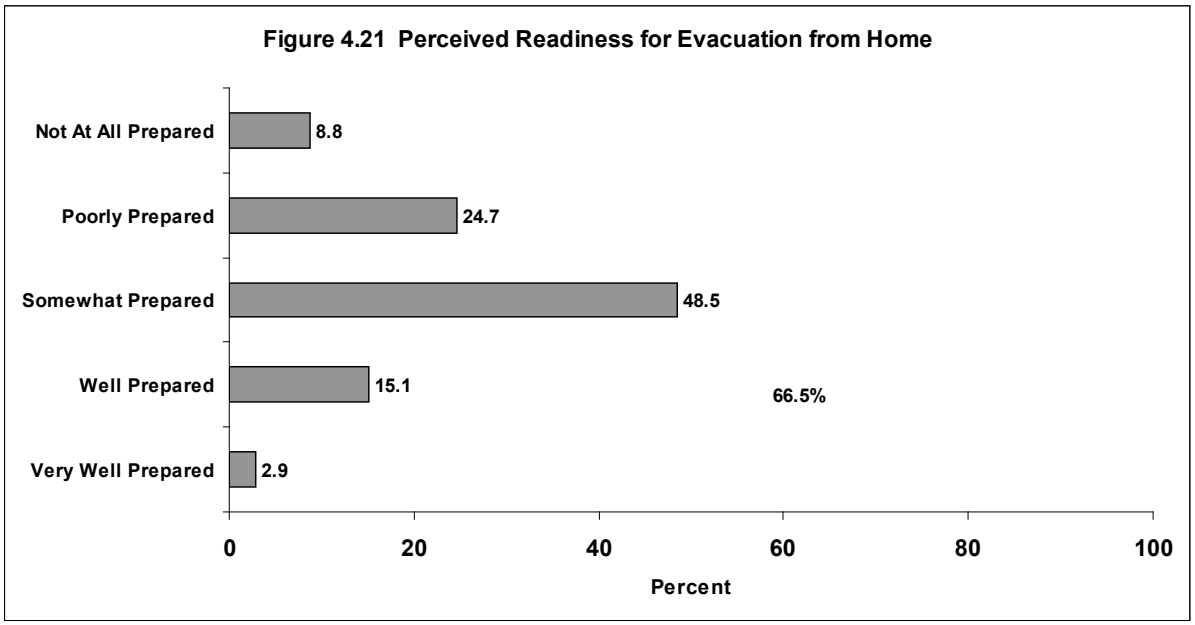
Respondent self-reports on the level of engagement in preparedness planning and action, with a specific focus on “getaway kit” evacuation preparedness, can be thought of as health-protective behaviours for disaster resilience.

4.1.3.2.1 Preparedness Status

Respondents were asked to consider the possibility of an earthquake or tsunami in the Wellington Region and self-rate their overall level of preparedness to evacuate from home (Question 30) as a baseline indicator of readiness. Response options range from “very well prepared” to “not at all prepared.”

4.1.3.2.1.1 Perceived Readiness

Fewer than one in five people consider themselves at least "well prepared" for evacuation due to earthquake or tsunami in Wellington. Two out of three people rate themselves as at least "somewhat prepared" to evacuate from home (Figure 4.21).



- The distribution of readiness within the study population is generally normal, with a slight tendency toward lower levels of preparedness.
    - About half (48.5%) consider themselves "somewhat prepared."
    - The next most prevalent category is "poorly prepared" (24.7%), followed by "well prepared" (15.1%), "not at all prepared" (8.8%), and "very well prepared" (2.9%) for evacuation from earthquake or tsunami.

4.1.3.2.1.2 Types of Readiness

Many types of activities are helpful for overall disaster preparedness and may naturally pave the way toward effective planning and preparing for evacuation from home. These activities can range from simply *talking* about the possibility of a disaster with friends, family or neighbours, to information *seeking*, *making* "getaway plans," *testing* "getaway plans," and assembling materials or *making* "getaway kits" containing items for immediate survival, evacuation, and communications.

In the context of a threat or damage from earthquake or tsunami, people in this study were asked 16 items about the level of activity in each of the above-described categories (Question 35). The study survey included 3 additional items for people to specifically identify whether their steps to increase their level of home preparedness were, in general, for earthquake, tsunami, or "other."

All 19 items were designed with a 5-point Likert scale using the Stages of Change Model (Prochaska et al. 1982, 1983, where 1 = I have not thought about this (*precontemplation*); 2 = I have thought about this, but that's all (*contemplation*); 3 = I intend to do this (*intention*); 4 = I have started doing this (*action*); and 5 = I do this regularly (*maintenance*). Results were dichotomised into broader categories of *intention* (1-3) and *action* (4-5) for inferential analyses. Consistent with the study aims, making an evacuation "Getaway Kit" was selected as the primary behavioural variable of interest for inferential analysis.

- The most frequent preparedness activities are *made a survival/escape kit (e.g., torch, fire extinguisher, first aid kit)*; *talked with my social network (e.g., friends and family)*; and *sought out information about how to prepare for earthquake or tsunami*. In each of these categories, over half of the respondents have taken action.
- The least frequent preparedness activities are in the categories of having *followed an evacuation route, gone to an assembly area,* and *participated in a drill.*

Specific findings by type of activity are shown for both dichotomous conditions of intention versus action (Figure 4.22) and with the Stages of Change Model (Figure 4.23). The greatest discrepancies between intention and action emerge for evacuation testing, talking with neighbours, planning and kit-making, and general non-earthquake preparedness. Similar patterns are observed at the Stages of Change level of measurement.

Figure 4.22 Level of Preparedness Activity, Intention versus Action

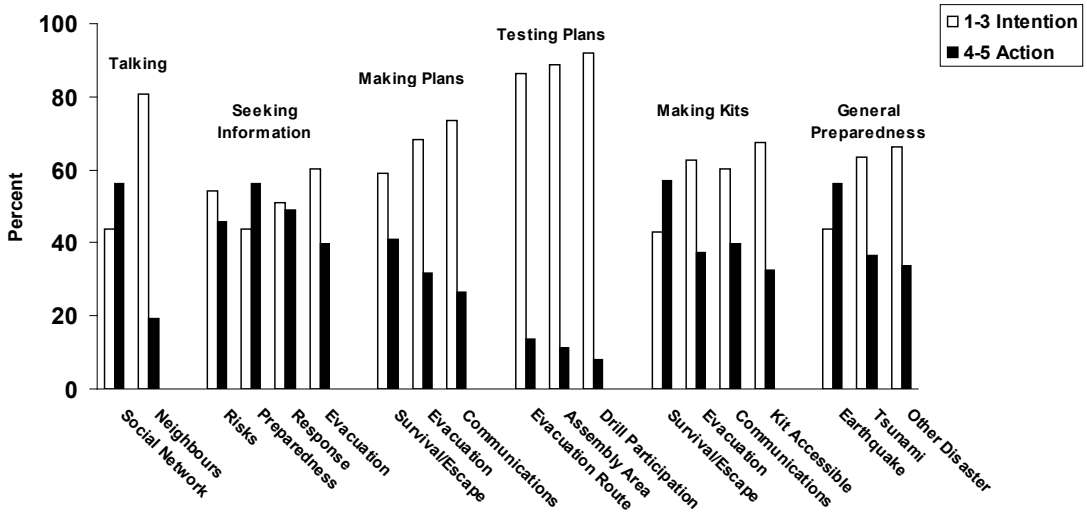
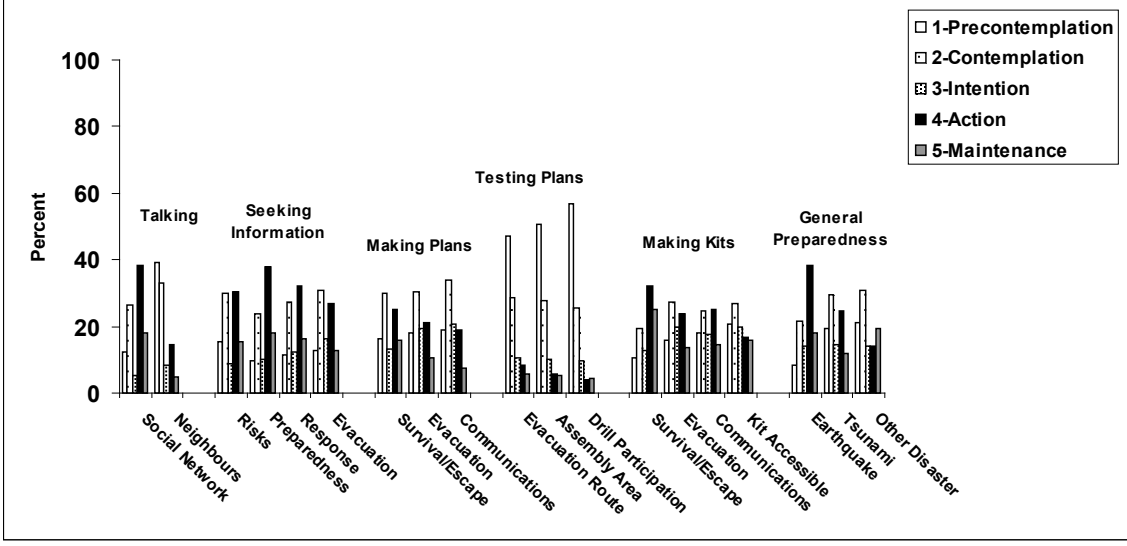


Figure 4.23 Level of Preparedness Activity, Stages of Change Model



The following bullet points summarise the data displayed in Figure 4.22 and Figure 4.23. These data are also detailed in Tables 4.12 and 4.13. Frequency counts and percentages are provided for data at dichotomised levels of measurement for each of the nineteen preparedness items in Table 4.12. Counts and frequencies, as well as calculated means and other summary statistics, are also provided for the data at the Stages of Change continuous level of measurement in Table 4.13.

Talked about the possibility of an earthquake or tsunami

- Over half (56.1%) have *talked with my social network (e.g., friends, family)* about the possibility of an earthquake or tsunami.
- About one-fifth (19.3%) have *talked with others in my neighbourhood*.
- Using the Stages of Change scale, results are negatively skewed for *with my social network* (3.2, SD = 1.3, -.285), and positively skewed for *with others in my neighbourhood* (2.1, SD = 1.2, .899)

Sought out information about earthquakes or tsunamis

- About half have sought out information about *how to prepare for* (56.1%), *how to respond during* (48.9%), and the *risks and consequences* (45.7%) of earthquakes and tsunamis.
- About forty percent (39.7%) have sought out information about *how to evacuate from* earthquakes or tsunamis.
- Using the Stages of Change scale, results are negatively skewed for *how to prepare for* (3.3, SD = 1.3, -.348), *how to respond during* (3.2, SD = 1.3, -.142), and *risks and consequences* (3.0, SD = 1.4, -.007). Results are positively skewed for *how to evacuate from* (3.0, SD = 1.3, .075).

Made Home "Getaway Plans"

- About forty percent (40.8%) have made *survival/escape plans (e.g., for immediately responding to an event and for protecting my physical health).*
- About one-third (31.7%) report making *evacuation/dislocation plans (e.g., for leaving home with what is important to me; following evacuation routes; going to assembly locations).*
- About one-quarter (26.6%) have made *communications plans (e.g., for being in contact with my network of friends and family).*
- Results for the Stages of Change scale are positively skewed for *survival/escape plans* (3.0, 1.4, .091), *evacuation/dislocation plans* (2.8, 1.3, .244), and *communications plans* (2.6, 1.2, .359).

Tested Home "Getaway Plans"

- About fourteen percent (13.8%) have tested home "getaway plans" by *following an evacuation route*.
- About one in ten (11.2%) report they have *gone to an assembly area* to test home "getaway plans."
- Fewer than one in ten (8.2%) have *participated in a drill* for testing home "getaway plans."
- Using the Stages of Change scale*,* results are positively skewed for *followed an evacuation route* (2.0, 1.2, 1.164), *gone to an assembly area* (1.9, 1.2, 1.356), and *participated in a drill* (1.7, 1.1, 1.592).

Made a Home "Getaway Kit"

- About sixty percent (57.2%) have assembled items for *survival/escape (e.g., torch, fire extinguisher, first aid kit).*
- About forty percent (39.6%) report they have assembled items for *communications (e.g., contact list, phone, portable radio).*
- Over one-third (37.3%) have assembled items for *evacuation (e.g., outerwear, water, money, documents).*
- About one-third (32.4%) report having *placed a "getaway kit" in an easily accessible spot, ready for evacuation.*
- Results using the Stages of Change scale are negatively skewed (-.425) for assembling items for *survival/escape*, indicating more people tended towards the action end of the scale than simply thinking about it or not even thinking about it at all. The mean score (3.4, SD = 1.3) falls between the categories of *I intend to do this* and *I have started doing this*. All other means are between the categories of *contemplation* and *intention* and are positively skewed (items for *communications*, 2.9, SD = 1.3, .033; items for *evacuation*, 2.9, SD = 1.3, .084; *kit accessible*, 2.8, SD = 1.4, .250). This indicates that people primarily restricted consideration of these items to thought rather than to action.

Taken steps to increase level of home preparedness

- About half (56.4%) have taken action for earthquake preparedness.
- About one-third (36.6%) have taken action for tsunami preparedness.
- Less than one-fifth of the sample (n = 188) report taking action to increase home preparedness for 'other' types of disaster.
    - Of this subpopulation, about one-third (n = 61) specified type. The three most common types were fire (n = 29), flood/storm/weather (n = 13), and pandemic/flu (n = 10). These 'other' data are provided for information only and are not suitable for statistical reporting or inference.
- Using the Stages of Change scale, results are negatively skewed for *earthquake preparedness* (3.4, SD = 1.2, -.406) and positively skewed for *tsunami preparedness* (2.8, SD = 1.3, .174).

Table 4.12 Level of Preparedness Activity, Intention vs. Action (Dichotomised)

Type of Preparedness Activity		Level of Engagement			
		1-3 Intention		4-5 Action	
		n	%	n	%
Talked about the possibility of earthquake or tsunami	Talked with social network (n=672)	295	43.9	377	**56.1**
	Talked with others in neighbourhood (n=657)	530	**80.7**	127	19.3
	Sought information on risks and consequences (n=663)	360	**54.3**	303	45.7
Sought out information about earthquakes and tsunamis	Sought information on preparedness (n=667)	293	43.9	374	**56.1**
	Sought information on response (n=665)	340	**51.1**	325	48.9
	Sought information on evacuation (n=665)	401	**60.3**	264	39.7
Made Home "Getaway Plans"	Made survival/escape plans (n=666)	394	**59.2**	272	40.8
	Made evacuation/dislocation plans (n=665)	454	**68.3**	211	31.7
	Made communications plans (n=666)	489	**73.4**	177	26.6
Tested Home "Getaway Plans"	Tested plans – followed an evacuation route (n=659)	568	**86.2**	91	13.8
	Tested plans – gone to an assembly area (n=663)	589	**88.8**	74	11.2
	Tested plans – participated in a drill (n=656)	602	**91.8**	54	8.2
Made a Home "Getaway Kit"	Made survival/escape kit (n=671)	287	42.8	384	**57.2**
	Made evacuation kit (n=668)	419	**62.7**	249	37.3
	Made communications kit (n=666)	402	**60.4**	264	39.6
	Kit accessible (n=664)	449	**67.6**	215	32.4
Taken steps to increase my level of preparedness at home	Taken steps for earthquake preparedness (n=670)	292	43.6	378	**56.4**
	Taken steps for tsunami preparedness (n=650)	412	**63.4**	238	36.6
	Taken steps for other disaster preparedness (n=133)	88	**66.2**	45	33.8

Table 4.13 Level of Preparedness Activity, Stages of Change Continuum

Type of Preparedness Activity	Level of Engagement										Summary Statistics		
	1		2		3		4		5				
	Precontemplation		Contemplation		Intention		Action		Maintenance				
	n	%	n	%	n	%	n	%	n	%	Mean	SD	Skew
Talked with social network (n=672)	82	12.2	178	26.5	35	5.2	257	**38.2**	120	17.9	3.2	1.3	-.285
Talked with others in neighbourhood (n=657)	259	**39.4**	217	33.0	54	8.2	95	14.5	32	4.9	2.1	1.2	.899
Sought information on risks and consequences (n=663)	102	15.4	198	29.9	60	9.0	200	**30.2**	103	15.5	3.0	1.4	-.007
Sought information on preparedness (n=667)	65	9.7	160	24.0	68	10.2	253	**37.9**	121	18.1	3.3	1.3	-.348
Sought information on response (n=665)	75	11.3	183	27.5	82	12.3	215	**32.3**	110	16.5	3.2	1.3	-.142
Sought information on evacuation (n=665)	86	12.9	205	**30.8**	110	16.5	179	26.9	85	12.8	3.0	1.2	.075
Made survival/escape plans (n=666)	107	16.1	199	**29.9**	88	13.2	167	25.1	105	15.8	3.0	1.3	.091
Made evacuation/dislocation plans (n=665)	121	18.2	203	**30.5**	130	19.5	141	21.2	70	10.5	2.8	1.2	.244
Made communications plans (n=666)	125	18.8	225	**33.8**	139	20.9	126	18.9	51	7.7	2.6	1.2	.359
Tested plans – followed an evacuation route (n=659)	310	**47.0**	188	28.5	70	10.6	54	8.2	37	5.6	2.0	1.2	1.164
Tested plans – gone to an assembly area (n=663)	337	**50.8**	185	27.9	67	10.1	38	5.7	36	5.4	1.9	1.1	1.356
Tested plans – participated in a drill (n=656)	372	**56.7**	168	25.6	62	9.5	26	4.0	28	4.3	1.7	1.3	1.592
Made survival/escape kit (n=671)	70	10.4	131	19.5	86	12.8	217	**32.3**	167	24.9	3.4	1.3	-.425
Made evacuation kit (n=668)	106	15.9	181	**27.1**	132	19.8	159	23.8	90	13.5	2.9	1.3	.084
Made communications kit (n=671)	119	17.9	165	24.8	118	17.7	167	**25.1**	97	14.6	2.9	1.3	.033
Made kit accessible (n=668)	139	20.9	117	**26.7**	133	20.0	110	16.6	105	15.8	2.8	1.4	.250
Taken steps for earthquake preparedness (n=670)	55	8.2	144	21.5	93	13.9	258	**38.5**	120	17.9	3.4	1.3	-.406
Taken steps for tsunami preparedness (n=650)	127	19.5	191	**29.4**	94	14.5	160	24.6	78	12.0	2.8	1.4	.174
Taken steps for other disaster preparedness (n=133)	28	21.1	41	**30.8**	19	14.3	19	14.3	26	19.5	2.8	1.4	.319

4.1.3.2.1.3 Evacuation Readiness

In addition to the evacuation preparedness activities highlighted in the preceding graphs and tables, people were asked three additional questions relating to their evacuation readiness (Questions 36-38).

4.1.3.2.1.3.1 Essential Items for Evacuation

Respondents were asked to list the top three items they considered essential for a personal evacuation "getaway kit" (Question 36). The following items emerged as the first priority, based on self-report responses to this open-ended question. A content analysis was completed and results for the top priority item are tabulated by the most common categories, listed in Table 4.14 below.

Table 4.14 Most Essential Item for Personal Evacuation Kit

Type of Kit Item	Top Priority
	n
Food	118
Clothing/outwear	95
Medications	88
Documents/identification/wallet	47
Medical supplies/First aid	45
Water	27
Footwear	26
Cell phone	26
Family	25
Radio	16
Blankets/insulation/sleeping bag	11
Pets	10
Shelter/tent	9
Money/credit cards	9
Photos	9
Emergency Kit	6
Bible	5
Contacts	4
Glasses/eyewear	4
Computer	3

4.1.3.2.1.3.2 Evacuation Plan Coordination

Respondents were also asked (“yes” or “no”) if they have given any personal evacuation plans to friends or relatives living outside of the Wellington Region (Question 37).

- Nearly all (93.3%) have not shared evacuation plans with friends or relatives living outside the Wellington Region.

4.1.3.2.1.3.3 Workplace Evacuation Preparedness

The study includes an exploratory question on respondent activity (“yes” or “no”) for making workplace “getaway plans”, workplace “getaway kits”, and/or other activities in multiple-response format (Question 38).

Descriptive reporting on workplace activities is representative only for those who have a workplace and is not generalisable to all respondents. A respondent who completed Question 38 could tick as many response options as applicable, therefore only frequency counts for this subpopulation are reported here.

- A count of n=177 report they have made workplace “getaway plans,” followed by workplace “getaway kit” (n=120), and “other” activities (n=42). The predominant “other” activity cited is participation in fire and evacuation drills, followed by storing survival items (e.g., water, food, shoes).

4.1.4 Motivation for Behaviour Change

Motivation is conceptualised for this study as a process that leads to the intention to change behaviour. This motivation can come from the physical environment, based on risk perceptions and risk judgments, and also from influences in the social environment. In the latter it can derive from outside an individual ('external motivation') or within a person's internal value system ('internal motivation'). Possible social contexts for preparedness motivation are described in this section.

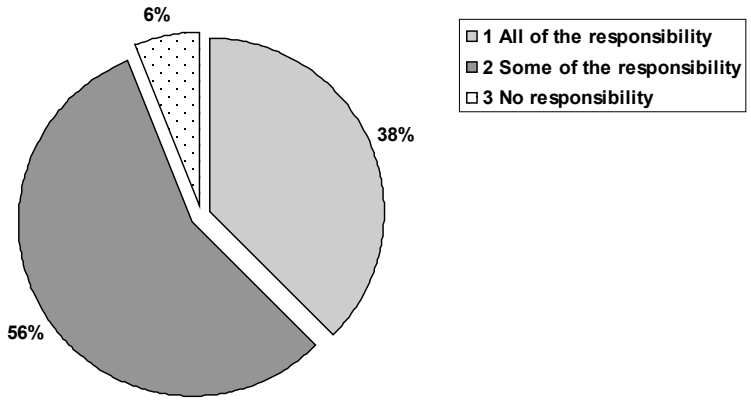
4.1.4.1. External motivation for preparedness behaviour

A selection of external motivations for preparedness activity (household responsibility, workplace requirement, media exposure) is explored through a variety of response formats in Questions 39, 40, and 41.

Nearly all (93.9%) describe themselves as having at least some responsibility for disaster preparedness in their household (Question 41).

- About half (56.3%) state they have "some of the responsibility," followed by "all of the responsibility" (37.6%), and "no responsibility" (6.0%).

Figure 4.24 Household Role for Disaster Preparedness



Workplace- related and news-related motivations for evacuation preparedness (Questions 39 and 40) apply only to those who have a workplace or were specifically motivated to prepare because of a news event. A respondent who completed these questions could tick as many response options as applicable, therefore only frequency counts for these subpopulations are reported here. These results are reported for broad-spectrum interest but are not generalisable.

- The most frequent reason for workplace-related preparedness (Question 39) is "my choice" (n=88), followed by "workplace requirement" (n=84), "workplace request" (n=61), and "other" (n=15). The predominant "other" reason cited is the nature of the workplace (e.g., hospital, emergency response) or role (e.g., fire warden), followed by workplace laws, policies or plans.

Over one in four people (n=182) report that they engaged in evacuation planning due to media coverage of a specific disaster (Question 40). The most motivating event was the 2004 South Asian Tsunami (n=129), followed by the 2008 Wenchuan, Sichuan Earthquake (n=53). The next most frequently reported media influence is television programming about local disaster risk; many respondents cited a TV programme about earthquake and tsunami in Wellington ("Aftershock," aired by TV3 in October 2008). Other non-specified disasters also play a role (n=20). Additional educational efforts to boost disaster awareness and understanding of the Wellington geologic setting have also made an impression (Table 4.15).

Figure 4.25 Media Influences on Evacuation Preparedness

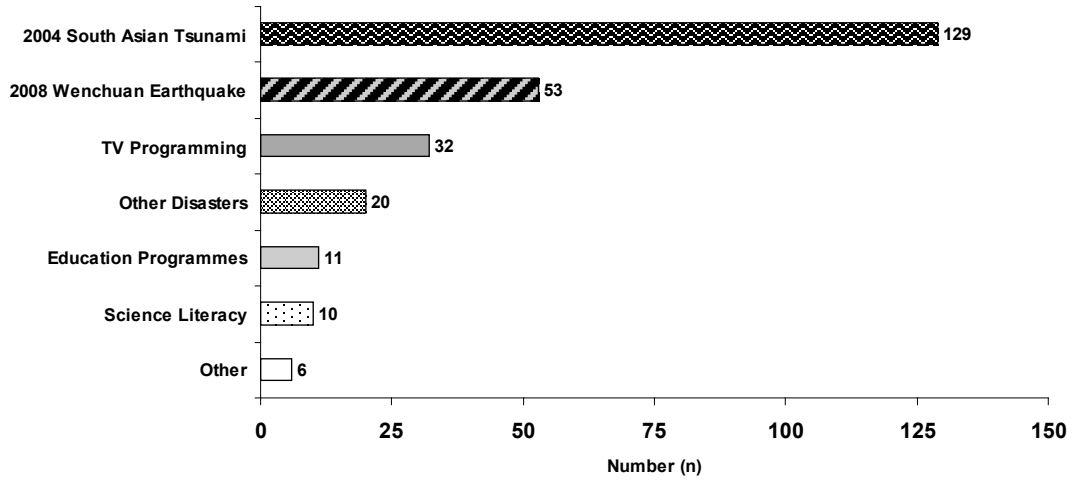


Table 4.15 Media Influences on Evacuation Preparedness

Media or Educational Event	Count (n)	Examples
2004 South Asian "Boxing Day") Tsunami	**129**	n/a
2008 Wenchuan, Sichuan, China Earthquake	**53**	n/a
TV Programming	**32**	Nearly all (n=29) made reference to a New Zealand television programme dramatising an earthquake and tsunami in Wellington ("Aftershock") that aired on TV3 in October 2008.
Other Disasters	**20**	Earthquakes in Inangahua (1986), Whakatane (1987), Gisborne (2007); other Wellington and New Zealand quakes; Peru earthquake (2007); the Wahine Storm (1968) in Wellington; cyclones in northern Australia; Hurricane Iniki in Hawaii (1992); floods in New Zealand and the USA; Mount Ruapehu volcanic eruptions; medical emergency; disease outbreaks; war and wartime experience; and civil defence experience.
Preparedness Education Programmes	**11**	TV advertisements; local preparedness programmes through Civil Defence, Ministry of Education, Rotary International, schools and workplace.
Science Literacy	**10**	General awareness (e.g., local knowledge of geologic setting, risk, vulnerability, history).
Other	**6**	"Sensible," "just did it," "always have plans."
TOTAL	**263**	

4.1.4.2 Internal Motivation for Preparedness Behaviour

For the study, individual differences in the extent to which people tend to feel a sense of personal choice versus external regulation with respect to one's behaviours are measured (Question 15) using the Self-Determination Scale, Perceived Choice Subscale (SDS-PC), after Deci & Ryan (1985).

Further examination of perceived choice, set in the context of health-related reasons for engaging in disaster preparedness behaviour, is explored in Question 31 using the Treatment Self-Regulation Questionnaire, 15-item (TSRQ15), after Ryan & Connell (1989) and Williams et al. 1996, 2002. Response options follow a Likert scale response format where 1 = “Not true at all” and 7 = “Very true.”

4.1.4.2.1 Scale Reliability

SDS-PC is scored as one stand-alone subscale and TSRQ15 is scored through 3 subscales. Table 4.16 provides evidence of the psychometric validity of these scales for the descriptive purposes of this study. All yield sufficient Cronbach’s alphas for internal consistency and substantially exceed the .7 threshold convention for scale reliability, except the TSRQ amotivation subscale (TSRQ-AM) with a Cronbach’s alpha of .591.

Table 4.16 Motivation – Scale Reliability

Scale Name	Cronbach's alpha
Self-Determination Scale, Perceived Choice (SDS-PC)	0.857
Treatment Self-Regulation Scale, Autonomous Regulation Subscale (TSRQ-RA)	0.876
Treatment Self-Regulation Scale, Controlled Regulation Subscale (TSRQ-RC)	0.832
Treatment Self-Regulation Scale, Amotivation Subscale (AM)	0.591

4.1.4.2.2 Scale Results

Table 4.17 summarises the results of people in this study for the SDS-PC and TSRQ15. Respondents tend to report high Self-Determination scores ($\bar{x}$ =20.4, SD 3.8), indicating a tendency to be autonomous in their behavioural choices. Scores on the Treatment Self-Regulation Questionnaire (TSRQ15) subscale for autonomy (RA) are also moderately high and indicate a tendency toward a sense of personal responsibility for maintaining their health and well-being. For the RC (controlled) and AM (amotivated) subscales the respondents average around 3 on the 1-7 point scale indicating a tendency away from external controls on their behaviour.

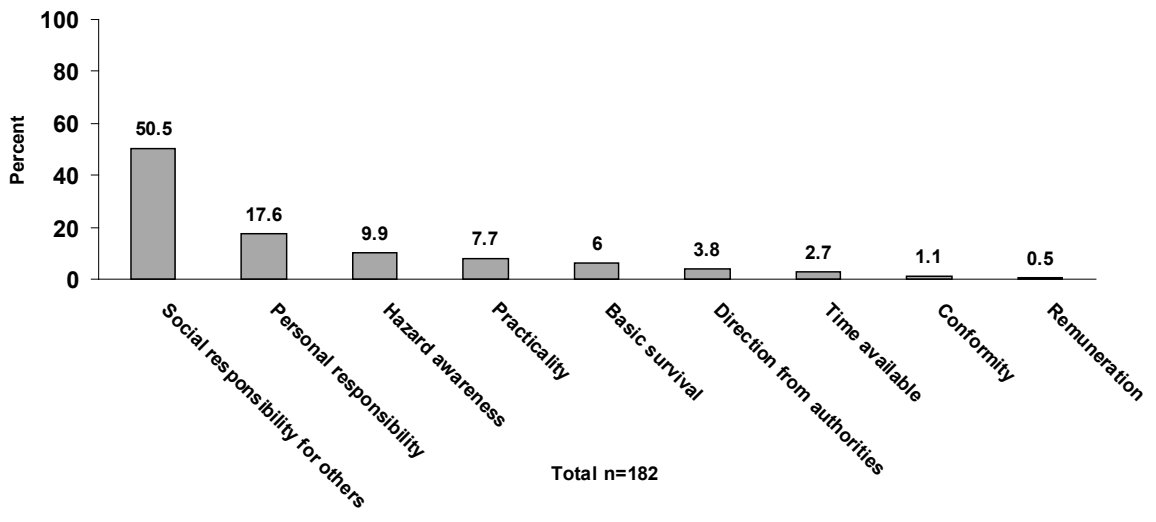
Table 4.17 Motivation – Descriptive Results

Scale	Response Rate n	%	Possible range	Sample range	Sample mean	Standard deviation
SDS-PC	674	97.0	5-25	5-25	20.1	3.8
TSRQ-RA	652	93.8	1-7	1-7	5.1	1.3
TSRQ-RC	652	93.8	1-7	1-7	3.3	1.4
TSRQ-AM	632	90.9	1-7	1-7	2.7	1.4

4.1.4.3 Other Factors Motivating Evacuation Preparedness

An open-ended question (Question 32) asked people what factors they consider significant for either preparing for evacuation or continuing to do so. Figure 4.26 shows that social responsibility for others (e.g., family, whanau, children, grandchildren, dependent others, partner, loved ones, neighbours, friends, others in the community) is important to over half (n=92) of 182 respondents.

Figure 4.26 Other Factors Motivating Evacuation Preparedness



- A sense of personal responsibility (n=32) is also important, both to lessen vulnerability and build self-reliance (e.g., “I have diabetes,” “I want to be independent”). Others cited hazard awareness (n=18), practicality (n=14), basic survival (n=11), direction from authorities (n=7) (e.g., MCDEM, Fire Service), availability of time (n=5), conformity (n=2), and remuneration (n=1).

4.2 Inferential Results

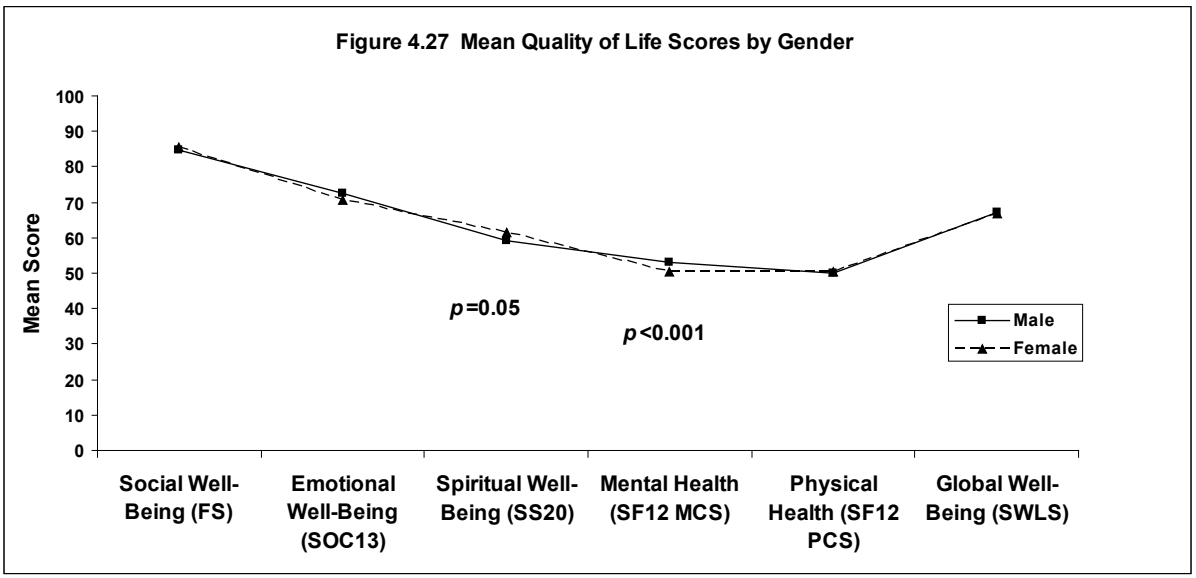
4.2.1 Bivariate Results – Comparisons between Key Variables

The results of an independent samples t-test comparing the mean scores on quality of life variables by gender are reported in Section 4.2.1.1. A one-way between-groups ANOVA comparing the mean scores on quality of life variables by age group is presented in Section 4.2.1.2. To explore for differences in evacuation kit activity by gender and age, contingency tables were constructed to compare frequencies; these results are discussed in Sections 4.2.1.3 and 4.2.1.4. Independent-samples t-tests comparing quality of life scores by evacuation kit activity (intention and action conditions) were also conducted for each domain of well-being and results are presented in Section 4.2.1.5.

4.2.1.1 Quality of Life and Gender

Slight differences in mean quality of life scores are found between genders. Mean scores are slightly higher for men in emotional well-being, mental health, and global well-being. Mean scores are slightly higher for females in social well-being, spiritual well-being, and physical health. Figure 4.27 illustrates the relative value of quality of life scores and differences in means by gender, normalised onto a 0-100 scale.

Figure 4.27 Mean Quality of Life Scores by Gender



- Significant differences ($p < .05$) are found in mean scores between males and females only for spiritual well-being and mental health (Figure 4.27, Table 4.18).
    - Female spiritual well-being is slightly higher. On the Serenity Scale (SS20) scores are as follows: males (67.4 SD 11.3) and females (69.3, SD 12.9); t (557) = -1.96, p = .05 (two-tailed). The magnitude of the difference in means (mean difference -1.9, 95% CI: -3.8 to 0.0) is very small (eta squared = .006). 0.6% of the variance in spiritual well-being is explained by gender.
    - Male mental health status is slightly higher. On the SF12-MCS scale scores are as follows: males (52.9, SD 7.4) and females (50.4, SD 9.0); t (584) = 3.87, p <= 0.001 (two-tailed). The magnitude of the difference in means (mean difference 2.5, 95% CI: 1.2 to 3.8) is small (eta squared is .02). 2% of the variance in mental health score is explained by gender.
- No significant differences are found in mean scores between males and females for social well-being, emotional well-being, physical health, and global well-being.

Table 4.18 Quality of Life Mean Scores by Gender

Independent Samples T-Test

Quality of Life Domain (Scale Name)	Gender	N	Range	Sample Mean (x)	Std. Deviation (SD)	Sig. (p)	Effect Size (eta squared)
Social Well-Being (FS)	1 Male	243	0-24	20.3	4.3		n/a
	2 Female	414		20.5	3.9		
Emotional Well-Being (SOC13)	1 Male	248	13-91	69.6	11.0		n/a
	2 Female	422		68.2	11.0		
Spiritual Well-Being (SS20)	1 Male	241	20-100	**67.4**	11.3	**.05***	**.006**
	2 Female	416		**69.3**	12.9		
Physical Health Status (SF12 PCS)	1 Male	244	0-100	49.9	8.7		n/a
	2 Female	416		50.4	9.8		
Mental Health Status (SF12 MCS)	1 Male	244	0-100	**52.9**	7.4	**.000*****	**.02**
	2 Female	416		**50.4**	9.0		
Global Well-Being (SWLS)	1 Male	248	5-35	25.2	6.4		n/a
	2 Female	422		25.0	6.9		

* $p < 0.05$ (two-tailed)

** $p < 0.01$ (two-tailed)

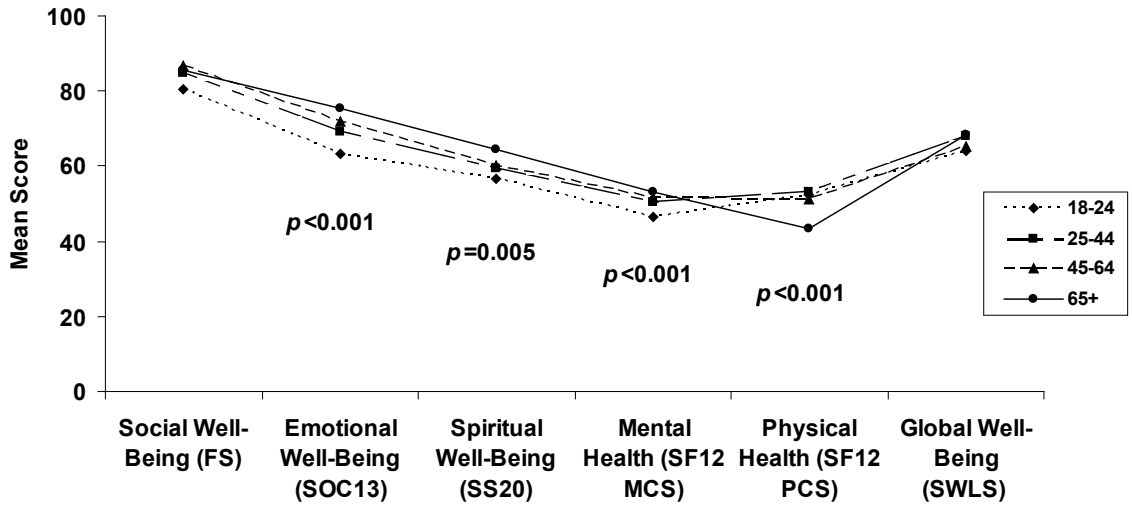
*** $p < 0.001$ (two-tailed)

These data indicate that gender has a small effect on mean scores in spiritual well-being and mental health status that is not likely to have occurred by chance. Gender has no effect on social and emotional well-being, physical health status, and global well-being. The degree to which gender is associated with these scores may not have any practical significance. With large sample sizes it is natural to detect some variance, and even very small differences in groups can become statistically significant.

4.2.1.2 Quality of Life and Age

Quality of life differs with age in the study sample. The 18-24 years age group has the lowest mean quality of life scores in every domain except physical health. The 25-44 years age group enjoys the highest mean scores for physical health. The 45-65 years age group has the highest mean scores for social well-being. Those 65 years and over enjoy the highest mean scores for emotional well-being, spiritual well-being, mental health, and global well-being. Figure 4.28 illustrates the relative value of quality of life scores and differences in means by age, normalised onto a 0-100 scale.

Figure 4.28 Mean Quality of Life Scores by Age



- Significant differences ($p < .05$) are found in mean scores between the four age groups (Table 4.19) for emotional well-being (SOC13), spiritual well-being (SS20), physical health status (PCS), and mental health status (MCS).
    - Emotional well-being (SOC13): F (3, 653) = 4.3, p =.005.
    - Spiritual well-being (SS20): F (3, 666) = 9.3, p <= 0.001.
    - Physical health status (PCS): F (3, 656) = 39.9, p <= 0.001.
    - Mental health status (MCS): F (3, 656) = 7.1, p <= 0.001.
- Despite reaching statistical significance, the actual difference in mean scores between age groups is quite small (eta squared $\leq$.04) for all scores except for physical health status (eta squared = .15). Age accounts for 15% of the variance in physical health scores.
- There is no significant difference in mean scores by age group for social well-being (FS) and global well-being (SWLS). Age has no effect on the variance for these scores.

The ANOVA test indicates that when comparing mean scores for quality of life across four age groups, age has a small effect on emotional well-being, spiritual well-being and mental health status that is not likely to have occurred by chance. Age has a large effect on physical health status that is not likely due to chance. Age has no effect on any differences in mean scores for social well-being and global well-being.

The magnitude of the differences between age groups, or relative magnitude of the differences between means, may not have any practical or theoretical significance. With large sample sizes, even very small differences in groups can become statistically significant.

Table 4.19 Quality of Life Mean Scores by Age

Descriptive Statistics and ANOVA Significance

Quality of Life Domain (Scale Name)	Age	N	Sample Mean (x)	Std. Deviation (SD)	Sig. (*p*)	Effect Size (eta squared)
Social Well-Being (FS)	1 18-24 years	28	19.3	4.1	.242	n/a
	2 25-44 years	226	20.3	4.2		
	3 45-64 years	261	20.8	3.8		
	4 65 years +	142	20.5	4.2		
	Total	657	20.5	4.0		
Emotional Well-Being (SOC13)	1 18-24 years	28	**62.4**	9.0	**.000*****	**.04**
	2 25-44 years	229	**67.0**	10.8		
	3 45-64 years	263	**69.1**	10.9		
	4 65 years +	150	**71.8**	11.1		
	Total	670	**68.7**	11.0		
Spiritual Well-Being (SS20)	1 18-24 years	27	**65.2**	11.7	**.005****	**.02**
	2 25-44 years	228	**67.6**	11.9		
	3 45-64 years	256	**68.1**	12.0		
	4 65 years +	146	**71.6**	13.3		
	Total	657	**68.6**	12.3		
Physical Health Status (SF12 PCS)	1 18-24 years	28	**52.3**	8.3	**.000*****	**.15**
	2 25-44 years	226	**53.1**	7.1		
	3 45-64 years	259	**51.3**	8.5		
	4 65 years +	147	**43.5**	11.1		
	Total	660	**50.2**	9.4		
Mental Health Status (SF12 MCS)	1 18-24 years	28	**46.3**	8.7	**.000*****	**.03**
	2 25-44 years	226	**50.4**	9.0		
	3 45-64 years	259	**51.4**	8.2		
	4 65 years +	147	**53.3**	7.6		
	Total	660	**51.3**	8.5		
Global Well-Being (SWLS)	1 18-24 years	28	24.2	6.0	.380	n/a
	2 25-44 years	228	25.4	6.8		
	3 45-64 years	263	24.6	6.7		
	4 65 years +	151	25.5	6.8		
	Total	670	25.1	6.8		

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

4.2.1.3 Evacuation Kit Activity and Gender

Neither gender is more likely to prepare than the other. The effect of any differences between males and females on kit activity is very small. A Chi-square test for independence confirms that gender and kit activity status are unrelated, indicating no significant association, x^2 (1, n = 664) = .004, p = .952, *phi* = -.006.

- The gender distribution of respondents does not change, whether engaged in evacuation kit activity or not (Table 4.20). The proportion of male and female preparers, whether intending to prepare or actively preparing, is the same as the proportion within the total sample. Among those who report they are not engaged in kit activity, 63.3% are female and 36.7% are male. Among those who report they are engaged, 62.8% are female and 37.2% are male.

Table 4.20 Relationship between Genders within Evacuation Kit Activity

Gender Distribution by Evacuation Kit Activity (n=664)

			Gender		Total
			Male	Female	
Level of Kit Activity	Intention	n	153	264	417
		% within kit activity	**36.7%**	**63.3%**	100.0%
	Action	n	92	155	247
		% within kit activity	**37.2%**	**62.8%**	100.0%
Total		n	245	419	664
		% within kit activity	**36.9%**	**63.1%**	100.0%

p = .05 (two-tailed)

- Individuals who engage in kit activity tend to do so at the same level whether they are male or female (Table 4.21). The actual proportion of males who do not prepare (62.4%) is nearly the same as the proportion of females who do not prepare (63.0%). The actual proportion of males who prepare (37.6%) is nearly the same as the proportion of females who prepare (37.0%).

Table 4.21 Relationship between Levels of Evacuation Kit Activity within Gender

Kit Activity Distribution by Gender (n=664)

			Gender		Total
			Male	Female	
Level of Kit Activity	Intention	n	153	264	417
		% within gender	**62.4%**	**63.0%**	**62.8%**
	Action	n	92	155	247
		% within gender	**37.6%**	**37.0%**	**37.2%**
Total		n	245	419	664
		% within gender	100.0%	100.0%	100.0%

p = .05 (two-tailed)

4.2.1.4 Evacuation Kit Activity and Age

Age affects preparedness. A Chi square test for independence confirms that age and kit activity status are related; there is a significant association with a medium effect size, x^2 (3, n = 664) = 18.028, p <= 0.001, Cramer's V = .165. The strength of this relationship is moderate and in part reflects the large sample size.

- Most preparers are in their middle to later years (Table 4.22). The age group most frequently reported for preparers is 45-64 years (40.9%), followed by 25-44 years (30.4%), 65 years and over (27.9%), and 18-24 years (0.8%).
- The likelihood of preparing increases with age (Table 4.23). The actual proportion of preparers is greatest among those 65 years and over (46%), followed by 45-64 years (39.1%), 25-44 years (32.9%), 18-24 years (7.1%).

Table 4.22 Relationship between Age Groups within Evacuation Kit Activity

Age Distribution by Evacuation Kit Activity (n = 664)

			Age				
			18-24 years	25-44 years	45-64 years	65 + years	Total
Level of Kit Activity	Intention	n	26	153	157	81	417
		% within kit activity	**6.2%**	**36.7%**	**37.6%**	**19.4%**	100.0%
	Action	n	2	75	101	69	247
		% within kit activity	**.8%**	**30.4%**	**40.9%**	**27.9%**	100.0%
Total		n	28	228	258	150	664
		% within kit activity	**4.2%**	**34.3%**	**38.9%**	**22.6%**	100.0%

p = .05 (two-tailed)

Table 4.23 Relationship between Levels of Evacuation Kit Activity within Age Groups

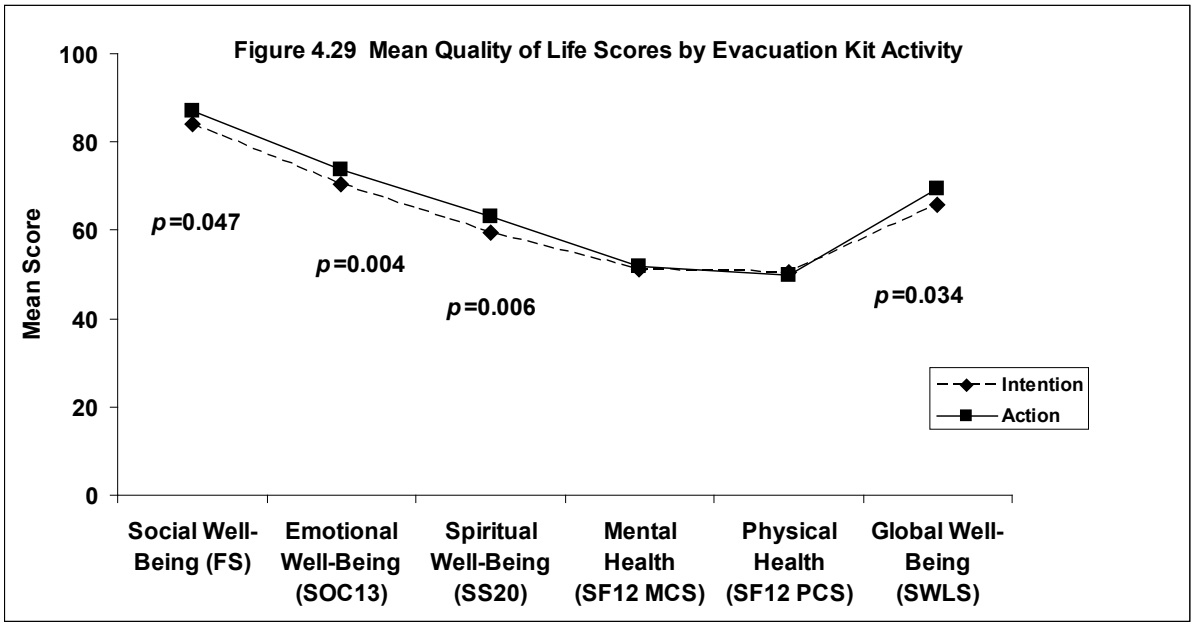
Evacuation Kit Activity Distribution by Age (n = 664)

			Age				
			18-24 years	25-44 years	45-64 years	65+ years	Total
Level of Kit Activity	Intention	n	26	153	157	81	417
		% within age group	**92.9%**	**67.1%**	**60.9%**	**54.0%**	**62.8%**
	Action	N	2	75	101	69	247
		% within age group	**7.1%**	**32.9%**	**39.1%**	**46.0%**	**37.2%**
Total		n	28	228	258	150	664
		% within age group	100.0%	100.0%	100.0%	100.0%	100.0%

p = .05 (two-tailed)

4.2.1.5 Quality of Life and Evacuation Kit Activity

An independent samples t-test found that differences in mean quality of life scores are present between those who engage in kit activity and those who do not (Table 4.24), although the differences are modest. Figure 4.29 graphically illustrates that quality of life mean scores are higher in those who prepare than those who only intend to prepare for every domain of well-being except physical health status.



Significant differences ($p < .05$) are found in mean scores between conditions of kit intention and kit action for social well-being, emotional well-being, spiritual well-being and global well-being. Summary statistics for each domain are as follows:

- Emotional well-being (SOC13): intention (67.8, SD 11.3) and action (70.4, SD 10.2); t (541) = -2.93, p = .004 (two-tailed). The magnitude of the differences in means (mean difference -2.53, 95% CI: -4.23 to -.83) is small (eta squared = .013). 1.3% of the variability in activity is explained by emotional well-being.
- Spiritual well-being (SS20): intention (67.6, SD 12.8) and action (70.4, SD 11.4); t (638) = -2.75, p = .006 (two-tailed). The magnitude of the differences in means (mean difference -2.75, 95% CI: -4.72 to .785) is small (eta squared = .011). 1.1% of the variability in activity is explained by spiritual well-being.

- Social well-being (FS): intention (20.2, SD 4.3) and action (20.9, SD 3.6); *t* (551) = -1.995, *p* = .047 (two-tailed). The magnitude of the differences in means (mean difference -.63, 95% CI: -1.26 to -.010) is very small (eta squared = .006). <.06% of the variability is explained by social well-being.
- Global well-being (SWLS): intention (24.7, SD = 6.8) and action (25.8, SD = 6.7); *t* (650) = -2.12, *p* = .034 (two-tailed). The magnitude of the differences in means is very small (eta squared = .007). .07% of the variability is explained by life satisfaction.
- No significant differences are found in mean scores in physical health status and mental health status:
    - Physical health status: intention (50.6, SD 9.1) and action (49.7, SD 9.6); *t* (640) = 1.19, *p* = .233 (two-tailed).
    - Mental health status: intention (51.0, SD 8.6) and action (51.9, SD 8.1); *t* (640) = -1.323, *p* = .186 (two-tailed).

Table 4.24 Quality of Life Mean Scores by Evacuation Kit Activity

Independent Samples T-Test

Quality of Life Domain (Scale Name)	Kit Activity	N	Range	Sample Mean (x)	Std. Deviation (SD)	Sig. (*p*)	Effect Size (eta squared)
Social Well-Being (FS)	1 Intention	406	0-24	**20.2**	**4.3**	**.047***	**.006**
	2 Action	234		**20.9**	**3.6**		
Emotional Well-Being (SOC13)	1 Intention	410	13-91	**67.8**	**11.3**	**.004****	**.013**
	2 Action	240		**70.4**	**10.2**		
Spiritual Well-Being (SS20)	1 Intention	401	20-100	**67.6**	**12.8**	**.006****	**.011**
	2 Action	239		**70.4**	**11.4**		
Physical Health Status (SF12 PCS)	1 Intention	403	0-100	50.6	9.1	.233	n/a
	2 Action	239		49.7	9.6		
Mental Health Status (SF12 MCS)	1 Intention	403	0-100	51.0	8.6	.186	n/a
	2 Action	239		51.9	8.1		
Global Well-Being (SWLS)	1 Intention	407	5-35	**24.7**	**6.8**	**.034***	**.007**
	2 Action	245		**25.8**	**6.7**		

* $p < 0.05$ (two-tailed)

** $p < 0.01$ (two-tailed)

*** $p < 0.001$ (two-tailed)

In summary, the independent samples t-test indicates that emotional well-being and spiritual well-being have a small effect on engaging in evacuation kit activity that is not likely to have occurred by chance. Social well-being and global well-being have

a very small effect on engaging in kit activity. Physical health status and mental health status has no effect on kit activity and any differences in mean scores is likely due to chance. The influence of the independent variable, quality of life, on engagement in evacuation kit activity is weak. The strength of any differences between preparers and non preparers due to quality of life variables is low.

4.2.2 Bivariate Results – Correlations

The focus of this section is on reporting results from bivariate analyses performed to detect and describe the strength and direction of any relationships between quality of life variables and between quality of life and evacuation kit activity.

4.2.2.1 Relationships between Quality of Life Variables – Scale Utility

Correlational analyses reveal that none of the quality of life scales are redundant or substantially overlap (Table 4.25), thus none of the scales need to be omitted or removed from inferential analyses. This finding indicates utility for each scale to represent distinct domains of well-being.

As expected, scale pairings showed some degree of association at statistically significant levels for nearly all possible combinations, which may reflect the mutually-supportive nature of the various domains of well-being.

- Strong, positive associations (r = .50 to 1.0) are observed between emotional well-being and social well-being, and between emotional well-being and mental health status.
- Moderate, positive associations (r = .30 to .49) are observed between emotional well-being and spiritual well-being, and between social well-being and mental health status. They are also observed between life satisfaction and emotional well-being, social well-being, spiritual well-being, and mental health status.
- Weak, positive associations (r = .10 to .29) are observed between life satisfaction and physical health status; social well-being and physical health status; social well-being and spiritual well-being; and spiritual well-being and mental health status.
- A weak, negative association (r = -.10 to -.29) is observed between physical and mental health status.

- No association ($r < \pm .10$) is observed between emotional well-being and physical health status, or between spiritual well-being and physical health status.

Table 4.25 Intercorrelations on Quality of Life Scales

		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	**Emotional Well-Being (SOC13)**	**Spiritual Well-Being (SS20)**	**Physical Health Status (PCS)**	**Mental Health Status (MCS)**	**Global Well-Being (SWLS)**
Social Well-Being (FS)	Pearson's *r* *p* (2-tailed) n	1	**.52***** **.000** **655**	.23*** .000 633	.10* .011 635	.40*** .000 635	.39*** .000 645
Emotional Well-Being (SOC13)	Pearson's *r* *p* (2-tailed) n		1	.41*** .000 646	.04 .327 646	**.56***** **.000** **646**	.45*** .000 657
Spiritual Well-Being (SS20)	Pearson's *r* *p* (2-tailed) n			1	-.04 .382 644	.29*** .000 644	.30*** .000 647
Physical Health (PCS)	Pearson's *r* *p* (2-tailed) n				1	-.10** .008 662	.11** .002 655
Mental Health (MCS)	Pearson's *r* *p* (2-tailed) n					1	.45*** .000 655
Global Well-Being (SWLS)	Pearson's *r* *p* (2-tailed) n						1

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

4.2.2.1 Relationships between Quality of Life Variables and Kit Activity

Correlation analyses reveal only slight tendencies or effects on evacuation kit preparedness from the quality of life variables. Weak, positive associations ($r = .10$ to .29) with evacuation kit behaviour are observed at statistically significant levels only for spiritual well-being and emotional well-being (Table 4.26).

Table 4.26 Correlations between Quality of Life and Evacuation Kit Activity

Evacuation Preparedness		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	Emotional Well-Being (SOC13)	Spiritual Well-Being (SS20)	Physical Health Status (PCS)	Mental Health Status (MCS)	Global Well-Being (SWLS)
Kit Activity (Stages of Change)	Pearson's *r* *p* (2-tailed) n	.07 .078 640	**.12**** **.002** **650**	**.15***** **.000** **640**	-.08* .042 642	.07 .077 642	.07 .079 652
Kit Activity (dichotomised)	Pearson's *r* *p* (2-tailed) n	.08 .057 640	**.11**** **.005** **650**	**.11**** **.006** **640**	-.05 .233 642	.05 .186 642	.08* .034 652

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

4.2.3. Multivariate Results – Regressions

The focus of this section is on reporting results from multivariate analyses to test the explanatory power of quality of life variables on kit activity; and to assess the relative contribution for each quality of life variable to kit activity. These findings are preceded by a discussion on the suitability of the regression models to distinguish differences in evacuation kit activity due to the effects of quality of life.

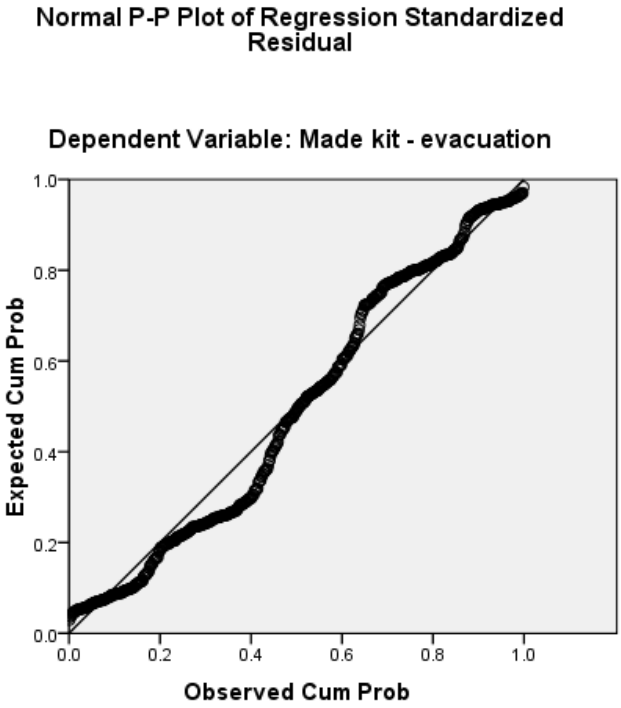
4.2.3.1 Regression Model Performance

The multiple regression models developed for this study are satisfactory as statistical tools to detect predictive relationships or strong effects between quality of life and evacuation kit activity as described in the study survey. Each model is able to explain the variance or distinguish differences in 5 levels of evacuation kit activity that can be predicted due to the effects of quality of life. Regardless of the activity level, the models are consistent in their predictions for the distribution of evacuation kit activity scores.

- Collinearity statistics did not exceed cut-off points (tolerance < .10, VIF > 10, Pallant, 2007) for multiple correlations among any quality of life scales, indicating these independent variables are not strongly related to each other
- The models do not violate assumptions of normality. The normal probability plots and scatterplots for all multiple regressions performed show closely similar patterns of distribution to those presented in Figures 4.30 and 4.31 for the standard multiple regression (SMR1):
    - Normal Probability Plots: The diagonal alignments observed on the Regression Standardised Residuals (Figure 4.30) do not suggest strong deviations in the distribution of predicted scores for kit activity. The differences between the actual and expected values for kit activity show only random fluctuations and slight underestimation when predicting lower levels of kit activity, and slight overestimation when predicting higher levels of kit activity from health-related quality of life

scores. There is no deviation of residuals in the centre of the plots about the mean.

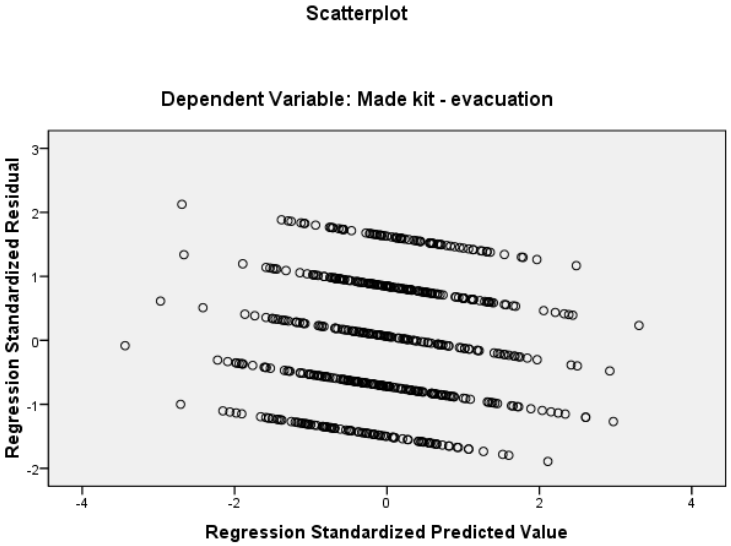
Figure 4.30 Standard Multiple Regression Normal P-P Plot (SMR1)



- Scatterplots: The array of data points on the Regression Standardised Residuals (Figure 4.31) shows no strong pattern that would indicate the predicted distributions along each level (1-5) of kit activity are not normal. The majority of scores for the residuals, or the difference between the actual and predicted value of activity, are concentrated toward the centre of the plot for each level of activity (1-5), and are symmetrically distributed about zero. There are few outliers toward any end of the plot (values with ±3.5 standard deviations about the mean) and no obvious confounding effect. The appearance and pattern of the circles along five lines reflects the categorical nature of the kit activity scale levels (discrete integer values from 1 to 5), and indicates that the distribution of the predicted values along these levels are not different from one level to another.

- The models show homogeneity of variance, meeting the assumption that the extent to which quality of life scores account for variability in kit behaviour is roughly equal at all levels of activity.
    - The cluster of points is fairly similar in width and distribution for all predicted activity scores.

Figure 4.31 Standard Multiple Regression Scatterplot (SMR1)



The logistic regression models developed for this study also perform satisfactorily when evacuation kit activity is dichotomised into 2 levels of activity: intention and action. Chi-square goodness-of-fit tests (Omnibus Tests of Model Coefficients) show that all four logistic regression models (saturated and stepwise data entry, both with and without life satisfaction) were able to distinguish between respondents who reported kit activity and those who reported intention, and that the results are statistically significant ($p < .001$).

4.2.3.2 Regression Model Results

When kit activity is dichotomised from five levels down to two levels (intention and action) and entered into a logistic regression model, results show that quality of life variables explain from 4.6 to 6.8% of the variance, $p = .001$. Standard and hierarchical multiple regression analyses indicate that from 3.4 to 4.2% of the

variance in kit activity, as measured on the 5-level Stages of Change scale, can be explained with statistical significance at $p < .01$ by quality of life variables. Spiritual well-being is the only quality of life factor that makes a unique contribution, explaining up to 2.2% of the variance. Results for all multiple regression analyses are summarised in Tables 4.27 -4.29.

Standard Multiple Regression

Standard regression modelling (SMR1) provides R^2 values indicating that health-related quality of life explains only 3.3% of the variance in kit activity, with a statistical significance of $p = .001$. When life satisfaction is included in the model (SMR2), the variance increases slightly to 3.4% ($p = .002$).

- The health-related quality of life factor that is making the strongest and most significant unique contribution to the prediction of kit activity (SMR1), using standardised regression coefficient beta, is spiritual well-being (beta = .112, $p = .010$).
- The only other factor making a statistically significant unique contribution is physical health status (beta = -.085, $p = .035$).
- Similar beta values are observed when life satisfaction is included in the model (SMR2): spiritual well-being (beta = .110, $p = .012$); physical health status (beta = -.087, $p = .033$).
- For both SMR1 and SMR2, spiritual well-being uniquely explains only 1% of the variance.

Hierarchical Multiple Regression

When the effects of age and gender are entered into the models, there is a statistically significant but very small increase in how well the model predicts kit activity. The model as a whole (HMR1) explains 4.1% of the variance in kit activity, $p <= 0.001$. When life satisfaction is added into the model (HMR2), the variance increases slightly to 4.2%, $p = .001$.

- In Block 1, age and gender explain 1.9% of the variance in kit activity, p = .002.
- In Block 2, after removing the effects of age and gender, health-related quality of life factors are still able to explain an additional 2.2% of the variance in kit activity, a statistically significant change (p <= 0.001).
- These values do not change when life satisfaction is added into the model as Block 3.
- Using standardised regression coefficient beta, the only factors making statistically significant unique contributions to the model (HMR1) for predicting of kit activity are spiritual well-being (beta = .107, p = .014) and age (beta = .097, p = .025). Similar beta values are observed when life satisfaction is included in the model (HRM2): spiritual well-being (beta = .104, p = .018); age (beta = .098, p = .024).
- For both HMR1 and HMR2, spiritual well-being and age each uniquely explain less than 1% of the variance in kit activity.

Logistic Regression

In the logistic regression analyses, when age, gender and HrQoL are entered into the dichotomous outcome model, there is a statistically significant but very small increase in how well the model predicts kit activity.

The model as a whole (LR1) explains 4.6% (Cox and Snell R square) to 6.3% (Nagelkerke R square) of the variance in kit activity (p = .001), and correctly classified 63.1% of the cases, predicting that 94.2% of the sample has intention rather than action. When life satisfaction is included in the model (LR2), R^2 values indicate the model explains 5.0% (Cox and Snell R square) to 6.8% (Nagelkerke R square) of the variance in kit activity (p = .001), and correctly classifies 63.2% of the cases, predicting that 94.4% of the sample has intention rather than action.

- Using standardised regression coefficient beta, the only factors making statistically significant unique contributions to the model (LR1) for predicting of

kit activity are spiritual well-being (beta = .015, *p* = .052) and age (beta = 2.144, *p* = .006).

- For LR2, only age is a statistically significant contributor for predicting kit activity (beta = 2.172, *p* = .005). The results for spiritual well-being are beta = .013, *p* = .107.

Confirmatory analysis – Stepwise Regressions

Stepwise ordinary least squares regressions (OLSR1 and OLSR2) confirmed results similar to the hierarchical multiple regressions. Both models as a whole explain 3.6% of the variance in kit activity, *p* <= 0.001.

- SPSS entered spiritual well-being first, followed by spiritual well-being and age. Age explains 1.4% of the variance (*p* <= 0.001) and spiritual well-being explains an additional 2.2% (*p* <= 0.001).
- Using standardised regression coefficient beta, both spiritual well-being and age make statistically significant unique contributions to the model (OLSR1) for predicting of kit activity: spiritual well-being (beta = .132, *p* = .001) and age (beta = .119, *p* = .003). The same values are observed when life satisfaction is included in the model (OLSR2).

Stepwise logistic regressions (LR3 and LR4) provided results similar to the saturated logistic regression models. The model as a whole (LR3) explains 4.2% (Cox and Snell R square) to 5.8% (Nagelkerke R square) of the variance in kit activity (*p* <= 0.001), and correctly classified 62.9% of the cases, predicting that 95.0% of the sample has intention rather than action. When life satisfaction is included in the model (LR2), R^2 values indicate the model explains between 4.1% (Cox and Snell R square) and 5.7% (Nagelkerke R square) of the variance in kit activity (*p* <= 0.001), and correctly classifies 62.9% of the cases, predicting that 95.2% of the sample has intention rather than action.

- Using standardised regression coefficient beta, both spiritual well-being and age make statistically significant unique contributions to the model (LR3) for

predicting of kit activity: spiritual well-being (beta = .018, *p* = .013) and age (beta = 2.199, *p* = .004). Similar beta values are observed when life satisfaction is included in the model (LR4): spiritual well-being (beta = .017, *p* = .019) and age (beta = 2.196, *p* = .004).

Table 4.27 Multiple Regression Model Summary [b1]

Multiple Regression Model Summary[b1]

Model Type	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	ANOVA Sig. (*p*)
SMR1[a1] - Saturated	**.033**	.026	1.279	-	**.001**
SMR2[a2] - Saturated	**.034**	.024	1.280	-	**.002**
HMR1[a3] - Block 1	.019	.016	1.285	.019	.002
HMR1[a4] - Block 2	**.041**	.030	1.276	.022	**.000**
HMR2[a3] - Block 1	.019	.016	1.285	.019	.002
HMR2[a4] - Block 2	.041	.030	1.276	.022	.000
HMR2[a5] - Block 3	**.042**	.029	1.277	.000	**.001**
OLSR1[a6] - Stepwise 1	.022	.020	1.283	.022	.000
OLSR1[a7] - Stepwise 2	**.036**	.032	1.274	.014	**.000**
OLSR2[a6] - Stepwise 1	.022	.020	1.283	.022	.000
OLSR2[a7] - Stepwise 2	**.036**	.026	1.279	.014	**.000**

a1. Data Entry: Saturated. Predictors: (Constant), PCS, MCS, SOC13, SS20, HAW
a2. Data Entry: Saturated. Predictors: (Constant), PCS, MCS, SOC13, SS20, HAW, SWLS
a3. Data Entry: Sequential, Pre-determined Blocks. Predictors: (Constant), Age, Gender
a4. Data Entry: Sequential, Pre-determined Blocks. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW
a5. Data Entry: Sequential with Pre-determined Blocks. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW, SWLS
a6. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), SS20, Age
a7. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), SS20, Age
b1. Dependent Variable: Made evacuation kit (activity levels 1-5)

Table 4.28. Multiple Regression

Standardised Coefficients of Statistical Significance[b1]

Model Type	Predictors	Beta	Sig. (p)	Part Corr	Variance
SMR1[a1]	SS20	**.112**	**.010**	.102	**0.010**
SMR2[a2]	SS20	**.110**	**.012**	.099	**0.010**
HMR1[a3] - Block 1	Age	.140	.000	.138	0.019
HMR1[a4] - Block 2	Age	**.097**	**.025**	**.088**	**0.008**
	SS20	**.107**	**.014**	**.096**	**0.009**
HMR2[a3] - Block 1	Age	.140	.000	.138	0.019
HMR2[a4] - Block 2	Age	.097	.025	.088	0.008
	SS20	.107	.014	.096	0.009
HMR2[a5] - Block 3	Age	**.098**	**.024**	**.089**	**0.008**
	SS20	**.104**	**.018**	**.093**	**0.009**
OLSR1[a6] - Stepwise 1	SS20	.147	.000	.147	0.022
OLSR1[a7] - Stepwise 2	SS20	**.132**	**.001**	**.131**	**0.017**
	Age	**.119**	**.003**	**.118**	**0.014**
OLSR2[a6] - Stepwise 1	SS20	.147	.000	.147	0.022
OLSR2[a6] - Stepwise 2	SS20	**.132**	**.001**	**.131**	**0.017**
	Age	**.119**	**.003**	**.118**	**0.014**

a1. Data Entry: Saturated. Predictors: (Constant), PCS, MCS, SOC13, SS20, HAW

a2. Data Entry: Saturated. Predictors: (Constant), PCS, MCS, SOC13, SS20, HAW, SWLS

a3. Data Entry: Sequential, Pre-determined Blocks. Predictors: (Constant), Age, Gender

a4. Data Entry: Sequential, Pre-determined Blocks. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW

a5. Data Entry: Sequential with Pre-determined Blocks. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW, SWLS

a6. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), SS20

a7. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), Age, SS20

b1. Dependent Variable: Made evacuation kit (activity levels 1-5)

Table 4.29. Logistic Regression Model Summary [b1]

Logistic Regression Model Summary[b1]

Model Type	Cox & Snell R Square	Nagelkerke R Square	Sig. (*p*)
LR1[a1] - Saturated	.046	.063	.001
LR2[a2] - Saturated	.050	.068	.001
LR3[a3] - Stepwise 1	.042	.058	.000
LR4[a4] - Stepwise 1	.041	.057	.000

a1. Data Entry: Saturated. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW
a2. Data Entry: Saturated. Predictors: (Constant), Age, Gender, PCS, MCS, SOC13, SS20, HAW, SWLS
a3. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), SS20, Age
a4. Data Entry: SPSS-selected Stepwise, forward selection. Predictors: (Constant), SS20, Age
b1. Dependent Variable: Made evacuation kit (activity levels 0-1)

4.2.4 Additional Relationships between Quality of Life and Preparedness

The models tested in this study show that quality of life explains only low levels of variance in evacuation kit behaviour. This conclusion led to hypothesising whether the same set of quality of life variables would influence other preparedness activities to a greater extent.

When associations were examined between quality of life and other 'getaway kit' activities (e.g., *made a survival kit, made a communications kit, kit accessible*) at the dichotomous level of measurement (Table 4.30), results were found to be similar to those for *made an evacuation kit*. Spiritual well-being and emotional well-being are the variables that most consistently show a relationship to these preparedness activities. *Made a survival kit* shows a weak, positive association (r = .13) for social well-being. *Made a communications kit* shows weak, positive associations for emotional well-being (r = .14) and spiritual well-being (r = .13).

Table 4.30 Correlations between Quality of Life and Kit Activity (Dichotomised Conditions of Intention and Action)

Type of Kit Activity		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	Emotional Well-Being (SOC13)	Spiritual Well-Being (SS20)	Physical Health Status (PCS)	Mental Health Status (MCS)	Global Well-Being (SWLS)
Survival Kit	Pearson's *r* *p* (2-tailed) n	**.13**** **.001** **642**	.08* .035 653	-.01 .743 642	.05 .195 645	.06 .158 645	.05 .186 655
Evacuation Kit	Pearson's *r* *p* (2-tailed) n	.08 .057 640	**.11**** **.005** **650**	**.11**** **.006** **640**	-.05 .233 642	.05 .186 642	.08* .034 652
Communications Kit	Pearson's *r* *p* (2-tailed) n	.09* .020 638	**.14***** **.000** **648**	**.13**** **.001** **638**	.00 .957 640	.06 .092 640	.08* .037 650
Kit Accessible	Pearson's *r* *p* (2-tailed) n	.08 .058 635	.09* .026 646	.07 .062 639	-.03 .449 641	.044 .262 641	.08* .036 649

* $p < 0.05$
**** $p < 0.01$**
***** $p < 0.001$s**

Using the Stages of Change model (Table 4.31), these associations were examined again. A weak, positive association (r = .11) at statistically significant levels is observed between *made a survival kit* and social well-being. *Made a communications kit* shows weak, positive associations at statistically significant levels only for spiritual well-being (r = .16) and emotional well-being (r = .14). Weak, positive associations are shown for *kit accessible* at statistically significant levels for spiritual well-being (r = .12) and global well-being (r = .10).

Table 4.31 Correlations between Quality of Life and Kit Activity (Stages of Change)

Type of Kit Activity		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	Emotional Well-Being (SOC13)	Spiritual Well-Being (SS20)	Physical Health Status (PCS)	Mental Health Status (MCS)	Global Well-Being (SWLS)
Survival Kit	Pearson's *r* *p* (2-tailed) n	**.11**** **.007** **642**	.09* .028 653	.03 .455 642	.03 .511 645	.06 .148 645	.04 .308 655
Evacuation Kit	Pearson's *r* *p* (2-tailed) n	.07 .078 640	**.12**** **.002** **650**	**.15***** **.000** **640**	-.08* .042 642	.07 .077 642	.07 .079 652
Communications Kit	Pearson's *r* *p* (2-tailed) n	.07 .077 638	**.14***** **.000** **648**	**.16***** **.000** **638**	-.049 .212 640	.07 .066 640	.08* .036 650
Kit Accessible	Pearson's *r* *p* (2-tailed) n	.06 .109 635	.08 .051 646	**.12**** **.002** **639**	-.01 .721 641	.04 .318 641	**.10**** **.009** **649**

* $p < 0.05$
**** $p < 0.01$**
***** $p < 0.001$**

To further explore the potential value of additional regression analyses on associations between quality of life and preparedness, correlational analyses were performed for all five health-related quality of life variables and for global quality of life with all the remaining fifteen preparedness behaviours (Question 35). At best, there are weak, positive associations ($r \leq .18$) of statistical significance between quality of life and preparedness activity, whether examined at the Stages of Change level or under dichotomised conditions of intention and action (Table 4.33, Table 4.34).

- The domains of well-being that tend to consistently show relationships, even though weak and positive, are spiritual well-being, emotional well-being, global well-being, and mental health status.
- Social well-being shows weak, positive relationships in fewer categories.
- Physical health status shows no relationship with any type of preparedness activity, except a very weak relationship with *talking with social network*.
- The only exception to these weak relationships are moderate relationships (*r* = .20 to.30) of statistical significance between emotional well-being and global well-being and *taking steps to increase the level of home preparedness for other types of disasters* (non-earthquake or tsunami). This question, however, has a very small sample size (n=129-130).

Table 4.32 Correlations between Quality of Life and Preparedness (Dichotomous)

Type of Preparedness Activity		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	Emotional Well-Being (SOC13)	Spiritual Well-Being (SS20)	Physical Health Status (PCS)	Mental Health Status (MCS)	Global Well-Being (SWLS)
Talked with social network	Pearson's *r* *p* (2-tailed) n	.13* .001 642	.09* .029 654	.05 .183 644	.08* .037 647	.05 .179 647	.12 .002 656
Talked with others in neighbourhood	Pearson's *r* *p* (2-tailed) n	.07 .106 630	.08* .041 642	.08* .037 630	-.04 .382 634	.05 .181 634	**.12**** **.004** **642**
Sought information on risks and consequences	Pearson's *r* *p* (2-tailed) n	.09* .022 634	**.12**** **.002** **645**	**.11**** **.004** **635**	.06 .129 638	.08 .053 638	**.14**** **.001** **648**
Sought information on preparedness	Pearson's *r* *p* (2-tailed) n	.10* .015 640	**.14***** **.000** **650**	**.11**** **.007** **640**	.07 .078 643	**.14***** **.000** **643**	.11* .004 652
Sought information on response	Pearson's *r* *p* (2-tailed) n	**.11**** **.007** **640**	**.14***** **.000** **648**	**.11**** **.004** **640**	.08 .057 642	**.14***** **.000** **642**	.10* .015 650
Sought information on evacuation	Pearson's *r* *p* (2-tailed) n	.08 .055 637	**.12**** **.003** **648**	**.14***** **.000** **639**	-.00 .979 642	**.11**** **.008** **642**	.08* .044 650
Made survival/ escape plans	Pearson's *r* *p* (2-tailed) n	.06 .151 637	.08* .036 649	.08* .042 639	.03 .453 641	**.11**** **.006** **641**	**.13**** **.001** **650**
Made evacuation/ dislocation plans	Pearson's *r* *p* (2-tailed) n	.09* .017 637	**.12**** **.003** **647**	.07 .089 638	.02 .663 641	**.14**** **.001** **641**	.06 .136 650
Made communications plans	Pearson's *r* *p* (2-tailed) n	**.11**** **.006** **640**	**.12**** **.002** **649**	**.11**** **.005** **639**	.04 .340 643	.09 .017 643	**.11**** **.005** **651**
Tested plans – followed an evacuation route	Pearson's *r* *p* (2-tailed) n	.018 .650 630	.03 .481 641	.10 .011 634	-.04 .320 635	**.11**** **.008** **635**	.06 .127 643
Tested plans – gone to an assembly area	Pearson's *r* *p* (2-tailed) n	-.00 .918 633	.02 670 646	.06 .145 638	-.05 .214 638	.02 .664 638	.003 .942 647
Tested plans – participated in a drill	Pearson's *r* *p* (2-tailed) n	.05 .242 627	.05 .210 640	.05 197 631	-.032 .425 632	.013 .742 632	.04 .315 640
Taken steps – earthquake preparedness	Pearson's *r* *p* (2-tailed) n	**.10**** **.009** **640**	.08* .032 652	.04 .262 643	.036 .363 646	.10* .016 646	**.11**** **.007** **655**
Taken steps – tsunami preparedness	Pearson's *r* *p* (2-tailed) n	**.12**** **.002** **622**	**.14***** **.000** **633**	**.13**** **.001** **625**	.01 .809 626	**.14**** **.001** **626**	**.13**** **.001** **635**
Taken steps – other preparedness	Pearson's *r* *p* (2-tailed) n	.11 .201 129	**.27**** **.002** **130**	.15 .095 128	-.14 .126 122	.17 .069 122	**.30**** **.001** **129**

* $p < 0.05$
**** $p < 0.01$**
***** $p < 0.001$**

Table 4.33 Correlations between Quality of Life and Preparedness (Stages of Change)

Type of Preparedness Activity		Health-Related Quality of Life					Global Quality of Life
		Social Well-Being (FS)	Emotional Well-Being (SOC13)	Spiritual Well-Being (SS20)	Physical Health Status (PCS)	Mental Health Status (MCS)	Global Well-Being (SWLS)
Talked with social network	Pearson's *r* *p* (2-tailed) n	**.11**** **.007** **642**	.09* .019 654	.06 .109 644	.06 .162 647	.06 .128 647	**.11**** **.005** **656**
Talked with others in neighbourhood	Pearson's *r* *p* (2-tailed) n	.09* .026 630	.11* .005 652	**.16***** **.000** **630**	-.08 .046 634	.07 .085 634	.10 .014 642
Sought information on risks and consequences	Pearson's *r* *p* (2-tailed) n	.10* .014 634	**.13**** **.002** **645**	**.14***** **.000** **635**	.02 .564 638	**.10**** **.008** **638**	**.14***** **.000** **648**
Sought information on preparedness	Pearson's *r* *p* (2-tailed) n	.11* .011 640	**.14***** **.000** **650**	**.11**** **.007** **640**	.04 .304 643	**.14***** **.000** **643**	**.11**** **.006** **652**
Sought information on response	Pearson's *r* *p* (2-tailed) n	**.13**** **.002** **640**	**.14***** **.000** **648**	**.13**** **.001** **640**	.04 .289 642	**.15***** **.000** **642**	**.11**** **.005** **650**
Sought information on evacuation	Pearson's *r* *p* (2-tailed) n	.09* .021 637	**.14***** **.000** **648**	**.18***** **.000** **639**	.00 .981 642	**.12**** **.002** **642**	**.12**** **.002** **650**
Made survival/ escape plans	Pearson's *r* *p* (2-tailed) n	.06 .110 637	**.11**** **.006** **649**	**.13**** **.001** **639**	.01 .726 641	**.12**** **.002** **641**	**.15**** **.000** **650**
Made evacuation/ dislocation plans	Pearson's *r* *p* (2-tailed) n	**.11**** **.007** **637**	**.15***** **.000** **647**	**.12**** **.002** **638**	.02 .605 641	**.13**** **.001** **641**	**.11**** **.005** **650**
Made communications plans	Pearson's *r* *p* (2-tailed) n	**.13**** **.001** **640**	**.15***** **.000** **649**	**.15***** **.000** **639**	.01 .784 643	**.11**** **.005** **643**	**.15***** **.000** **651**
Tested plans – followed an evacuation route	Pearson's *r* *p* (2-tailed) n	.02 .679 630	.03 .450 641	**.18***** **.000** **634**	-.05 .255 635	.10* .012 635	.09* .020 643
Tested plans – gone to an assembly area	Pearson's *r* *p* (2-tailed) n	-.01 .743 633	.01 .732 646	**.14**** **.001** **638**	-.08 .052 638	.034 .397 638	.06 .128 647
Tested plans – participated in a drill	Pearson's *r* *p* (2-tailed) n	.04 .348 627	.03 .426 640	**.13**** **.001** **631**	-.031 .436 632	.01 .844 632	.06 .128 640
Taken steps – earthquake preparedness	Pearson's *r* *p* (2-tailed) n	.09* .020 640	.09* .021 652	.04 .282 643	.03 .408 646	.10* .009 646	.09* .016 655
Taken steps – tsunami preparedness	Pearson's *r* *p* (2-tailed) n	.09* .019 622	.10* .010 633	**.15***** **.000** **625**	.00 .945 626	**.13**** **.001** **626**	**.10**** **.009** **635**
Taken steps – other preparedness	Pearson's *r* *p* (2-tailed) n	.07 .438 129	.20* .025 130	.15 .085 128	-.10 .293 122	.137 .131 122	.19* .029 129

* $p < 0.05$
**** $p < 0.01$**
***** $p < 0.001$**

CHAPTER 5. DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Wellington adults are highly individualistic and a minority are taking adequate action to build their resilience to pending disaster from earthquake- or tsunami-triggered evacuation. At the time of survey participation, fewer than one out of four people thought an earthquake or tsunami could trigger a disaster in Wellington within the next year. Roughly two out of three Wellington residents were not prepared for evacuation from home, and only about one in ten have tested evacuation plans. This is consistent across multiple demographic and stereotypic variables. The level of an individual's quality of life is weakly associated with preparedness. The strongest associations for preparedness are observed in a positive direction for spiritual well-being, emotional well-being, and life satisfaction; all involve a sense of existential meaningfulness. Gender is not a factor. Those 18-24 years of age are least likely to prepare and evacuation preparedness increases with age. These are the primary findings of this dissertation, and indicate that engaging in evacuation preparedness is a very complex, holistic, yet individualised decision-making process, and likely involves highly subjective considerations for what is personally relevant.

Previous research has shown that positive health and well-being are associated with resilient outcomes. Preventing adverse outcomes before disaster strikes, through developing strengths-based skill sets in health-protective attitudes and behaviours, is increasingly advocated in disaster research, practise, and management. Health promotion studies integrate multiple domains of health (e.g., physical, mental, emotional, spiritual, social, life satisfaction) to reflect people's subjective perceptions of well-being. This is the first study known to examine the multi-dimensional aspects of positive health and global well-being ("health-related quality of life") as resilient processes for engaging in preparedness behaviours.

Results of this study show that, at a population level, multi-dimensional quality of life is associated with preparedness. While this association is statistically significant, it must be emphasised that the strength of the relationship is weak, accounting for only 4.6% to 6.8% of the variability in evacuation preparedness. Spiritual well-being is

the only dimension of quality of life that stands out as a unique predictor of evacuation preparedness, accounting for up to 2.2% of the variability in evacuation preparedness.

This work indicates areas for improvement in promoting self-management of disaster risk and building resilience to disaster, and describes relationships among key variables for promoting preventive health in the disaster context. Chapter 5 begins by summarising findings from the literature review (**Section 5.1**) and re-states the methodological approach for the study (**Section 5.2**). **Section 5.3** discusses the results for the primary study aims and briefly highlights observations for select ancillary variables. Strengths and limitations of the study are noted in **Section 5.4**. Recommendations for policy actions, as well as suggestions for practise improvements and directions for future research are offered in **Section 5.5**. Multiple conclusions that can be derived from this study are presented in **Section 5.6**.

5.1 Background Summary

Dramatic increases over the last decade in the type, scale and consequences of disaster are producing urgent calls across the globe for reducing disaster risk and building disaster resilience through effective prevention strategies. Health consequences can become most acute when living conditions are substandard or uncertain, creating additional exposure to health impacts beyond the original disaster 'footprint,' or require evacuations that displace people from their homes, livelihoods, and day-to-day lives. Preventive development of a stronger baseline of resilience and well-being in the population, buffering the impacts of disruptions in functioning created by disaster, can create more resilient outcomes. However, promoting disaster resilience through disaster preparedness is pragmatically problematic. Rates of preparedness are suboptimal and many barriers to engaging in preparedness activities exist.

This thesis reports the results of a study investigating relationships between health-protective attitudes and health-protective behaviours for earthquake and tsunami preparedness in a sample of the general adult population in Wellington, New Zealand. Wellington is vulnerable to severe earthquake and tsunami effects, which pose a significant risk of lifeline utility/infrastructure disruptions lasting for several months and could result in mass displacement of people from their homes.

The aim of this investigation was to discover whether people with higher levels of self-reported physical, mental, emotional, spiritual, and social well-being ("health-related quality of life") and overall subjective well-being (global quality of life or "life satisfaction") show higher levels of engagement in evacuation preparedness activities. Health management resources can serve as attributes in a personal strengths-based skill set for developing disaster resilience as both a process and outcome. A secondary purpose of the research was to discover whether age or gender modifies the relationships between people's well-being and preparedness.

This study is the first of its type to look at relationships between the multi-dimensional domains of well-being and evacuation preparedness. The results

indicate that Wellington residents are highly aware of the potential for disaster but are not necessarily prepared. Predicting who will and will not be prepared is presently not possible as people are highly variable in their level of preparedness relative to their quality of life and previously held important differences such as age.

5.1.1 Closing the Preparedness Gap: Reducing Risk, Building Resilience

Disaster research, practise and management frameworks are converging in unison on the importance of pre-event planning to reduce disaster risk through preparedness activities and to develop psychosocial resilience capacities, both of which can improve adaptive functioning in the post-disaster environment. These goals can be implemented at the individual level through promotion and development of personal resources, conceptualised in this study as health-protective attitudes and behaviours, to support disaster resilience as both a process and outcome.

This particular focus on building individual and community strengths in the 'readiness' or prevention phase of disaster is now woven throughout protocols for policy, service delivery and research around the world (e.g., Department of Health and Human Services, US (DHHS, 2009b); Department of Homeland Security, US (DHS, 2008); Emergency Management Australia (EMA, 2010); Homeland Security Council, US (HSC, 2007); International Federation of the Red Cross and Red Crescent Societies (IFRC, 2008); Ministry of Civil Defence and Emergency Management, New Zealand (MCDEM, 2006); Ministry of Health, New Zealand (MOH, 2007, 2008a); National Health Service, UK (NHS, 2009a, 2009b); State Emergency Service, Australia (SES, 2010)).

Disaster Risk Reduction through Health-Protective Behaviours

The majority of people at risk from seismic hazards do little in terms of preparedness activities to significantly reduce their vulnerability to disaster; this is true both for New Zealand and the world over (MCDEM, 2011b; Rossetto et al. 2011; Solberg et al. 2010; Spittal et al. 2008; Statistics New Zealand, 2008). Compounding this problem, evacuation planning and readiness typically pales in comparison to the most

common type of activity, survival preparedness for post-disaster 'sheltering-in-place,' and is also less common than taking actions to mitigate household damage (Russell et al. 1995; Solberg et al. 2008; Spittal et al. 2008).

This study indicated that roughly two out of three Wellington residents were not prepared for evacuation from home, and only about one in ten had tested evacuation plans. Overall, people in this study focused most heavily on talking with their social networks, seeking information on preparedness, and having survival items rather than being ready to evacuate. Preparedness was poorest for talking with others in their neighbourhood, making and testing evacuation plans, making evacuation and communications kits, and making kits accessible. Although a majority had taken steps for general earthquake preparedness, a minority had for tsunami preparedness.

These are neither terrible nor acceptable levels of preparedness. Yet considering the high risk of earthquake and tsunami, potential isolation, and lifeline disruption (Berryman, 20055; Cousins et al., 2008a, 2009, 2010; Wallace et al. 2009; Webb, 2005; Van Dissen et al. 2010), preparedness remains of substantial concern. Recent data from national surveys by the New Zealand Ministry of Civil Defence and Emergency Management (MCDEM, 2011b) indicate that since the Canterbury earthquakes of 2010-2011, preparedness in the New Zealand population may be at its highest levels to date, but this preparedness is focussed more on home survival measures than evacuation planning.

While there are a variety of conceptualisations of 'preparedness' in disaster research surveys, which makes precise comparisons problematic, the study findings are consistent in general with those from other studies in New Zealand and the Wellington Region (e.g., MCDEM, 2011b; Spittal et al. 2008; Statistics New Zealand, 2008; Van Schalkwyk & Hare, 2007). The study findings reinforce a persistent need for publicity and educational efforts to address gaps in evacuation preparedness. They also suggest possible perceptual misunderstandings among the study population regarding the gravity of potential evacuation conditions. This is disquieting, not only due to the inherent nature of the Wellington hazardscape, but also because risk perception during a disaster can be profoundly complicated by

uncertainty: the situation is powerfully dynamic and real-time decision-making for evacuation can be intensely complex and laden with ambiguity about the best course of action (Dash & Gladwin, 2007; Slovic, 1987).

Disaster Resilience through Health-Protective Attitudes and Behaviours

From the perspective of understanding individual differences and population trends in the response to disaster, resilience research paradigms have an extensive history of examining population vulnerability factors (e.g., Freedy et al., 1992, 1993, 1994; Mileti, 1999; Norris, 2006a, 2006b) and psychological variables (e.g., Kaminsky et al. 2006; Paton, Smith & Violanti, 2000) for their relationships with both preparedness activities and post-traumatic outcomes, especially from a social-cognitive perspective. These types of studies frequently measure outcomes as illness or disability and examine personality traits as the triggering mechanisms in a pathogenic process that devolves into ill health. However, Bonanno et al. (2010) found that individual differences in disaster outcomes are informed by a number of unique contextual factors, and that multivariate studies indicate that there is no one single dominant psychological factor that is a predictor of disaster outcomes.

Recently, affective studies have gained attention in resilience research for shifting focus from psychological factors to subjective perspectives on quality of life and the relationship with post-disaster outcomes. They also enhance the consideration of strengths-based or wellness perspectives in understanding resilient processes and outcomes. For instance, the interaction of health-related quality of life with social support after the 2008 Wenchuan, Sichuan earthquake was examined by Ke et al. (2010). Others have examined the supportive role of subjective well-being post-disaster through the construct of life satisfaction (after Diener et al. (1985), e.g., Henderson, 2009; Tremblay et al., 2006).

Previous research on the role of health-related quality of life and global well-being in disaster preparedness is not known, although these factors are considered significant to disaster recovery. Integrating the affective domain in preparedness research makes sense as it reflects the importance of multi-dimensional health (WHO, 1948) in patient-reported outcomes (Cella, 1994; Cella et al. 2007), health-

related quality of life theory (Wilson & Cleary, 1995), and salutogenesis theory (Antonovsky, 1987).

Further, an affective construct of well-being that is implicit in these theories, meaningfulness, shows a positive relationship with self-determined motivation (Deci & Ryan, 1985) and action-focused post-traumatic growth (Hobfoll et al., 2007).

Meaningfulness, conceptualised as a process of salutogenesis and measured through the strengths-based Sense of Coherence construct (Antonovsky, 1987, 1993), shows positive relationships with both health-protective behaviours (Eriksson & Lindstrom, 2006) and post-disaster resilient outcomes (Almedom, 2005; 2011; Almedom & Glandon, 2007; Almedom & Tumwine, 2008). Understanding the role of the affective domain from a health perspective is thus of importance in health promotion and disaster prevention, and this study sought to contribute knowledge to this evidence base.

This large, population-based study found that overall quality of life is neither a profound barrier nor powerful predictor of disaster preparedness. No single well-being variable stands out as a strong salutary factor or correlate of preparedness. Within the numerous predictive models constructed to analyse this data set, quality of life and well-being account for only a very small amount (4.6% to 6.8%) of the variability in evacuation preparedness.

The strongest findings of a statistically significant relationship with disaster preparedness involve factors that are most-closely tied to a deep sense of personal meaning: spiritual well-being, a strong "sense of coherence," and satisfaction with life. It is interesting to note that of those in this study with prior disaster experience, when asked the open-ended question of "*what helped you cope the most?*" many anecdotally reported that it was making meaning of the disaster and developing personal resilience. These findings are consistent with post-disaster resilient processes and outcomes observed by Almedom (2005), Almedom & Glandon (2007), and Almedom & Tumwine (2008).

Surprisingly, mental health status and social well-being are not associated with evacuation preparedness at statistically significant levels in positive or negative directions. Physical health status is very weakly associated with preparedness, but only when examined along a continuum of engagement in preparedness action, and in a negative sense. It must be emphasised that all of these findings are relative rankings for very weak associations between quality of life and preparedness. The heterogeneity across individuals was striking.

5.2 Research Design

This thesis informs the field of research into disaster risk reduction and disaster resilience and expands the evidence base for preparedness planning by providing robust quantitative data on:

1) The prevalence and distribution of health-protective attitudes (quality of life) and health-protective behaviours (evacuation kit preparedness) in the study population;
2) The associations between quality of life and evacuation kit preparedness;
3) The degree of predictive power that quality of life factors have for explaining variations in evacuation kit preparedness; and
4) The effects of age and gender.

This study also contributes descriptive data on many ancillary variables of interest that were beyond the scope of this PhD but are research questions of interest for future analytical investigations, such as: the role of other demographic characteristics, the role of contextual effects in the social and physical environment for motivating preparedness (including risk perception, prior experience, and intrinsic versus extrinsic motivation), and associations with disaster preparedness activities.

A quantitative epidemiological survey, using a cross-sectional study design, was selected to measure the variables of interest. The mode of administration was a postal survey. The mode of observation was the general adult population of Wellington, New Zealand, obtained through a multi-stage cluster randomisation sampling plan for the eastern suburbs of Wellington. The response rate was 28.4%, yielding a sample size of n = 675 with a +/- 3.8% margin of error at a 95% confidence level, and 80% power to detect a true correlation 0.11 or greater. The sound sampling procedures, satisfactory response rates, sufficient statistical power, and similarities in demographic characteristics of the respondents with the general adult population of Wellington indicate that the results of this study are representative and generalisable with a high level of confidence that they are correct.

5.3 Discussion of Results

Results indicate the majority of Wellington adults rate their overall quality of life positively, with mean quality of life scores from average to above average in all domains of well-being. Despite enjoying good health and well-being, and being aware of disaster risk to the Wellington Region from earthquake and tsunami, evacuation preparedness is not prevalent at the population level.

5.3.1 Prevalence and Distribution of Quality of Life

Study participants exhibit slightly higher mean levels of physical and mental health status, as measured by scores using the SF12 scale (Ware et al. 1996), than means observed globally (Scott et al. 1999) although the differences are not likely of great significance. Age has a large effect on physical health and a small effect on mental health, with the highest physical health status and lowest mental health status in those 18-24 years old; the converse is true for those 65 years and over. Differences in physical health by gender are not statistically significant. Male mental health status is slightly higher; however the magnitude of the difference in means with female mental health status is small.

Emotional well-being in the study population, as measured by the SOC13 scale (Antonovsky, 1987, 1993) is moderately high and slightly greater than means observed globally (Eriksson & Lindstrom, 2006, 2007). Spiritual well-being is also moderately high, as measured by the SS20 scale, and consistent with means observed in Wellington-based studies (Boyd-Wilson et al. 2004, 2006). Age has a small effect on emotional and spiritual well-being, with the highest mean scores in those 65 years and over and lowest in those 18-24 years old. Differences in emotional well-being by gender are not statistically significant. Female spiritual well-being is slightly higher than for males, although the effect size is very small.

Study participants exhibit moderately high levels of social well-being (“socially connected”), as measured by FS scores (Hawthorne, 2006), consistent with means reported in Australasian studies. Life satisfaction, as measured by SWLS scores

(Diener et al.1985), is moderate to moderately high ("slightly satisfied to satisfied"), consistent with or higher than means observed globally in developed countries. Differences by age and gender are not statistically significant for either social well-being or life satisfaction.

The study results on quality of life are consistent with the findings of the 2006/2007 New Zealand Health Survey (MOH, 2008c) and the 2010 Quality of Life Survey in New Zealand Cities (ACNielsen, 2011) for all domains measured in these national surveys. All results are as expected, given the role of youth in positive physical health, the role of maturity in all other domains of well-being, and the positive health-oriented culture of New Zealand.

5.3.2 Prevalence and Distribution of Disaster Preparedness

Over half of the study respondents are talking with their social networks about preparedness, seeking preparedness information, and assembling survival items. While two out of three people perceive themselves as at least "somewhat prepared" to evacuate from home, only about one out of three have made an evacuation plan, evacuation kit, or communications kit. Only one out of ten have tested home evacuation plans. Nine out of ten have not shared evacuation plans with friends or relatives outside Wellington.

A possible explanation for this apparent contradiction in perceived versus actual preparedness may be how 'preparedness' is individually defined, or possibly due to an overconfidence for how they might respond within a scenario they have not yet experienced (e.g. Smith & Walton, 2009). It also might be a simple realisation of the maxim that "*actions speak louder than words*" (i.e. "*people's intentions can be judged better by what they do than what they say*").

These findings on levels of preparedness are generally consistent with trends observed in findings by MCDEM (2008b, 2011b) and the New Zealand General Social Survey (Statistics New Zealand, 2008) and as reported throughout preparedness literature: there is tendency to focus on sheltering-in-place activities

such as stockpiling food and water, but less attention to household emergency planning.

Anecdotal findings on what items respondents considered “essential” for evacuation indicate that food is the top priority for their health and well-being. Food is closely followed by clothing/outwear and medications. The next most frequently cited items that respondents considered “essential” were: documents/ID/wallet and medical supplies/first aid. Caution is advised on interpretation of these priorities, since the data are aggregated from optional responses to a qualitative open-ended question and are not suitable for quantitative analysis. However, they may be useful perspectives for future testing of preparedness messages.

5.3.3 Associations between Quality of Life and Preparedness (H_1 to H_6)

The null hypothesis for the primary investigation of this study assumes there is no actual relationship between quality of life and evacuation kit preparedness (Chapter 3, Section 3.1.4). Six specific directional hypotheses were generated to test for positive associations between quality of life and preparedness. Results are summarised and discussed below; detailed results are provided in Chapter 4, Section 4.2.

Physical Health (H_1): Adults with higher physical health status do not exhibit higher levels of engagement in evacuation kit preparedness. A weak, negative association with physical health is observed in those who engaged in evacuation kit preparedness; this relationship is statistically significant at the Stages of Change level of measurement ($p < 0.05$) but not at the dichotomous level of intention versus action. Hence being in better physical health does not mean that an individual is more likely to be prepared. Consequently, study hypothesis H_1 is not supported. Weak associations, from negative to positive, are also observed between physical health and other types of kit activity measured in the study. These relationships are not statistically significant at either level of measurement.

These results are unexpected, given conventional wisdom that those who enjoy strong health would be actively engaged in protecting their future health and those with health vulnerabilities would also be actively engaged to decrease potential dependency concerns. On a population level, physical health does not appear to be a particularly significant factor in people's preparedness levels. One possible explanation for this could be an expectation of stamina within the healthy ("I can look out for myself"), or an expectation of dedicated social support for vulnerable adults ("someone will look out for me"), although there are no data in this study to support this or similar types of conjectures.

Mental Health (H_2): Adults with higher mental health status do not exhibit higher levels of engagement in evacuation kit preparedness. A weak, positive association with mental health is observed in those who engaged in evacuation kit preparedness, but is not statistically significant at either level of measurement. Therefore, study hypothesis H_2 is not supported. Weak, positive associations are also observed between mental health and all other types of kit activity measured in the study. However, none of these relationships are statistically significant at either level of measurement.

Similar to physical health, these results are also unexpected, considering stereotypes that embracing preparedness would not be a daunting proposition for those with high mental health status, or conversely that poor mental health would lead to overzealous preparedness. A possible explanation is that, regardless of mental health, certain 'unthinkable' scenarios are just not pleasant to think about and people are more motivated to engage in situations to their liking. These findings may also be suggestive of the construct of 'false optimism,' described extensively in preparedness literature (e.g., Smith & Walton, 2009; Spittal et al. 2005). Many other biases in risk perception and risk judgments (e.g., denial, fatalism, outcome expectancy, coping strategies, and beliefs about the efficacy of preparedness) could be involved but are beyond the scope of discussion here.

Emotional Well-Being (H_3): Adults with strong Sense of Coherence do exhibit higher levels of engagement in evacuation kit activity. A weak, positive association ($p < 0.01$) is observed in those who engaged in evacuation kit preparedness, at both

dichotomous (intention/action) and Stages of Change levels of measurement. Accordingly, H_3 is supported. Although this relationship is statistically significant, the strength or magnitude of this relationship (effect size) is small. Weak, positive associations are also observed between emotional well-being and all other types of kit activity measured in the study; all are statistically significant at both levels of measurement, with the exception of kit accessibility measured at the Stages of Change level.

As expected, emotional well-being – measured here with the Sense of Coherence scale (Antonovsky, 1987, 1993) which synthesises comprehensibility, manageability, and meaningfulness – does seem to promote preparedness behaviour, although the effect is small. A possible reason for this result, in contrast to the less significant findings for mental health, is the integration of the meaning component in this construct. It may also be due to the measure's ability to reflect the respondent's cognitive understanding of situational variables and their personal assessments of resistance resources available to them for stressful situations.

Spiritual Well-Being (H_4): Adults with strong spiritual well-being do exhibit higher levels of engagement in evacuation kit preparedness. A weak, positive association with spiritual well-being is observed in those who engaged in evacuation kit preparedness, at both dichotomous ($p < 0.01$) and Stages of Change levels of measurement ($p < 0.001$). Therefore, H_5 is supported. Although this relationship is statistically significant, the strength or magnitude of this relationship is small. Weak, positive associations are also observed between spiritual well-being and several other types of kit activity measured in the study. These relationships are statistically significant for communications kit activity at both levels of measurement, and kit accessibility at the Stages of Change level.

The inherent significance of meaning in the Serenity Scale (Boyd-Wilson et al. 2004, 2006) may explain the association of positive spiritual well-being with higher levels of preparedness in the study population. The Serenity Scale appears to capture a dimension of acceptance of how things are and trust in the greater good (Roberts & Aspy, 1993) that is not represented to the same degree in any other study variable.

Social Well-Being (H_5): Adults with strong social well-being do not exhibit higher levels of engagement in evacuation kit preparedness. A weak, positive association with social well-being is observed in those who engaged in evacuation kit preparedness; this relationship, however, is not statistically significant at either dichotomous (intention/action) or Stages of Change levels of measurement. Therefore, H_4 is not supported. Weak, positive associations are observed between social well-being and all other types of kit activity measured in the study population. These relationships vary in their statistically significance depending on the level of measurement.

Given the importance of social support in the post-disaster environment, previously reported in the literature (e.g., Ke et al. 2010) and anecdotally by respondents in this study who have prior disaster experience, it could be surprising that social well-being does not show a more prominent role in evacuation preparedness. On the other hand, the presence of strong social networks, and thus perhaps an expectation of support post-disaster, may discourage individual preparedness. Examining expectations of support versus actual and perceived support is an emerging area of research in disaster studies that may further inform these ambiguities in the future.

Global Well-Being (H_6): Adults with higher life satisfaction do exhibit higher levels of engagement in evacuation kit preparedness. A weak, positive association with life satisfaction is observed in those who engaged in evacuation kit preparedness. This relationship is statistically significant at the dichotomous level of measurement ($p < 0.05$) but not at the Stages of Change level. Therefore H_6 is supported, but only for behaviour measured at the intention versus action level. The strength or magnitude of this effect is very small. Weak, positive associations are also observed between life satisfaction and all other types of kit activity measured in the study. These relationships are statistically significant at both levels of measurement, with the exception of survival kit activity.

It can be hypothesised that those with high life satisfaction would perceive there would be more to lose in a disaster, and thus higher life satisfaction would strongly correlate with preparedness activity. At the same time, those with lower life satisfaction may have greater fatalism, be wearier, or perceive lower levels of

efficacy in their preparedness actions, and therefore be less engaged in preparedness.

It is not possible to say precisely why there is a trend toward an association of higher life satisfaction with preparedness. A possible explanation for the observed results, consistent with those for emotional and spiritual well-being, is that being satisfied with life suggests a meaningful, fulfilling life experience, and thus there is some desire to maintain that subjective sense of well-being as much as reasonably possible.

5.3.4 Explanatory Power of the Quality of Life Model (H_7)

The regression models demonstrate that quality of life is positively associated with evacuation preparedness. Yet as a group and individually, quality of life variables have, at best, weak explanatory power over evacuation kit preparedness behaviour.

Quality of life variables explain from 4.6% (p = .001) to 6.8% of the variance (p = .001) in evacuation kit activity, measured at the dichotomised levels of intention versus action. At the Stages of Changes level of measurement, quality of life variables explain from 3.4% (p = .002) to 4.2% (p = .001) of the variance in evacuation kit activity. The statistical significance of these findings at both levels of measurement indicates that H_7 is supported.

Spiritual well-being makes the strongest and the most statistically significant unique contribution to explaining evacuation kit preparedness. Spiritual well-being uniquely explains from about 1% (p = .01) to 2.2% of the variance (p <= 0.001). Other domains of quality of life do not have explanatory power over evacuation kit preparedness at a domain-specific level in the multivariate models.

These findings are consistent with the results previously described for the correlational analyses, where spiritual well-being has the strongest association for all quality of life variables measured. The emergence of spiritual well-being as the sole quality of life factor with explanatory power in the regression models appears to

confirm that meaning is an important dimension in health-related quality of life and well-being for this study population.

5.3.5 The Role of Age (H_8) and Gender (H_9)

As indicated earlier, relationships between quality of life and evacuation kit preparedness behaviour are affected by age but not by gender. There is a significant association between age and evacuation kit activity and the likelihood of preparing appears to increase with age. The effect of differences by age group is moderate. Age accounts for only up to 1.4% of the variance (p <= 0.001) in evacuation preparedness. There is no significant association between gender and evacuation kit activity. Accordingly, H_8 is supported and H_9 is not supported.

Evacuation kit activity ranges from about one out of three for the 25-44 years of age group to nearly one out of two for those 65 years and over. Yet for those 18-24 years old, less than one out of ten have taken action. A possible factor in these findings is the accumulation of life experience leading one to realise no one is 'invincible,' and a greater sense of personal and social responsibility throughout mature adulthood. Anecdotal comments from older survey respondents support this interpretation, with reports of a sense of responsibility due to age-related physical vulnerabilities, a desire not to be a 'burden,' and a wish to be in a position to help younger family and community members.

Taking into account that the sample tends to be only slightly older and includes more women by about 10% than the greater Wellington population, these results show that the sample is reasonable in both its representativeness and generalisability.

5.3.6 Other Factors

***Perceptions of physical risk and vulnerability*:** People identify earthquake and tsunami as the most likely physical risk of disaster that they face in Wellington. It is notable that earthquake is considered the most likely cause of disaster at a 2:1 ratio over tsunami. It is difficult to explain this result, but it could be attributable to general

knowledge that not every earthquake produces a tsunami. Tsunami risk in Wellington is present from local, regional and distant source (e.g., trans-Pacific) earthquakes, potentially increasing the number of scenarios that could produce a disaster from tsunami over a disaster due to earthquake. Tsunami clearly emerged as the 2nd choice among other hazards by a greater than 2:1 ratio, despite extensive attention focused in recent years on the social, economic and institutional impacts of pandemic flu.

A possible explanation for the combined top rankings of earthquake and tsunami could be that they are a common focus of civil defence and Earthquake Commission public education programmes. In addition, the possible interference of the study focus on earthquake and tsunami, identified in the study cover letter and information sheet, cannot be ruled out for the results observed.

Fewer than one out of four people think an earthquake or tsunami could trigger a disaster in Wellington within the next year, but three out of four believe an earthquake disaster could happen within 100 years, and over two out of three believe a tsunami could strike Wellington within 100 years. Seven out of ten people said they are thinking about these phenomena infrequently (once a month to a few times a year). Only 2% report they never think about an earthquake happening in Wellington; 21% report they never think about a tsunami.

Perceptions of personal risk and vulnerability: For both earthquake and tsunami, about half of the study respondents think adverse effects on their property, mobility and daily activities will be very likely; about half believe they will be affected for more than 30 days. Further, about half think evacuation will be at least likely; about one-half express at least moderate concern about evacuation being required due to earthquake; over one-third express at least moderate concern for evacuation being required due to tsunami. Nine out of ten have never had to evacuate due to any type of disaster.

The findings of the study are broadly consistent on the expected likelihood of direct and indirect adverse effects to property, personal health and safety, and day-to-day life. However, when these types of effects are compared across the domains of

persistence and worry or concern, possible contradictions emerge. For example, the data suggest the biggest worry or concern is health and safety, although impacts on day-to-day life are anticipated to have the greatest impact and persistence. Worry and expectation are different constructs; strong caution is indicated on any interpretation of personal vulnerability from direct and indirect effects across the domains of likelihood, persistence, and worry or concern. Convergences or divergences in perceptions of personal vulnerability may or may not be logically inconsistent. These questions are domain-specific, which thus affects the degree of transference between them.

These data were collected prior to the Canterbury earthquakes of 2010-2011 and the 2011 Japan earthquake and tsunami, and both risk identification and risk evaluations are undoubtedly higher and more consistent now. Nevertheless, at the time of this survey administration, the study population appeared to clearly understand that Wellington is vulnerable to high-consequence disaster triggered by earthquake, and that evacuation is a distinct possibility. This is not surprising given the well-known geological risks of the Wellington Region. Wellingtonians are also generally more aware of seismic risk than the general New Zealand population (MCDEM, 2011b).

Still, biases in risk perception for low frequency hazards are generally common and need to be taken into consideration, specifically those underestimating the level of risk and required action if people don't think 'it' will happen in their lifetime (Slovic, 1987). This study population appears to succumb to this effect, in view of the low proportion of people who recognised an earthquake- or tsunami-triggered disaster could happen today, or at any time.

Risk judgments are typically considered cognitive evaluations, and risk perception research has focused extensively on the cognitive domain. However, a converging body of evidence suggests that subjective risk judgments are not purely cognitive and affective reactions (an internal "early-warning" system or "street calculus") play a central role (Slovic & Weber, 2002; Slovic et al. 2004). This affective aspect could be an explanation for the study population's strong assessment of the likelihood of future evacuation in Wellington.

***Personal experience with disaster*:** Slovic et al. (2004) note the beneficial aspects of "*experiencing is believing*" in risk perceptions. While over two-thirds of study respondents report no experience with earthquake- or tsunami-triggered disaster and over three-quarters have never had to evacuate due to a disaster of any type, for those who have experienced disaster, their anecdotal reports paint a dramatic picture of devastating events and impacts.

Among the study participants there have been 145 encounters with a wide variety of natural disasters (primarily severe cyclonic weather, floods and earthquakes); 51 experiences of significant violence (interpersonal, terrorism, civilian and military exposure to war, internment and civil unrest); and 36 accidents (mostly building fire). Some people in this study have experienced more than one significant disaster.

Some lost loved ones. Scores of losses to health, safety, and property were reported, with profound emotional impacts and real property impacts being the most frequent types of consequences. Survivors indicated that quality of life factors were their most significant coping resource: social network and mental/emotional resources were the two most commonly reported categories.

Perceived choice and preparedness responsibility: A sense of autonomy or self-determination is moderately high to high in the study population. A desire for perceived choice and for taking personal responsibility for one's health, in the context of starting or continuing to prepare for evacuation, is also strong. A sense of social responsibility for others was reported anecdotally as another significant factor for engaging in evacuation preparedness. In addition, more than nine out of ten say they have at least some responsibility for household preparedness.

This widespread ownership of personal and social responsibility suggests motivations based on ethical principles of conscious choice and acting at the individual and community level for the greater good. This is consistent in theory with the concept of meaning as a bridge between health-related quality of life and preparedness behaviour.

5.3.7 Results Summary

This study found that there is small but significant difference in the quality of life level of those who have prepared to evacuate from home and those who have not that is not likely due to chance. Hence being prepared has something to do with quality of life. This fits with the theoretical frameworks of quality of life and salutogenesis that suggest health-protective attitudes and health-protective behaviours are positively related.

This study examined relationships using several analytical methods with increasing levels of robustness. Mean scores for quality of life variables are higher ($p < .05$) in those who prepare than those who only intend to prepare for the domains of emotional, spiritual, and social well-being, as well as for life satisfaction. The magnitude of these differences (effect size) is very small to small.

Positive correlations were detected for spiritual well-being, emotional well-being, and in part, for satisfaction with life, that are not likely due to chance. While these correlations are of statistical significance, they are weak. No statistically significant association is found for physical health, mental health, or social well-being that is not likely due to chance.

There is no significant correlation between gender and preparedness. Neither gender is more likely to be prepared than the other. There is a significant correlation between age and evacuation kit activity. The likelihood of preparing appears to increase with age. While statistically significant, the strength of this relationship is moderate and in part reflects the large sample size.

The influence or explanatory power of the independent variable, quality of life, on the level of engagement in evacuation kit activity, as the dependent variable, was tested through several regression models and found to be statistically significant. The strongest unique contribution is from spiritual well-being. Age also makes a statistically significant unique contribution in this conceptual model. Both of these influences, however, are weak.

5.4. Limitations and Strengths of this Study

The results reported in this thesis are conditional on the specific methods and measures chosen, and the timing of the study.

5.4.1 Limitations

Results are representative only for the time of survey administration. The same findings would not be expected now; this is the nature of cross-sectional study designs. As previously noted, awareness and acceptance that a future earthquake or tsunami can profoundly impact the Wellington Region – and in ways far exceeding indirect effects on day-to-day activities – is also anticipated to be significantly higher than when the study survey was administered in late 2008. The loss of life, widespread property damage, and the protracted nature of health and safety concerns following the 2010-2011 Christchurch earthquakes and the 2011 Japan earthquake and tsunami offer difficult but firm evidence of the effects of earthquake and tsunami on other populations living with similar geological risk. Disaster awareness is now likely at its highest level in recent history in New Zealand.

If other psychometric scales were chosen for any domain of well-being measured in the study, the inferential results might have been different. This was the first-known application of any of these scales in the pre-disaster context. Two validated psychometric scales, the Serenity Scale (Boyd-Wilson et al. 2004, 2006) and the Friendship Scale (Hawthorne, 1986), are not known to have been used before in any disaster context. By virtue of novelty, it is not possible to evaluate consistency of scale results in similar study designs.

Correlation is not causation. The nature of epidemiological cross-sectional study designs does not allow interpretation of more than the strength and direction of relationships, and the contribution of an independent variable to explaining the variance in the outcome variable.

Preparedness has wide-ranging definitions. As a comparative outcome variable, there is a valid argument for greater agreement on how preparedness is measured (e.g. The "*Earthquake Readiness Scale*" after Spittal et al. 2006). On the other hand, there is a need for flexibility that will allow researchers to explore associations with specifically-defined activities. While important, it is difficult to make comparison assessments drawn from similar populations when assessing the significance of slightly different outcome variables.

It is not possible to predict if a person will be at home when disaster strikes or if their evacuation kit will be accessible following damage to a person's home or property. However, this does not negate the value of having preparedness kits.

Survey responses do not always predict subsequent behaviour. People's experience of an issue and their degree of involvement with it can also influence behaviour, including survey response rates. The people who responded to this survey may be more or less prepared than those who did not reply. If they are more likely to prepare, then these results are overinflated. Determining how those people who chose not to participate differed from those who did is not possible for this study.

5.4.2 Strengths

The strengths of this study include the large and representative study population and the standardised assessment procedures with well-validated quality of life measures. This research thus provides a sound evidence base, built through careful study design, random sampling, systematic data collection, quality-controlled data processing, and rigorous analytical techniques, yielding results with high validity and reliability. The large and representative sample can be considered generalisable to the Wellington population.

In multi-dimensional research, constructs that are theoretically associated should show convergence (i.e., correlate moderately with each other), but should not be so high that they call into question the distinctness of various constructs within a multi-dimensional model. These circumstances are precisely the case in this study.

This study presents a robust, new evidence base on previously unexamined relationships between quality of life and preparedness behaviour, which has significant implications (discussed in the next section) for research, policy and practise. The value of this research has grown as the thesis project progressed, due to the increased recognition of disaster risk for the Wellington Region. There are now many 'teachable moments' and opportunities for supporting preparedness for the next disaster. These results can guide the content and direction for directly involving the community in strengthening disaster preparedness and promoting health, well-being, and quality of life in Wellington.

5.5 Recommendations

5.5.1 Future Research

Further research into isolating single quality-of-life factors as strong predictors of preparedness is unlikely to be productive since this study found a pronounced individual streak in people. The more the study variables were isolated, the less powerfully an effect was observed with preparedness. This points to people being much more than a function of their demographic characteristics, disposition, or outlook at a particular moment in time. Even when looked at holistically, effects remain small. Similar to findings from social-cognitive research, one overall predictive model of disaster resilience seems unlikely to exist.

This study demonstrates, however, that examining subjective perceptions of quality of life, especially from a multi-dimensional perspective incorporating an affective heuristic, has importance for providing a more complete picture of resilient processes and outcomes. After carefully constructing a theoretical framework and conducting a methodologically and analytically robust study, consistent yet small effects were observed between several quality of life variables and preparedness behaviour, principally those that involve affective meaning. Despite these findings, it must be emphasised that none of the individual quality of life domains have strong explanatory power for evacuation preparedness behaviour.

Thus, this study also challenges the concept that there are profound barriers to preparedness from quality of life. No link was observed between physical, mental or social well-being and evacuation preparedness. Pockets of weak positive associations were observed for relationships among spiritual, emotional, and global well-being and preparedness.

Theoretical relationships often fail to materialise with profound effects when tested in an empirical setting. Hence, the absence of strong associations between quality of life and evacuation preparedness is not terribly surprising. It can be argued from these data, however, that health-related quality of life and well-being research brings

an in-depth holistic approach to understanding disaster risk reduction and resilience, and that meaning is a critical component. The detection of this positive correlation in the study population is thus hypothesis-generating for further investigation into the contribution of quality of life toward disaster-resilient processes and outcomes, and supports continued emphasis of affective domain in preparedness research. Understanding the intersection of the cognitive, affective, and behavioural domains will continue to be critical for providing a sound evidence base for decision-making in natural hazards planning, health care policy development, and emergency management.

With specific regard to meaning, in this study the Sense of Coherence measure works conceptually and appears useful whether it is considered as a global or domain-specific (emotional) construct. It moderately correlates with mental health status, social well-being, spiritual well-being, and life satisfaction, but is not redundant with any of these constructs. Future application of the serenity construct also appears warranted. Establishment of norms or cut points for general adult populations for both scales would be useful for comparative analyses; these are the only two validated quality of life scales used in this study that do not have them.

Further mining of the data set for this study is recommended to explore for relationships among contextual factors (physical and social environment) and evacuation preparedness, especially as they relate to motivation for preparedness. There is also a strong rationale for conducting follow-up studies to examine the impacts of the Canterbury disasters on the study population's risk perceptions, risk judgments, quality of life, motivations for preparedness, and preparedness status.

5.5.2. Future Policy and Practise

Data drive practises, resources, policies and programmes. These reliable and valid study data reflect a diversity of individual perceptions and experiences, yet are representative and generalisable to the general adult population of the Wellington Region. They provide a solid evidence base for translation from the research

environment to direct applications in the community. Some key needs and potential solutions are highlighted below:

Focus for Emergency Management

Target Audiences: The study findings indicate there is a need for more preparedness education that is broadly based for the general population. Findings also point to a need to specifically targets evacuation planning and testing, which show the largest gaps between intention and action. This is vital because of the numerous lifelines studies showing the protracted restoration time expected for meeting basic needs in Wellington following a significant earthquake, and the potentiality of sudden tsunami inundation, potentially heightening the need to evacuate homes throughout the eastern suburbs of Wellington.

Content: Getting messages out on the importance of evacuation planning, how to do it, what is important to have in an evacuation kit, the consequences of staying or going, and overall evacuation decision-making is critical to overcome this gap in awareness and preparedness action, especially considering the tendency for people to define 'preparedness' according to needs for sheltering-in-place. It is also important for managing expectations about the long-term timelines that are typical for disaster recovery, and assisting people with assessing and reducing uncertainties. Warning systems strategies, evacuation route testing, and drills are some of the numerous other elements of evacuation preparedness that are important to continue strengthening. Encouraging people to focus on what actions are especially meaningful to them will also enhance the relevance of their preparedness actions.

Messengers: People learn from interaction with each other and look to their personal social networks for support and making sense of difficult events. Continuing to encourage "look after yourself, look after your mates" decreases isolation and increases a sense of meaning.

Further, the level of experience with prior disaster found in this community sample is a source of knowledge and insight that could be drawn upon to communicate the realities of post-disaster life and mentor preparedness in people throughout the

Wellington Region. Drawing on these resources already within the community can also help mentors develop meaning from their disaster experiences.

Interaction with the community: The "greater good" meaning component can also be integrated at the personal and community level by partnering with organisations that are motivated by a service ethic (e.g., non-profit community service organisations, faith-based communities, civic groups, professional associations). Service-oriented organisations can not only help build resilience as a process, but also help give meaning and context to people's lives outside of their day-to-day roles, which can lead to greater resilient outcomes following disaster.

Regular interaction between emergency managers and the community facilitates trust and familiarity, can normalise the topic of preparedness in a pre-disaster context, and can increase engagement in preparedness activity in ways that makes sense for the physical and social environments people live in. Further strengthening the 'on-the-ground' presence of emergency managers prior to disaster within the community can build foundations for post-disaster recovery. For instance, local information briefings in Christchurch neighbourhoods and suburbs brought residents and emergency managers together on a regular basis for updates on earthquake recovery with a community 'feel,' contributing to a sense of community resilience.

Social media can also provide a mechanism for information and sharing, help people advocate for their own health and well-being, and feel socially connected. The use of social media by University of Canterbury to communicate with students following the 2010-2011 earthquakes is but one example of how both essential situational information and effective preparedness, response and recovery knowledge was quickly shared.

Focus for the Health Sector

The health sector is perhaps uniquely positioned to help people on an one-on-one basis to understand the balance of factors or 'formula' that works best for them to maintain and promote their personal health, and take care of themselves during times of stress or crisis. Developing intervention strategies to help community

residents better understand what promotes their own well-being for disaster resilience – designed for service delivery in multiple healthcare settings – may exponentially improve levels of preparedness.

For example, interventions can take place in public health settings, within specialty healthcare provider clinics, and at the local GP office. Anywhere that a person interacts with a health care provider is an opportunity to discuss 'safety plans' and to encourage individuals to expand their personal well-being programme to include activities that will enhance their personal disaster resilience.

Wellness or preventive health perspectives are also consistent with health care cost-minimisation policies, goals to advance health literacy, and movement in the health sector towards complementary and integrated health care.

Other Systems and Stakeholders

The emergency management and health sectors are well-positioned to play crucial roles in not just helping people recover from disaster, but also in preparing people for disaster, and thus are crucial pieces of the resilience puzzle. However, a synthesis of perspectives on disaster preparedness research from the physical, social, behavioural and health sciences – and applied across clinical, public health, emergency management, educational, planning and policy making settings – will continue to be needed. Disasters are complex problems, with complex solutions. No one person, profession, organisation, or nation can sort it all out. Collaboration will continue to paramount.

5.6 Conclusions

People are individuals.

Disaster resilience is dynamic, personal, and sometimes situational. Many factors are associated with preparedness behaviour. No one specific domain of well-being stands out as a dominant predictor. There is dramatic variability in quality of life scores across all levels of preparedness. What may be a strong predictor of preparedness (a resilient process) for one individual might not be a factor at all for another, or may change with life situation and perspective. There is no specific type of person who will be consistently better or worse prepared. These findings are new in this context and have profound implications for disaster preparedness education.

These findings are also consistent with research in the post-disaster environment showing that resilience trajectories reflect a variety of responses between individuals and over time. What may be a strong predictor of recovery (a resilient outcome) for one individual might not be for another. Different factors are important to a person one month, three months, six months, a year, or many years after a disaster; no one factor explains the variability in outcomes at the population level. The vulnerable and the distressed, although perhaps at greater risk, can still emerge resiliently, and the “resilient” are still vulnerable to trauma, depending on circumstances.

The study findings have implications in that there is no evidence for making specific adaptations for preparedness education at the community level based on one particular domain of well-being over another. Many assumptions such as those who are more “resource-rich” will be strongly engaged in health-protective behaviours are not supported by the findings of this study. Likewise, those that suggest people with deficits in quality of life might be more attuned to disaster vulnerability, and therefore more prepared, are also not supported by these data.

Many literature sources further say that gender is a profound influence on a wide range of disaster-related variables. Stereotypes are common that gender is a factor in preparedness. In this study, no such gender effect materialised, hence there is no

evidence basis for gender-specific preparedness programming. Age is a factor; no age group should be overlooked in preparedness education and health promotion.

Multi-dimensional models for preparedness are essential.

Disaster resilience is multi-dimensional. While the foregoing conclusions present an even-more complicated picture than previously known for understanding disaster resilient processes and outcomes, they also point out the importance and sensibility of using a multi-dimensional set of measures in promoting disaster risk reduction and disaster resilience. "Broad brush" campaigns, both in target audience and content, may be the most successful at the population level, because they will best reflect the diversity of people's subjective perceptions and experiences. The study data suggest this will be true for health-related quality of life approaches to preparedness. Arguably a multi-dimensional approach would be most successful for large civil defence and emergency management campaigns, rather than focusing solely on risk perception, or limiting definitions of preparedness to what is needed for 1-, 3-, or 7-day physical survival.

From a research standpoint, it is beneficial to look at multiple domains of well-being as a set of variables for many reasons, including: quality of life domains converge in their construct validity but are not redundant; different strengths and directions of effects are found within domains; and as a set there is a small but statistically significant effect for quality of life factors in explaining preparedness.

The affective domain matters. Meaning matters.

Risk perception is more than thinking; it is also feeling. Being resilient in attitude and behaviour is also more than thinking. People tend to want to feel good and to make meaning of their lives, cognitively, affectively, and behaviourally: doing what is meaningful can lead to resilience. The study findings support this tendency and corroborate evidence that resilient processes and outcomes depend upon the ability to find some form of meaning in a stressor.

This conclusion is observed in the presence of associations found between the constructs of serenity (spiritual well-being), sense of coherence (emotional well-being), and life satisfaction (global well-being) with evacuation kit preparedness. These associations, although weak, are positive and statistically significant; even if the reasons for their presence are arguable, their existence is real. The same domains also show positive relationships with other measures of preparedness in this study. All three are affective constructs, and they all involve meaning. They are important contributors, however small, to preparedness in this study population.

The importance of the affective domain in this study and in disaster resilience research is consistent with findings of significance for the meaning construct in positive psychology, salutogenesis, quality of life, and self-determination theory, as well as the application of these theories in the post-disaster environment.

Health matters. Preparedness matters. Prevention matters.

Surviving and thriving through life's challenges can be enhanced by taking preventive action that protects health and well-being before crisis strikes. Preventive actions can also increase an immediate sense of personal control over the potential range of outcomes that can directly affect a person and indirectly their post-disaster quality of life.

A preventive health perspective is important to this study population. Among health-related reasons for starting or continuing to engage in evacuation preparedness, personal health was the strongest motivating factor. A sense of social responsibility for others was also reported anecdotally as a significant factor; being prepared so one can help others is health-promoting at the community level as well.

Health promotion, especially from a multi-dimensional health perspective, also has a role in all phases of the disaster cycle. People can be motivated to prepare for disaster by one health management resource, and helped by another resource afterwards. For example, study respondents generally think their physical and mental resources will help with their capacity to cope the most, even though these strengths are not associated with evacuation preparedness. Respondents also

perceive their emotional resources and social networks as very important for coping with evacuation, but do not perceive their spiritual resources as helping a great deal during evacuation, even though emotional and spiritual well-being are associated with preparedness in this study population.

These findings may not be mutually exclusive, and could reflect a well-considered assessment of which items from their personal "resilience" toolkit are right "for the job at hand." For example, if a person identifies which set of strengths or resources will be most important for their survival and functioning if they are on their own or with others at the time of an earthquake or tsunami, and what might be most important to them in the days, weeks or months to follow, they can do their own personal gap assessment and develop a plan that could work for them.

Thus, taking a holistic and multidimensional approach to identifying what health-protective resources are available for an individual and which ones may be personally relevant – evaluated for their utility in preparedness and recovery timeframes – could be an enormous step forward in building personal and community resilience for all phases of disaster.

Subjective perspectives on what constitutes quality of life and well-being are clearly important to the people in this study. People are also looking for clear guidance on how to best prepare for disaster, and many prefer to consult with someone they trust. Preparing a population to self-manage disaster risk and uncertainty will require seeing preparedness through the eyes of the public, and the sensitivity to help them hone the personal decision-making skills to deal with location-specific yet tricky questions such as, "*when shall I leave?*" and deeply personal questions such as, "*what will help me cope the most?*"

Getting the input of those at risk is now consistent with the whole direction of movement in health care toward patient-centred approaches and preventive health management. Nearly everyone in this study has a doctor they see annually, suggesting an opportunity for one-on-one preparedness consultation with a health professional that could reach almost the entire general population. Disaster preparedness can also become part of regular health maintenance visits, integrative

and preventive health care, wellness programmes, and community health promotion. Theses are all potential pathways to achieving disaster-resilient processes and outcomes at both personal and community levels.

By integrating preventive health practices into emergency management planning, and disaster preparedness into wellness strategies, from local to international levels, communities can build disaster resilience. Resilience is vital to promote and health is imperative to protect.

> "*For regions as vulnerable as ours, disaster preparedness is no desktop exercise – it's a matter of survival*."
>
> \- H.E. Jim McLay
> New Zealand Permanent Representative to the United Nations
> Address to the UN General Assembly
> 27 September 2011

Postscript: It is impossible to look at this study, done before the recent catastrophic events of the Canterbury earthquakes, and comment on how these findings relate to this new context post-disaster for Wellington and all of New Zealand. First, undoubtedly awareness and readiness for preparedness education and taking action are likely to be at its peak now, so the ideas put forward for implementing programmes mentioned above are tantalisingly and readily applicable. Second, the resilience of the New Zealand population has been sorely tested by these natural disasters, so it begs the question whether they have weakened or strengthened New Zealanders resolve and resilience which could only be determined by further study. Finally, as the author of this thesis, the thesis committee, and all involved in this study were personally touched by these disasters, it is hard to know to what degree the events have coloured the interpretation of these findings. The thesis went from the abstract exercise of asking how one is preparing for and expects to manage if a disaster struck, to the real and harrowing experience of living through multiple earthquakes with thesis personnel and material literally being shaken to their core. If nothing else, this drives home the essential nature of this work in helping New Zealanders, and indeed anyone living in an area of potential seismic activity, to be as prepared and resilient as possible.

- Monica Gowan, Ray Kirk, and Jeff Sloan

"Living the Displaced Life"
Thesis papers in the boot of DAN 440, following 13 June 2011 earthquake
Café Euro Carpark, Avonhead, Christchurch, New Zealand
15 June 2011

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APPENDIX 1. Supporting Documentation—Survey Instrument

November 2008

Dear Wellington Community Member,

The University of Canterbury Health Sciences Centre, GNS Science/Massey University Joint Centre for Disaster Research, and Central Queensland University are conducting a research study into the strengths and skills of people who live with the risk of natural disaster. You are invited to take part in this study focused on the role of health and well-being in emergency preparedness. A better understanding of this relationship can lead to enhanced coping skills, trauma prevention, and increased quality of life.

While important for all types of disaster scenarios and settings, this study has a special interest in earthquakes and tsunamis because these hazards can trigger a need for evacuation. The information collected in this study will help Wellington fulfill the National Civil Defence Emergency Management Strategy 2007, which calls for *"increasing community awareness, understanding, and preparedness and participation in civil defence emergency management"* through *"improving individual, community and business preparedness".*

Participating in this study should take only about 30-60 minutes, depending on how much time you spend on the enclosed questionnaire (you may take as much time as you wish). We suggest that the person who completes this questionnaire in your household is the adult (age 18 or over) who most recently had a birthday. When you have finished the questionnaire, please place it in the enclosed freepost envelope and post it. If you decide not to participate, there will be no disadvantage to you and we thank you for considering our request.

We hope you will find that participating in this study is a simple way to contribute towards potentially significant discoveries on how to promote health and prevent personal disaster from following natural disasters. By filling out the enclosed questionnaire, you also will be providing important information to help community planners best prepare for disaster. The more people who participate, the stronger and better the results will be. Please help us with this very important and unique study; your views are critical to the success of this research into how to improve the situation of people everywhere who live with disaster risk. We look forward to hearing from you.

Kind regards,

Monica Gowan
PhD Candidate
University of Canterbury Health Sciences Centre
GNS Science/Massey University Joint Centre for Disaster Research

December 2008

Dear Wellington Community Member,

Recently you received a questionnaire titled, “Wellington Disaster Preparedness Study” as part of a scientific research project into the role of health and well-being in emergency preparedness. If you have already completed and returned the questionnaire to us, my research team and I would like to take this opportunity to offer our sincere thanks.

If not, we hope you will be able to assist us by completing the questionnaire and returning it to us in the Freepost envelope enclosed. We are asking again because of the significance each questionnaire has to the usefulness of this study. To properly understand the range of community views, we are seeking responses from both women and men, from a variety of age groups, situations, and backgrounds.

In your household, we ask only that the person who completes this questionnaire is the adult (age 18 or older) who most recently had a birthday. The responses you provide will be combined with the information we get from others. All information about you will be strictly confidential, and we will only report on general trends.

Please return your completed questionnaire to us at your earliest convenience or no later than 19 December. If you have any questions about completing the questionnaire or would like to know more about the study, please feel free to contact me.

Your views are very important to the success of this study, and we look forward to hearing from you. Thank you.

Kind regards,

Monica E. Gowan
PhD Candidate
University of Canterbury Health Sciences Centre
GNS Science/Massey University Joint Centre for Disaster Research
Tel 04 570 1444
Fax 04 570 4600
Email monica.gowan@canterbury.ac.nz

Wellington Disaster Prevention Study:

Involving the community in strengthening emergency preparedness and promoting health, well-being and quality of life in Wellington, New Zealand

Wellington
GNS Science Photolibrary

Study Questionnaire

Information for Participants – Wellington Disaster Prevention Study 2008

This study will assess the importance of health and well-being in motivating disaster preparedness and promoting positive mental health in disaster risk settings. Understanding the relationship between the personal strengths and skills of Wellingtonians and evacuation preparedness for earthquake and tsunami can help lead to significant discoveries on how to help people everywhere be healthy after a disaster. The outcomes of this research will be used by the Earthquake Commission, GNS Science, and emergency managers to improve public information programmes for preparedness and to help ensure local emergency management needs are met.

Your household address was randomly selected as part of a sample drawn from about 2500 households in several eastern suburbs of Wellington (Oriental Bay, Roseneath, Hataitai, Lyall Bay, Miramar North, and Seatoun). We suggest that the person who completes this questionnaire in your household is **the adult (age 18 or over) who most recently had a birthday**. The questionnaire is divided into four sections, asking your perspectives on: 1) the potential for disaster in Wellington and how you could be affected; 2) how you approach day-to-day life and your general health and well-being; 3) what you think and how you feel about preparing for and coping with an evacuation; and 4) what types of preparedness activities you might be considering doing.

The results of this study will be written in a PhD thesis dissertation for the University of Canterbury and a report will be prepared for the New Zealand Earthquake Commission. A summary of the findings will be available on the GNS Science web site (http://www.gns.cri.nz). The results may also be written as scientific papers and submitted to research journals for publication, but you may be assured of the complete confidentiality of information gathered and the preservation of your anonymity. All replies will be kept confidential and you are not asked to record any names. As a result, there is no way in which your responses will be identifiable in any research output. Information given by any study participant is always combined with information from many other participants; we will report only on general trends.

Your participation in this study is entirely voluntary, and you are free to not answer any question or to not return the questionnaire. Returning this questionnaire implies that you are consenting to participate in this study.

Your safety, privacy and confidentiality are protected. This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the (Massey) University's Human Ethics Committees. In addition, the Massey Low Risk Notification approval was submitted to the University of Canterbury Human Ethics Committee, where further approval for the project to proceed was granted. The researchers named below are responsible for the ethical conduct of this research. If you have any questions or seek additional information about any aspect of this research at any time, please feel free to contact any member of the research team:

Monica Gowan (University of Canterbury), telephone 04 570 1444, email monica.gowan@canterbury.ac.nz
Associate Prof Ray Kirk (University of Canterbury), telephone 03 366 7001 x8691, email ray.kirk@canterbury.ac.nz
Associate Prof David Johnston (GNS Sciences/Massey University), telephone 04 570 1444, email david.johnston@gns.cri.nz
Prof Kevin Ronan (Central Queensland University), telephone +61 7 4930 6746, email k.ronan@cqu.edu.au

Additionally, if you have any concerns about the conduct of this research that you wish to raise with someone other than the researchers, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz.

WELLINGTON DISASTER PREVENTION STUDY 2008

SECTION 1. In the first section of this four-part study, we are interested in learning what you believe, think and know about the potential for disaster in Wellington.

For the purposes of this study, by "disaster" we mean an event that causes significant damage, loss or disruption to the point the community is paralysed or needs rebuilding.

1. From the following list of hazards, which two do you believe are most likely to trigger a disaster in the Wellington Region? *(Please tick only two)*

- ☐1 Earthquake
- ☐2 Fire
- ☐3 Flood
- ☐4 Landslide
- ☐5 Pandemic flu
- ☐6 Terrorism
- ☐7 Tsunami
- ☐8 Volcanic eruption
- ☐9 Other (please specify) _____

2. The Greater Wellington Regional Council has published maps identifying areas vulnerable to several types of natural hazards, all of which can be caused by an earthquake. Do you (a) live or (b) work in one or more of these areas? *(Please tick all rows in both (a) and (b) columns)*

Type of Natural Hazard Area	(a) Live			(b) Work		
	Yes, I do	No, I don't	Don't Know	Yes, I do	No, I don't	Don't Know
Earthquake – fault rupture (actual land splitting)	☐1	☐2	☐3	☐4	☐5	☐6
Earthquake – ground shaking (surface motion)	☐1	☐2	☐3	☐4	☐5	☐6
Earthquake – liquefaction (soils flowing)	☐1	☐2	☐3	☐4	☐5	☐6
Tsunami (sea wave) or seiche (harbour 'sloshing')	☐1	☐2	☐3	☐4	☐5	☐6
Landslides (slope failure)	☐1	☐2	☐3	☐4	☐5	☐6
Wildfire (unplanned fire in urban-bush interface)	☐1	☐2	☐3	☐4	☐5	☐6

3. How often do you think about an earthquake or tsunami happening in Wellington? *(Please tick only one per column)*

	Earthquake	Tsunami
☐1	Daily	Daily
☐2	Multiple times a week (2-6 times)	Multiple times a week (2-6 times)
☐3	Once a week	Once a week
☐4	Once a month	Once a month
☐5	A few times a year	A few times a year
☐6	Never	Never

4. When is the soonest that you think an earthquake or tsunami could trigger a disaster in Wellington? *(Please tick only one per column)*

	Earthquake	Tsunami
☐1	Within the next year	Within the next year
☐2	Within the next 1-10 years	Within the next 1-10 years
☐3	Within 10-100 years	Within 10-100 years
☐4	In over 100 years	In over 100 years
☐5	Never	Never
☐6	Don't Know	Don't Know

Next, we'd like you to answer five questions about ways you believe *you* could be personally affected by disaster in the Wellington Region.

Even if you live with other people, please focus specifically on you in this study. This is because it is important to understand a person's individual strengths and resources for managing during a disaster, which can have a positive effect on others as well.

5. Please rate how likely you think it is that an earthquake or tsunami in the Wellington Region could affect *you* personally. *(Please tick only one per row)*

Direct Effects on You	**Not Very Likely** ←				→ **Very Likely**
Physical damage or loss to my property (e.g., real estate, home, vehicle, personal possessions)	☐1	☐2	☐3	☐4	☐5
Adversely affect my personal health and safety (e.g., illness, injury, emotional impact, safety and security)	☐1	☐2	☐3	☐4	☐5
Indirect Effects on Your Day-to-Day Life	**Not Very Likely** ←				→ **Very Likely**
Adversely affect my daily activities (e.g., work, leisure, projects)	☐1	☐2	☐3	☐4	☐5
Adversely affect my social network (e.g., level of support available from friends and family)	☐1	☐2	☐3	☐4	☐5
Adversely affect my mobility (e.g., ability to travel freely to get supplies, go to appointments, see friends and family, get to work, etc.)	☐1	☐2	☐3	☐4	☐5
Adversely affect my income (e.g., lose money because can't work; lose investments)	☐1	☐2	☐3	☐4	☐5
Require evacuation from my home	☐1	☐2	☐3	☐4	☐5

6. For how long do you think your ability to return to status quo ("normal"), with respect to your property, would be affected? *(Please tick only one)*

☐1 Less than a week
☐2 1-2 weeks
☐3 2 weeks to a month
☐4 More than 30 days
☐5 Don't Know

7. For how long do you think your personal health and safety would be affected? *(Please tick only one)*

☐1 Less than a week
☐2 1-2 weeks
☐3 2 weeks to a month
☐4 More than 30 days
☐5 Don't Know

8. For how long do you think your day-to-day life would be affected? (e.g. daily activities, social network, travel/mobility, income) *(Please tick only one)*

☐1 Less than a week
☐2 1-2 weeks
☐3 2 weeks to a month
☐4 More than 30 days
☐5 Don't Know

9. What is your biggest worry or concern, in terms of personal impact on *you*? *(Please fill in each blank with a number, ranked from 1 (highest) to 3 (lowest))*

____ My Property (e.g., real estate, home, vehicle, personal possessions)
____ My Personal Health and Safety (e.g., illness, injury, emotional impact, safety, security)
____ My Day-to-Day Life (e.g., activities, social network, mobility, income)

The last set of questions in this section asks about your *experience* with disaster.

10. Have you ever experienced an earthquake (or an earthquake-triggered tsunami, landslide or fire) that resulted in the following? *(Please tick all that apply)*

☐1 Yes, direct effects on me (e.g., my property, personal health and safety)
☐2 Yes, indirect effects on my day-to-day life (e.g. activities, mobility, social network, income)
☐3 No direct or indirect effects on me, but I personally witnessed impacts someone I knew or came into contact with was experiencing
☐4 None of the above

11. Have you ever experienced a personal disaster of *any other type* (e.g., house fire, flood, severe weather event, interpersonal violence, terrorism, dislocation due to war, refugee resettlement, severe disease outbreak or epidemic, other) that resulted in the following? *(Please tick all that apply)*

☐1 Yes, direct effects on me (e.g., my property, personal health and safety)
☐2 Yes, indirect effects on my day-to-day life (e.g. activities, mobility, social network, income)
☐3 No direct or indirect effects on me, but I personally witnessed impacts someone I knew or came into contact with was experiencing
☐4 None of the above

12. Have you ever had to evacuate due to a disaster (of *any type*)?

☐1 Yes
☐2 No

13. If you have been personally affected by any type of disaster, please share with us the **specific type** of disaster you experienced or witnessed; how *you* were **most significantly impacted**; and **what helped you cope the most**. If you have personally experienced more than one disaster, please focus your answer on the worst-case event. (Your confidentiality is assured for every part of this study.)

Type of Disaster: _____

_____

Most Significant Impact on **You** (e.g., house destroyed, job change, lost a friend): _____

_____

_____

_____

What Helped **You** Cope the Most (e.g., type of internal resources, external support) _____

_____

_____

_____

SECTION 2. In this part of the study we are interested in learning about how Wellingtonians approach day-to-day life and their general health and well-being.

The tables in this section are scientifically-validated, standardised sets of questions and responses. These "scales" are used worldwide to help researchers reliably understand the range of styles with which people think, feel, act, and interact with one another.

There is no right or wrong answer to any question. It is just about understanding how people look at things from their own personal standpoint. Please read each question and complete each table in full.

Roseneath and Hataitai
GNS Science photolibrary

14. Please think about your interactions with other people in the past four weeks. *Then tick a box (one per row) to show where you rate yourself on how much you agree or disagree with each statement.*

During the past 4 weeks...	Almost Always ◄				► Not At All
It has been easy to relate to others	☐1	☐2	☐3	☐4	☐5
I felt isolated from other people	☐1	☐2	☐3	☐4	☐5
I had someone to share my feelings with	☐1	☐2	☐3	☐4	☐5
I found it easy to get in touch with others when I needed to	☐1	☐2	☐3	☐4	☐5
When with other people, I felt separate from them	☐1	☐2	☐3	☐4	☐5
I felt alone and friendless	☐1	☐2	☐3	☐4	☐5

15. Please think about how much personal choice you feel you have in making everyday decisions. Compare the pair of statements in each row, and think about which statement seems more true for you. *Then tick the box (one per row) that best shows where you rate yourself between Statement A and B.*

Statement A ◄					► Statement B
I always feel like I choose the things I do.	☐1	☐2	☐3	☐4	☐5	I sometimes feel that it's not really me choosing the things I do.
I choose to do what I have to do.	☐1	☐2	☐3	☐4	☐5	I do what I have to, but I don't feel like it is really my choice.
I do what I do because it interests me.	☐1	☐2	☐3	☐4	☐5	I do what I do because I have to.
I *am* free to do whatever I decide to do.	☐1	☐2	☐3	☐4	☐5	What I do is often not what I'd choose to do.
I *feel* pretty free to do whatever I choose to.	☐1	☐2	☐3	☐4	☐5	I often do things that I don't choose to do.

16. The scale that follows is crucial to helping us understand more about overall orientation-to-life for Wellington residents – how people here use their own unique set of strengths and skills to comprehend, manage and make meaning of all kinds of life situations and events.

Please read each of the following questions listed in the left side of the table and look at the type of possible answers (A and B) shown to the right of each question. Then, circle the number (one per row) that best shows where you rate yourself between 1 and 7.

	A	← →	B
Do you have the feeling that you don't really care about what goes on around you?	Very seldom or never	1 2 3 4 5 6 7	Very often
Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?	Never happened	1 2 3 4 5 6 7	Always happened
Has it happened that people whom you counted on disappointed you?	Never happened	1 2 3 4 5 6 7	Always happened
Until now your life has had:	No clear goals or purpose at all	1 2 3 4 5 6 7	Very clear goals and purpose
Do you have the feeling that you're being treated unfairly?	Very often	1 2 3 4 5 6 7	Very seldom or never
Do you have the feeling that you are in an unfamiliar situation and don't know what to do?	Very often	1 2 3 4 5 6 7	Very seldom or never
Doing the things you do every day is:	A source of deep pleasure and satisfaction	1 2 3 4 5 6 7	A source of pain and boredom
Do you have very mixed-up feelings and ideas?	Very often	1 2 3 4 5 6 7	Very seldom or never
Does it happen that you have feelings inside you would rather not feel?	Very often	1 2 3 4 5 6 7	Very seldom or never
Many people - even those with a strong character - sometimes feel like sad sacks (losers) in certain situations. How often have you felt this way in the past?	Never	1 2 3 4 5 6 7	Very often
When something happened, have you generally found that:	You overestimated or underestimated its importance	1 2 3 4 5 6 7	You saw things in the right proportion
How often do you have the feeling that there's little meaning in the things you do in your daily life?	Very often	1 2 3 4 5 6 7	Very seldom or never
How often do you have feelings that you're not sure you can keep under control?	Very often	1 2 3 4 5 6 7	Very seldom or never

17. This scale is about coping. Each statement below describes a possible experience (thought, feeling or action) in reaction to life.

Please tick the box that best describes how often you have this experience when dealing with life's everyday challenges. (Please tick only one per row)

In dealing with life's everyday challenges…	**Never** ◄——►				**Always**
I am aware of an inner source of comfort, strength, and security.	☐1	☐2	☐3	☐4	☐5
During troubled times, I experience an inner source of strength.	☐1	☐2	☐3	☐4	☐5
I trust that life events happen to fit a plan which is larger and more gentle than I can know.	☐1	☐2	☐3	☐4	☐5
I see the good in painful events that have happened to me.	☐1	☐2	☐3	☐4	☐5
I experience peace of mind.	☐1	☐2	☐3	☐4	☐5
I am forgiving of myself for past mistakes.	☐1	☐2	☐3	☐4	☐5
In problem situations, I do what I am able to do and then accept whatever happens even if I dislike it.	☐1	☐2	☐3	☐4	☐5
I accept situations that I cannot change.	☐1	☐2	☐3	☐4	☐5
I am aware of an inner peace.	☐1	☐2	☐3	☐4	☐5
I experience an inner quiet that does not depend upon events.	☐1	☐2	☐3	☐4	☐5
I find ways to share my talents with others.	☐1	☐2	☐3	☐4	☐5
When I get upset, I become peaceful by getting in touch with my inner self.	☐1	☐2	☐3	☐4	☐5
I attempt to deal with what is, rather than what was, or what will be.	☐1	☐2	☐3	☐4	☐5
Even though I do not understand, I trust in the ultimate goodness of the plan of things.	☐1	☐2	☐3	☐4	☐5
I experience an inner calm even when I am under pressure.	☐1	☐2	☐3	☐4	☐5
I can feel angry and observe my feeling of anger and separate myself from it and still feel an inner peace.	☐1	☐2	☐3	☐4	☐5
I trust that everything happens as it should.	☐1	☐2	☐3	☐4	☐5
I feel forgiving of those who have harmed me.	☐1	☐2	☐3	☐4	☐5
When I remember people who have caused me pain, I hope that good things will happen to them.	☐1	☐2	☐3	☐4	☐5
I feel serene.	☐1	☐2	☐3	☐4	☐5

Seatoun, Miramar North
GNS Science photolibrary

Evans Bay, Wellington Airport, Lyall Bay
GNS Science photolibrary

6

Now we would like to ask for your views about your health and satisfaction with your quality of life.

18. Do you have a regular GP (general practitioner, doctor) that you see on at least an annual (once-a-year) basis?

☐1 Yes
☐2 No

19. In general, would you say your health is: *(Please tick only one)*

☐1 Excellent
☐2 Very Good
☐3 Good
☐4 Fair
☐5 Poor

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

20. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf: *(Please tick only one)*

☐1 Yes, limited a lot
☐2 Yes, limited a little
☐3 No, not limited at all

21. Climbing several sets of stairs: *(Please tick only one)*

☐1 Yes, limited a lot
☐2 Yes, limited a little
☐3 No, not limited at all

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

22. Accomplished less than you would like:

☐1 Yes
☐2 No

23. Were limited in the kind of work or other activities:

☐1 Yes
☐2 No

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

24. Accomplished less than you would like:

☐1 Yes
☐2 No

25. Didn't do work or other activities as carefully as usual:

☐1 Yes
☐2 No

26. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)? *(Please tick only one)*

- ☐1 Not at all
- ☐2 A little bit
- ☐3 Moderately
- ☐4 Quite a bit
- ☐5 Extremely

The table below is about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

27. How much of the time during the past 4 weeks…*(Please tick only one per row)*

	All of the time	Most of the time	A good bit of time	Some of the time	A little of the time	None of the time
Have you felt calm and peaceful?	☐1	☐2	☐3	☐4	☐5	☐6
Did you have a lot of energy?	☐1	☐2	☐3	☐4	☐5	☐6
Have you felt downhearted and blue?	☐1	☐2	☐3	☐4	☐5	☐6

28. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc)? *(Please tick only one)*

- ☐1 All of the time
- ☐2 Most of the time
- ☐3 Some of the time
- ☐4 A little of the time
- ☐5 None of the time

29. Please describe the extent to which you agree or disagree with the following statements. *(Please tick only one per row)*

	Strongly Disagree ←						→ Strongly Agree
In most ways my life is close to my ideal.	☐1	☐2	☐3	☐4	☐5	☐6	☐7
The conditions of my life are excellent.	☐1	☐2	☐3	☐4	☐5	☐6	☐7
I am satisfied with my life.	☐1	☐2	☐3	☐4	☐5	☐6	☐7
So far I have gotten the important things I want in life.	☐1	☐2	☐3	☐4	☐5	☐6	☐7
If I could live my life over, I would change almost nothing.	☐1	☐2	☐3	☐4	☐5	☐6	☐7

SECTION 3. Now, considering the possibility of an earthquake or tsunami in the Wellington Region, we are interested in knowing what you think and how you feel about preparing for and coping with a disaster evacuation for one.

30. How would you rate your overall level of preparedness to evacuate from home? *(Please tick only one)*

- ☐1 Very Well Prepared
- ☐2 Well Prepared
- ☐3 Somewhat Prepared
- ☐4 Poorly Prepared
- ☐5 Not At All Prepared

31. The following standardised scale relates to reasons why you would either start doing evacuation preparedness activities or continue to do so. Different people have different reasons for doing so, and we would like to know how true each of the following ***health-related*** *reasons* (i.e., for your physical, mental, emotional, social, or spiritual health and well-being) is for you.

Please read each of the reasons listed below and rate the extent to which each reason is true for *you*. *(Please tick only one per row)*

The reason I would prepare is:	**Not true at all** ←						→ **Very True**
Because I feel that I want to take responsibility for my own health	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I would feel guilty or ashamed of myself if I didn't	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I personally believe it is the best thing for my health	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because others would be upset with me if I didn't	☐1	☐2	☐3	☐4	☐5	☐6	☐7
I really don't think about it	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I have carefully thought about it and believe it is very important for many aspects of my life	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I would feel bad about myself if I did not	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because it is an important choice I really want to make	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I feel pressure from others to do so	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because it is easier to do what I am told than think about it	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because it is consistent with my goals	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I want others to approve of me	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because it is very important for being as healthy as possible	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Because I want others to see I can do it	☐1	☐2	☐3	☐4	☐5	☐6	☐7
I don't really know why	☐1	☐2	☐3	☐4	☐5	☐6	☐7

32. If there is another reason that is a significant factor in why you would either start doing evacuation preparedness activities or continue to do so, and you would like to mention it to us, please specify the reason in the space below:

_____

33. How much concern do you have that a disaster will require evacuation from the Wellington Region? *(Please tick only one per row)*

Type of Disaster	A little Concern ←				→ A lot of Concern
Earthquake	☐1	☐2	☐3	☐4	☐5
Tsunami	☐1	☐2	☐3	☐4	☐5
Other (please specify) _____	☐1	☐2	☐3	☐4	☐5

34. Please describe the extent to which you think that each of the following personal resources would help you manage or cope with a disaster evacuation in the Wellington Region: *(Please tick only one per row)*

Type of Personal Resources	Not much ←				→ A great deal
My physical abilities	☐1	☐2	☐3	☐4	☐5
My mental skills (eg., thinking, knowledge)	☐1	☐2	☐3	☐4	☐5
My emotional resources (e.g., attitudes, feelings)	☐1	☐2	☐3	☐4	☐5
My spiritual resources (e.g., attitudes, beliefs)	☐1	☐2	☐3	☐4	☐5
My social network *in* Wellington (e.g., friends and family)	☐1	☐2	☐3	☐4	☐5
My social network *outside* of Wellington (e.g., friends and family)	☐1	☐2	☐3	☐4	☐5
My local community (e.g., neighbours, local residents)	☐1	☐2	☐3	☐4	☐5
My current preparedness plan	☐1	☐2	☐3	☐4	☐5

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SECTION 4. In this last section of the study, we would like to ask if you are considering or have done certain types of disaster preparedness activities, and your understanding about how to plan and prepare for evacuation *from home* in case of a threat or damage from earthquake or tsunami.

35. In the following table, please tick the box that best describes how the following actions apply to *you* personally now. *(Please tick only one per row)*

I have…	A I have not thought about this	B I have thought about this, but that's all	C I intend to do this	D I have started doing this	E I do (or maintain) this regularly
Talked about the possibility of an earthquake or tsunami:					
With my social network (e.g., friends, family)	☐1	☐2	☐3	☐4	☐5
With others in my neighbourhood	☐1	☐2	☐3	☐4	☐5
Sought out information about earthquakes or tsunamis:					
Risks and consequences	☐1	☐2	☐3	☐4	☐5
How to prepare for	☐1	☐2	☐3	☐4	☐5
How to respond during	☐1	☐2	☐3	☐4	☐5
How to evacuate from	☐1	☐2	☐3	☐4	☐5
Taken steps to increase my level of preparedness at home for:					
Earthquake	☐1	☐2	☐3	☐4	☐5
Tsunami	☐1	☐2	☐3	☐4	☐5
Other, please specify _____	☐1	☐2	☐3	☐4	☐5
Made Home "Getaway Plans" :					
Survival/Escape Plans (e.g., for immediately responding to an event and for protecting my physical health)	☐1	☐2	☐3	☐4	☐5
Evacuation/Dislocation Plans (e.g., for leaving home with what is important to me; following evacuation routes; going to assembly locations)	☐1	☐2	☐3	☐4	☐5
Communications Plans (e.g., for being in contact with my network of friends and family)	☐1	☐2	☐3	☐4	☐5
Tested Home "Getaway Plans":					
Followed an evacuation route	☐1	☐2	☐3	☐4	☐5
Gone to an assembly area	☐1	☐2	☐3	☐4	☐5
Participated in a drill	☐1	☐2	☐3	☐4	☐5
Made a Home "Getaway Kit" containing:					
Items for Survival/Escape (e.g., torch, fire extinguisher, first aid kit)	☐1	☐2	☐3	☐4	☐5
Items for Evacuation/Dislocation (e.g., outerwear, water, money, documents)	☐1	☐2	☐3	☐4	☐5
Items for Communications (e.g., contact list, phone, portable radio)	☐1	☐2	☐3	☐4	☐5
Placed a "Getaway Kit" in an easily accessible spot, ready for evacuation	☐1	☐2	☐3	☐4	☐5

36. What are the three most important or valuable items that you would consider essential to have in your personal "Getaway Kit" (e.g., most important to your health and well-being, whether physical, mental, emotional, social, or spiritual), in case of a need to evacuate from home?

1st Most Important: _____

_____

2nd Most Important: _____

_____

3rd Most Important: _____

_____

37. Have you given any personal evacuation plans to friends or relatives living outside of the Wellington Region, in case of emergency?

☐1 Yes
☐2 No

38. Have you done any of the following activities for your workplace? *(Please tick all that apply. If none apply, skip to Question 40)*

☐1 Made workplace "getaway plans"
☐2 Made a workplace "getaway kit"
☐3 Other (please specify) _____

39. Why have you done these activities? *(Please tick all that apply)*

☐1 My own choice
☐2 My workplace requested that I do them
☐3 My workplace required that I do them
☐4 Other (please specify) _____

40. Have you done any evacuation planning because of a disaster in the news? *(Please tick all that apply)*

☐1 2004 Boxing Day (South Asian) Tsunami
☐2 2008 Sichuan (China) Earthquake
☐3 Other (please specify) _____

41. How would you best describe your current disaster preparedness role in your household? *(Please tick only one)*

☐1 I have all the responsibility for preparedness in my household
☐2 I have some of the responsibility for preparedness in my household
☐3 I have no responsibility for preparedness in my household

The last two pages of this study ask questions about you. We need this information only to determine how representative our sample is of the general population in Wellington, and to be able to compare the results to other groups of people in similar situations. Again, this information will be treated with complete confidence and we will only report on general trends.

42. How long have you lived in your current place of residence? *(Please tick only one)*

- ☐ 1 0-1 year
- ☐ 2 1-3 years
- ☐ 3 3-5 years
- ☐ 4 more than 5 years

43. How long have you lived in this suburb/area? *(Please tick only one)*

- ☐ 1 0-1 year
- ☐ 2 1-3 years
- ☐ 3 3-5 years
- ☐ 4 more than 5 years

44. Which best describes your living situation now? *(Please tick only one)*

- ☐ 1 I live on my own (one-person household)
- ☐ 2 I live with other people, not related to me (multiperson household)
- ☐ 3 I live with related family, with children
- ☐ 4 I live with related family, without children
- ☐ 5 One parent family with children
- ☐ 6 Couple family with children
- ☐ 7 Couple only
- ☐ 8 Other (please specify) _____

45. How many dependent children under 18 years of age live with you? _____

46. Do you own or rent where you live? *(Please tick only one)*

- ☐ 1 Own it or buying to live in it
- ☐ 2 Rent
- ☐ 3 Other (please specify) _____

47. Do you intend to remain in this neighbourhood for the next two years?

- ☐ 1 Yes
- ☐ 2 No

48. What is your age? *(Please tick only one)*

- ☐ 1 18-24 years
- ☐ 2 25-44 years
- ☐ 3 45-64 years
- ☐ 4 65 years and over

49. What is your gender?

- ☐ 1 Male
- ☐ 2 Female

50. What is your highest educational qualification? *(Please tick only one)*

- ☐ 1 No school qualifications
- ☐ 2 High school qualifications
- ☐ 3 Trade certificate, professional certificate or diploma
- ☐ 4 University undergraduate degree (e.g., university diploma or bachelor's degree)
- ☐ 5 University postgraduate degree (e.g., Master's, PhD)

51. Which of the following best describes you? *(Please tick all that apply)*

- ☐ 1 Self-employed for pay
- ☐ 2 Employed full-time for pay
- ☐ 3 Employed part-time for pay
- ☐ 4 Not working for pay at present

52. Are you? *(Please tick all that apply)*

- ☐ 1 A full-time homemaker
- ☐ 2 A stay-at-home parent
- ☐ 3 In school
- ☐ 4 Retired
- ☐ 5 Disabled
- ☐ 6 Other (please specify) _____

53. Which of the following best describes your ethnicity? *(Please tick all that apply)*

- ☐ 1 Maori
- ☐ 2 Pacific Peoples
- ☐ 3 New Zealand European
- ☐ 4 Asian
- ☐ 5 Other (please specify) _____

54. In the event that we need to follow up on a few questions, would you be willing to participate in a telephone interview? ☐ 1 Yes ☐ 2 No

If yes, please provide your telephone number: _____

55. Would you be interested in the possibility of being selected to participate in a second phase of this study looking further into some of the preparedness questions addressed in this questionnaire? ☐ 1 Yes ☐ 2 No

If yes, please provide your telephone number: _____

56. Please use this space to write any other comments you may have regarding disasters, your experiences with disaster, or this survey. All comments are welcome and would be useful.

_____

_____

_____

_____

Thank you for taking the time to participate in this study and for sharing your opinions. ***Remember, all of your information is confidential.***

Please return your completed questionnaire to us in the free-post envelope provided.

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APPENDIX 2: Supporting Documentation—Methods

Appendix 2, Table A2.1. Question Response Structure and Level of Measurement

	Variable Subitem	Variable Description	Question Format	Response Format	Data Type	Variable Type	Level of Measure
Survey Section 1. Cognitions Risk Perception: Physical Vulnerability (17 variables)	Q1mr, $	Hazard type	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.1a	Vulnerability – Earthquake fault rupture (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.2a	Vulnerability – Earthquake ground shaking (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.3a	Vulnerability – Liquefaction (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.4a	Vulnerability – Tsunami (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.5a	Vulnerability – Landslide (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.6a	Vulnerability – Wildfire (live)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.1b	Vulnerability – Earthquake fault rupture (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.2b	Vulnerability – Earthquake ground shaking (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.3b	Vulnerability – Liquefaction (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.4b	Vulnerability – Tsunami (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.5b	Vulnerability – Landslides (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q2.6b	Vulnerability – Wildfire (work)	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q3.1	Think – Earthquake	Closed	Rank order	Numeric	Continuous	Ordinal
	Q3.2	Think – Tsunami	Closed	Rank order	Numeric	Continuous	Ordinal
	Q4.1	Timing – Earthquake	Closed	Rank order	Numeric	Continuous	Ordinal
	Q4.2	Timing – Tsunami	Closed	Rank order	Numeric	Continuous	Ordinal
Survey Section 1. Cognitions Risk Perception: Personal Vulnerability (13 variables)	Q5.1	Exposure – Property	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.2	Exposure – Health & Safety	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.3	Exposure – Daily Activities	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.4	Exposure – Social Network	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.5	Exposure – Mobility	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.6	Exposure – Income	Closed	Rating	Numeric	Continuous	Ordinal
	Q5.7	Exposure – Evacuation	Closed	Rating	Numeric	Continuous	Ordinal
	Q6	Duration – Property	Closed	Rank order	Numeric	Continuous	Ordinal
	Q7	Duration – Health & Safety	Closed	Rank order	Numeric	Continuous	Ordinal
	Q8	Duration – Daily Activities	Closed	Rank order	Numeric	Continuous	Ordinal
	Q9.1	Worry – Property	Closed	Rank order	Numeric	Continuous	Ordinal
	Q9.2	Worry – Health & Safety	Closed	Rank order	Numeric	Continuous	Ordinal
	Q9.3	Worry – Daily Activities	Closed	Rank order	Numeric	Continuous	Ordinal
Section 1. Cognitions Personal Experience (6 variables)	Q10mr	Experience – Natural Disaster	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q11mr	Experience – Other Disaster	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q12	Experience – Evacuation	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q13.1$	Experience – Type of Disaster (comment)	Open		String		
	Q13.2$	Experience – Personal Impact (comment)	Open		String		
	Q13.3$	Experience – Coping Strategy (comment)	Open		String		
Section 2. Attitudes Personal Health and Well-Being/QoL (8 variables)	Q14sc	Social Well-Being – FS	Closed	Rating	Numeric	Continuous	Scale
	Q15sc	Personal Autonomy – SDS-PC	Closed	Rating	Numeric	Continuous	Scale
	Q16sc	Emotional Well-Being – SOC13	Closed	Rating	Numeric	Continuous	Scale
	Q17sc	Spiritual Well-Being – SS20	Closed	Rating	Numeric	Continuous	Scale
	Q18	Health Care Provider – GP	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q19-Q28sc	Physical and Mental Health Well-Being – SF12(v1)	Closed	Variety	Numeric	Continuous	Scale
	Q29sc	General Well-Being – SWLS	Closed	Rating	Numeric	Continuous	Scale
Survey Section 3. Attitudes Personal Resources: Evacuation Readiness (16 variables)	Q30	Evacuation Preparedness Level – Self-rating	Closed	Rating	Numeric	Continuous	Ordinal
	Q31sc	Evacuation Preparedness, Health-related Reason – TSRQ15	Closed	Rating	Numeric	Continuous	Scale
	Q32$	Reason to Prepare (comment)	Open		String		
	Q33.1	Evacuation Concern – Earthquake disaster	Closed	Rating	Numeric	Continuous	Ordinal
	Q33.2	Evacuation Concern – Tsunami disaster	Closed	Rating	Numeric	Continuous	Ordinal
	Q33.3	Evacuation Concern – Other type of disaster	Closed	Rating	Numeric	Continuous	Ordinal
	Q33.3$	Evacuation Concern – Other type of disaster (comment)	Open		String		
	Q34.1	Evacuation Coping Resources – Physical	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.2	Evacuation Coping Resources – Mental	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.3	Evacuation Coping Resources – Emotional	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.4	Evacuation Coping Resources – Spiritual	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.5	Evacuation Coping Resources – Social (local)	Closed	Rating	Numeric	Continuous	Ordinal

Appendix 2, Table A2.1. Question Response Structure and Level of Measurement (con't)

	Variable Subitem	Variable Description	Question Format	Response Format	Data Type	Variable Type	Level of Measure
	Q34.6	Evacuation Coping Resources – Social (extended)	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.7	Evacuation Coping Resources – Community	Closed	Rating	Numeric	Continuous	Ordinal
	Q34.8	Evacuation Coping Resources – Plans	Closed	Rating	Numeric	Continuous	Ordinal
Survey Section 4. Behaviours Personal Disaster Preparedness (Health-Protective Behaviours) (27 variables)	Q35.1	Behaviour – Talked (with social network)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.2	Behaviour – Talked (with neighbourhood)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.3	Behaviour – Sought info (risks)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.4	Behaviour – Sought info (preparedness)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.5	Behaviour – Sought info (response)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.6	Behaviour – Sought info (evacuation)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.7	Behaviour – Taken steps (earthquake)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.8	Behaviour – Taken steps (tsunami)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.9	Behaviour – Taken steps (other type of disaster)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.9$	Behaviour – Taken steps (other type of disaster)	Open		String		
	Q35.10	Behaviour – Made plans (survival/escape)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.11	Behaviour – Made plans (evacuation)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.12	Behaviour – Made plans (communications)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.13	Behaviour -- Tested plans (evacuation route)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.14	Behaviour – Tested plans (assembly)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.15	Behaviour – Tested plans (drill)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.16	Behaviour – Made 'Getaway Kit' (survival)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.17	Behaviour – Made 'Getaway Kit' (evacuation)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.18	Behaviour – Made 'Getaway Kit' (communications)	Closed	Rating	Numeric	Continuous	Ordinal
	Q35.19	Behaviour – Made 'Getaway Kit' (accessible & ready)	Closed	Rating	Numeric	Continuous	Ordinal
	Q36.1$	Priority 'Getaway Kit' Items – 1st (comment)	Open		String		
	Q36.2$	Priority 'Getaway Kit' Items – 2nd (comment)	Open		String		
	Q36.3$	Priority 'Getaway Kit' Items – 3rd (comment)	Open		String		
	Q37	Shared Personal Evacuation Plans	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q38mr, $	Workplace Evacuation Preparedness Activities, Type	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q39mr, $	Workplace Evacuation Preparedness Reason, Reason	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q40mr, $	Evacuation Planning, News Reason	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q41	Household Preparedness Role	Closed	Rank order	Numeric	Continuous	Ordinal
Survey Section 5. Demographics (12 variables)	Q42	Demographics – Yrs at Residence	Closed	Rank order	Numeric	Continuous	Ordinal
	Q43	Demographics – Yrs in Suburb	Closed	Rank order	Numeric	Continuous	Ordinal
	Q44ag	Demographics – Family Type	Closed	Rank order	Numeric	Categorical	Nominal
	Q45	Demographics – # of Dependents	Closed	Discrete (Count)	Numeric		
	Q46ag	Demographics – Tenure of Household	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q47	Demographics – Transience	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q48	Demographics – Age	Closed	Rank order	Numeric	Continuous	Ordinal
	Q49	Demographics – Gender	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q50	Demographics – Qualifications	Closed	Rank order	Numeric	Continuous	Ordinal
	Q51mr	Demographics – Employment	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q52mr, $	Demographics – Social role	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q53mr, $	Demographics – Ethnicity	Closed	Dichotomous	Numeric	Categorical	Nominal
Follow up	Q54, $	Permission to contact	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q55, $	Available for follow up study	Closed	Dichotomous	Numeric	Categorical	Nominal
	Q56$	Comment Box	Open		String		

Key
ag = aggregated variable
mr = multiple response variable
sc = scale variable
$ = string variable

Appendix 2, Table A2.2. Missing Values and Suitability for Quantitative Analyses

	Variable Subitem	Variable Description	Missing (n)	Missing (%)	Analytical Suitability
Survey Section 1. Cognitions Risk Perception: Physical Vulnerability (17 variables)	Q1mr, $	Hazard type	17	2.4	yes
	Q2.1a	Vulnerability – Earthquake fault rupture (live)	104	15.0	no
	Q2.2a	Vulnerability – Earthquake ground shaking (live)	63	9.1	no
	Q2.3a	Vulnerability – Liquefaction (live)	128	18.4	no
	Q2.4a	Vulnerability – Tsunami (live)	83	11.9	no
	Q2.5a	Vulnerability – Landslide (live)	102	14.7	no
	Q2.6a	Vulnerability – Wildfire (live)	130	18.7	no
	Q2.1b	*Vulnerability – Earthquake fault rupture (work)*	*218*	*31.4*	*n/a*
	Q2.2b	*Vulnerability – Earthquake ground shaking (work)*	*211*	*30.4*	*n/a*
	Q2.3b	*Vulnerability – Liquefaction (work)*	*236*	*34*	*n/a*
	Q2.4b	*Vulnerability – Tsunami (work)*	*216*	*31.1*	*n/a*
	Q2.5b	*Vulnerability – Landslides (work)*	*234*	*33.7*	*n/a*
	Q2.6b	*Vulnerability – Wildfire (work)*	*241*	*34.7*	*n/a*
	Q3.1	Think – Earthquake	6	0.9	yes
	Q3.2	Think – Tsunami	17	2.4	yes
	Q4.1	Timing – Earthquake	7	1.0	yes
	Q4.2	Timing – Tsunami	9	1.3	yes
Survey Section 1. Cognitions Risk Perception: Personal vulnerability (13 variables)	Q5.1	Exposure – Property	24	3.5	yes
	Q5.2	Exposure – Health & Safety	28	4.0	yes
	Q5.3	Exposure – Daily Activities	28	4.0	yes
	Q5.4	Exposure – Social Network	29	4.2	yes
	Q5.5	Exposure – Mobility	27	3.9	yes
	Q5.6	Exposure – Income	32	4.6	yes
	Q5.7	Exposure – Evacuation	33	4.7	yes
	Q6	Duration – Property	24	3.5	yes
	Q7	Duration – Health & Safety	21	3.0	yes
	Q8	Duration – Daily Activities	22	3.2	yes
	Q9.1	Worry – Property	194	27.9	no
	Q9.2	Worry – Health & Safety	143	20.6	no
	Q9.3	Worry – Daily Activities	187	26.9	no
Survey Section 1. Cognitions Personal Experience (6 variables)	Q10mr	Experience – Natural Disaster	22	3.2	yes
	Q11mr	Experience – Other Disaster	24	3.5	yes
	Q12	Experience – Evacuation	22	3.2	yes
	Q13.1$	*Experience – Type of Disaster (comment)*	*468*	*67.3*	*n/a*
	Q13.2$	*Experience – Personal Impact (comment)*	*487*	*70.1*	*n/a*
	Q13.3$	*Experience – Coping Strategy (comment)*	*483*	*69.5*	*n/a*
Survey Section 2. Attitudes Personal Health and Well-Being /QoL (8 variables)	Q14sc	Social Well-Being – FS	34	4.9	yes
	Q15sc	Personal Autonomy – SDS-PC	21	3.0	yes
	Q16sc	Emotional Well-Being – SOC13	44→21	6.3→3.0	yes
	Q17sc	Spiritual Well-Being – SS20	80→35	11.5→5.0	yes
	Q18	Health Care Provider – GP	7	1.0	yes
	Q19-Q28sc	Physical and Mental Health Well-Being – SF12(v1)	33 (PCS) 33 (MCS)	4.8 (PCS) 4.8 (MCS)	yes
	Q29sc	Global Well-Being – SWLS	20	2.9	yes
Survey Section 3. Attitudes Personal Resources: Evacuation Readiness (16 variables)	Q30	Evacuation Preparedness Level – Self-rating	14	2.0	yes
	Q31sc	Evacuation Preparedness, Health-related Reason – TSRQ15 (3 Subscales: RA, RC, and RAM)	43 (RA) 43 (RC) 63 (RAM)	6.2 (RA) 6.2 (RC) 9.1 (RAM)	yes*
	Q32$	*Reason to Prepare (comment)*	*497*	*71.5*	*n/a*
	Q33.1	Evacuation Concern – Earthquake disaster	21	3.0	yes
	Q33.2	Evacuation Concern – Tsunami disaster	30	4.3	yes
	Q33.3	*Evacuation Concern – Other type of disaster*	*579*	*83.3*	*n/a*
	Q33.3$	*Evacuation Concern – Other type of disaster (comment)*			
	Q34.1	Evacuation Coping Resources – Physical	27	3.9	yes
	Q34.2	Evacuation Coping Resources – Mental	26	3.7	yes
	Q34.3	Evacuation Coping Resources – Emotional	29	4.2	yes
	Q34.4	Evacuation Coping Resources – Spiritual	34	4.9	yes
	Q34.5	Evacuation Coping Resources – Social (local)	30	4.3	yes
	Q34.6	Evacuation Coping Resources – Social (extended)	26	3.7	yes

Appendix 2, Table A2.2. Missing Values and Suitability for Quantitative Analyses (con't)

	Variable Subitem	Variable Description	Missing (n)	Missing (%)	Analytical Suitability
	Q34.7	Evacuation Coping Resources – Community	28	4.0	yes
	Q34.8	Evacuation Coping Resources – Plans	28	4.0	yes
Survey Section 4. Behaviours Personal Disaster Preparedness (Health-Protective Behaviours) (27 variables)	Q35.1	Behaviour – Talked (with social network)	23	3.3	yes
	Q35.2	Behaviour – Talked (with neighbourhood)	38	5.5	yes*
	Q35.3	Behaviour – Sought info (risks)	32	4.6	yes
	Q35.4	Behaviour – Sought info (preparedness)	28	4.0	yes
	Q35.5	Behaviour – Sought info (response)	30	4.3	yes
	Q35.6	Behaviour – Sought info (evacuation)	30	4.3	yes
	Q35.7	Behaviour – Taken steps (earthquake)	25	3.6	yes
	Q35.8	Behaviour – Taken steps (tsunami)	45	6.5	yes*
	Q35.9	*Behaviour – Taken steps (other type of disaster)*	*562*	*80.8*	*n/a*
	Q35.9$	*Behaviour – Taken steps (other type of disaster)*			
	Q35.10	Behaviour – Made plans (survival/escape)	29	4.2	yes
	Q35.11	Behaviour – Made plans (evacuation)	30	4.3	yes
	Q35.12	Behaviour – Made plans (communications)	29	4.2	yes
	Q35.13	Behaviour -- Tested plans (evacuation route)	36	5.2	yes*
	Q35.14	Behaviour – Tested plans (assembly)	32	4.6	yes
	Q35.15	Behaviour – Tested plans (drill)	39	5.6	yes*
	Q35.16	Behaviour – Made 'Getaway Kit' (survival)	24	3.5	yes
	Q35.17	Behaviour – Made 'Getaway Kit' (evacuation)	27	3.9	yes
	Q35.18	Behaviour – Made 'Getaway Kit' (communications)	29	4.2	yes
	Q35.19	Behaviour – Made 'Getaway Kit' (accessible & ready)	31	4.5	yes
	Q36.1$	*Priority 'Getaway Kit' Items – 1st (comment)*	*49*	*7.1*	*n/a*
	Q36.2$	*Priority 'Getaway Kit' Items – 2nd (comment)*	*66*	*9.5*	*n/a*
	Q36.3$	*Priority 'Getaway Kit' Items – 3rd (comment)*	*80*	*11.5*	*n/a*
	Q37	Shared Personal Evacuation Plans	10	1.4	yes
	Q38mr, $	*Workplace Evacuation Preparedness Activities, Type*	*501*	*72.1*	*n/a*
	Q39mr, $	*Workplace Evacuation Preparedness Reason, Reason*	*489*	*70.4*	*n/a*
	Q40mr, $	*Evacuation Planning, News Reason*	*490*	*70.5*	*n/a*
	Q41	Household Preparedness Role	17	2.4	yes
Survey Section 5. Demographics (12 variables)	Q42	Demographics – Yrs at Residence	8	1.2	yes
	Q43	Demographics – Yrs in Suburb	7	1.0	yes
	Q44ag	Demographics – Family Type	11	1.6	yes
	Q45	Demographics – # of Dependents	73	10.5	yes
	Q46ag	Demographics – Tenure of Household	11	1.6	yes
	Q47	Demographics – Transience	12	1.7	yes
	Q48	Demographics – Age	7	1.0	yes
	Q49	Demographics – Gender	7	1.0	yes
	Q50	Demographics – Qualifications	14	2.0	yes
	Q51mr	Demographics – Employment	21	3.0	yes
	Q52mr, $	Demographics – Social role	260	37.4	no
	Q53mr, $	Demographics – Ethnicity	10	1.4	yes
Follow up	*Q54. $*	*Permission to contact*	*13*	*1.9*	*n/a*
	Q55, $	*Available for follow-up study*	*27*	*3.9*	*n/a*
	Q56$	*Comment Box*	*474*	*68.2*	*n/a*

Key

ag = aggregated variable
mr = multiple response variable
sc = scale variable
$ = string variable
44→21 original missing value followed by imputed missing value

yes= include in descriptive and inferential analyses; meets 5% threshold for missingness
yes*= report descriptive results; exclude from inferential analyses pending further study of potential systematic bias
no= exclude from descriptive and inferential analyses pending future study due to potential systematic bias
n/a = exclude from descriptive and inferential analyses; not applicable for quantitative analysis at a sample population level (*question would be skipped if it did not fit the respondent's circumstances and/or also requires coding of string variables*)

APPENDIX 3: Ethics Notifications

COPY

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(Research Ethics)
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17 April 2008

Assoc Prof David Johnston
School of Psychology
WELLINGTON

Dear David

Re: Self-Management of Disaster Risk and Uncertainty: Evaluating a Preventive Health Approach for Building Resistance to Disaster

Thank you for your Low Risk Notification which was received on 17 April 2008.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

A reminder to include the following statement on all public documents:

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Sylvia Rumball

Sylvia V Rumball (Professor)
Chair, Human Ethics Chairs' Committee and
Assistant to the Vice-Chancellor (Research Ethics)

cc Assoc Prof Mandy Morgan, HoS
School of Psychology
PN320

Human Ethics Committee
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UNIVERSITY OF CANTERBURY
Te Whare Wananga o Waitaha
CHRISTCHURCH NEW ZEALAND

10 June 2008

Associate Professor Ray Kirk
Director
HEALTH SCIENCES CENTRE

Dear Ray

Thank you for your letter of 29 May 2008 seeking Human Ethics approval to undertake the research project "Self-Management of Disaster Risk and Uncertainty: Evaluating a Preventive Health Approach to Building Resistance to Disaster".

I note that you have made application to Massey University's Human Ethics Committee and that approval has been granted, as outlined in their letter of 17 April 2008.

I am pleased to advise that this project has the approval of the University of Canterbury Human Ethics Committee as presented, however this is given on the understanding that if following the survey phase it becomes evident that the pilot study will not meet the low risk criteria a full application will be made to the Canterbury HEC for consideration.

With kind regards.

Yours sincerely

Dr Mike Grimshaw
Chair
Human Ethics Committee

APPENDIX 4: Population Statistics

Table A4.1. Age, Gender, and Ethnicity in the Study Population, Sample Frame, Area-Based Frame and Target Population

	Demographic Classification	SAMPLE		SAMPLE FRAME		AREA-BASED FRAME		TARGET POPULATION	
	(Item Dimension)	*(Analytic Units)*		*Eastern Ward (5 suburbs) + Oriental Bay (1)*		*Eastern Ward (13 suburbs) + Oriental Bay (1)*		*Wellington City*	
	Population Characteristic	n (individuals)	Valid %	n (individuals)	%	n (individuals)	%	n (individuals)	%
		18+ years		***Data on Age & Gender are for those 18+ years of age***					
Q48	**Age**								
	18-24 years	28	4.1%	1860	13.7%	3795	12.9%	25098	17.8%
	25-44 years	233	33.9%	6093	44.9%	13068	44.5%	62730	44.5%
	45-64 years	268	39.0%	3909	28.8%	8541	29.1%	38244	27.1%
	65+ years	159	23.1%	1722	12.7%	3960	13.5%	15033	10.7%
		688	**100.0%**	**13584**	**100.0%**	**29364**	**100.0%**	**141,105**	**100.0%**
Q49	**Gender**								
	1 - Male	255	37.1%	6465	47.6%	13944	47.5%	67407	47.8%
	2 - Female	433	62.9%	7119	52.4%	15420	52.5%	73698	52.2%
		688	**100.0%**	**13584**	**100.0%**	**29364**	**100.0%**	**141,105**	**100.0%**
		18+ years		***Data on Ethnicity are for those 15+ years of age***[10]					
Q53	**Ethnicity (Level 1)**								
	1 - European	563	79.4%	12441	72.0%	24840	65.4%	121296	67.6%
	2 - Māori	24	3.4%	1290	7.5%	3180	8.4%	13335	7.4%
	3 - Pacific Peoples	13	1.8%	729	4.2%	2874	7.6%	8931	5.0%
	4 - Asian	25	3.5%	1590	9.2%	4296	11.3%	22851	12.7%
	5 - Other	84	11.8%	1229	7.1%	2813	7.4%	13049	7.3%
		709	**100.0%**	**17279**	**100.0%**	**38003**	**100.0%**	***179462***	**100.0%**

[10] *This is a study of an adult (18+ years) population.15-17 year-olds would likely appear in similar proportions if they had been included in sample, and would not likely be radically different in ethnicity from the proportions observed.*