

Living Under The Health Protection Umbrella – Should We Be Worried?





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NB: Appendices 7 & 8 (Quantitative and Qualitative Surveys) attached separately.

Abstract

Background

There is a discrepancy between the scientific evidence and the public perception of hazards, their risks and the appropriate management. Public opinion plays a vital role in impacting decisions around how we as a society allocate resources to deal with these hazards. The national hazardscape published in 2007 by the Ministry of Civil Defence & Emergency Management summarised the evidence surrounding the risks and consequences of 17 key hazards. The objectives of this study were to assess whether public opinion differs from the scientific evidence and whether as a society we are focusing on investing resources into the hazards that pose the greatest actual threat.

Methods

This was an observational cross-sectional study undertaken from 3rd – 11th October 2017. Quantitative information was gathered from 155 members of the public via a public specific online survey and face-to-face recruitment within Wellington City. Quantitative information was gathered from 7 key informants via a key informant specific online survey. Qualitative information was gathered from 6 key informants via a semi-structured phone interview. These surveys and interviews were used to people's views on the likelihood of exposure, severity of consequences, personal locus of control, Government locus of control and level of worry regarding 10 major hazards. Various demographic data was also collected.

Results

We had a total of 155 respondents to the general public survey, 7 respondents to the key informant survey and 6 key informant interviews. There were statistically significant differences found in general public perception of likelihood of exposure, severity of consequences, personal locus of control and level of worry for a range of different hazards. There were no statistically significant differences for perception of level of government control between the general public and key informants for each of the hazards. A common theme that emerged from the key informant interviews was that none of the key informants believed that the general public had a realistic understanding of the human health hazards.

Conclusion

The degree of difference in perception between the public and key informants were not as great as anticipated. Our expectation was that there would be less concordance in the perception of likelihood of exposure, severity of consequences, personal locus of control, government control, and the level of worry over a range of hazards between the general public and the key informants. This study highlighted the mismatch between what the actual burden of various hazards is compared to the public perception. Analysis of surveys and key informant interviews produced various themes which warrant further detailed research. Additionally, the vast nature of the topic endears itself to a huge range of areas which could be further looked into.

Introduction

An overarching challenge that emerges ubiquitously in all societies is how to identify and best manage hazards that pose a threat to the safety and wellbeing of their members. Societies are tasked with the challenge of determining which hazards pose a level of unacceptable risk and how best to allocate resources to mitigate this. Ideally the level of resources allocated would mirror what the best evidence shows, however in reality there are other influences at play including, but not limited to: political will, public perception of risk, shared values and beliefs of society and the interests of key stakeholders.

The concept of how society protects its members from harm is often described as ‘health protection’. Health protection is defined as “the avoidance or reduction of potential harm from exposures through organised efforts, including direct action with individuals or communities, regulation, legislation, or other measures”.¹

A large component of health protection is risk management which can be defined as “the steps taken to alter (i.e. reduce) the levels of risk to which an individual or population is subject. The managerial, decision making, and active hazard control process to deal with the environmental agents of disease, such as toxic substances, for which risk evaluation has indicated an unacceptably high level of risk”.²

One way to systematically assess which hazards pose the greatest risk to a society is through a hazardscape assessment. The hazardscape is defined as “the net result of both natural and human-made (anthropogenic) hazards and the cumulative risks that they pose across a given geographical area. This includes the interactions among nature, society, and technology at a variety of spatial scales, creating a mosaic of risks that affect places and the people who live there”.³

In September 2007, the NZ Government through the Ministry of Civil Defence & Emergency Management (MCDEM) published its first ever National Hazardscape Report. The purpose of this report was to provide a “summary of the physical nature, distribution, frequency of occurrence and impacts and consequences of 17 key hazards affecting New Zealand”.⁴ This data was intended to be used to influence policy makers, hazard managers and citizens in management of the various risks posed by such hazards in NZ.

This project is aimed at identifying strengths and inconsistencies between the perceived hazardscape and the science and institutional hazardscape. To elaborate, the perceived hazardscape is what people perceive to be the major hazards that pose the greatest risk to society, whereas the science and institutional hazardscape examine the evidence surrounding these hazards as well as Governmental responsibility of management of them. Our aim is to examine the gaps between these groups to identify areas where there is potential for further development in regards to classification, prioritisation and management of the major hazards faced by everyday New Zealanders.

Aims and Objectives

The public sector in New Zealand is tasked with allocating its limited resources in a way that best protects the public from current and emerging hazards to health and wellbeing. However, the distribution of resources does not always accurately correlate to the level of risks these hazards pose. Other influences such as public perception can also alter how resources are distributed. Hence, the goal of our project is to identify opportunities for improving the way in which we manage and prioritise these hazards.

The aims of our project are:

To summarise the current science and evidence to form a consensus about which hazards are most important for active management

To describe how health hazards are perceived by the public in terms of their importance and modifiability (the perceived/popular hazardscape)

To identify strengths, gaps and inconsistencies in the management of human health hazards and potential improvements in the way these hazards are identified, assessed and managed in a modern, high income society like NZ.

Literature Review

Relevance of Risk Perception

Previous research has shown that perception of hazards does not necessarily match likelihood of occurrence, consequences of its impact or ability to mitigate the risks involved.^{5,6} This disparity between perceived risk and actual risks may seem inconsequential, but a multitude of case studies and expert analyses suggest that public opinions and perception play a vital role in the impacts and management of risk.^{5,7}

Individuals are less likely to prepare for risks and more likely to experience harm if they believe that their personal risk is low. An example of this is the Canterbury earthquakes of 2011, where much of the general public did not acknowledge or understand their own risk. This resulted in catastrophic damage to infrastructure and (potentially preventable) loss of life.⁸ Another factor that influences an individual's likeliness to prepare for a certain risk is their locus of control.^{5,6} Feeling a lack of control materialises in an emotional response to preparedness rather than a practical one, resulting in individuals preferring to ignore the possibility of harm and not adequately prepare themselves.

Public perception of risks is influenced by a large variety of personal and environmental factors including personal experience of similar events, media coverage, government and political actions and communication from the scientific community.⁶ Comprehensive and accurate communication to the public is key in shaping perception of personal risk and this is vital to the success of any widespread community risk reduction strategies.^{7,9} In addition to practical motives, many would also believe that the public have the right to know their likelihood of being

affected by a variety of natural and manmade hazards if that information is available. Biased and untrue information about risks in the media or from government could be considered unethical, as this type of reporting affects risk perception, preparation and therefore, morbidity and mortality.

Risk and Management of Ten Major Hazards

Housing

Lead-based paint

Definition: Chipped and peeling lead paint in residential homes is the leading cause of lead poisoning for children in large urban areas.¹⁰ In New Zealand, lead poisoning is notifiable to the Medical Officer of Health if blood levels reach $\geq 0.48 \mu\text{mol/L}$ from non-occupational lead exposure.¹¹

Physical Risk: International experts report that for children there is no safe level of lead in the blood therefore, it is difficult to quantify the magnitude of the problem in New Zealand today.¹⁰ High levels of exposure causing acute illness are detected through disease notifications, but low levels may go undetected and are associated with a range of behavioural and mental health problems, low IQ levels, cardiovascular complications and immunological changes.¹² Evidence specific to New Zealand shows that the problem of lead-based paint is likely to be having a very real effect on the wellbeing of individuals and society as a whole, with childhood exposure to lead-based paint associated with 93% of the variation in our crime rates.¹³

Management: This issue is managed by a range of authorities in New Zealand.¹⁴ The Ministry of Health manages the public health aspects of lead poisoning, including disease notification and public health measure. The Department of Labour regulates occupational exposure to lead and enforces use of protective equipment and testing in properties built before 1980. The Ministry of Consumer Affairs and the New Zealand Food Safety Authority are involved in restricting lead levels on imported foods and children's toys.¹⁴ Experts believe, however, that New Zealand should be doing more to understand the breadth of the problem in our country, including inspections of our rental housing stock.¹⁵

Damp housing

Definition: When discussing damp homes, many experts refer to quality measurement tools such as the Healthy Home Index and the Respiratory Hazard Index.^{16,17} These measures quantify several features in the home such as insulation, heating, ventilation and draft stopping.¹⁸ Each of these aspects contributes to the dampness of a home and mould growth, which are associated with a range of respiratory complications.

Physical Risk: Damp housing affects people of all ages, mostly through respiratory disease, which has a dose-response relationship with poor housing quality.¹⁹ There are also correlations with mental health issues and child development. It is estimated that damp housing is

responsible for a large part of New Zealand's burden of child illness, including a large proportion of child hospitalisations, mostly for asthma.²⁰ According to recent literature, children admitted to hospital with a condition associated with damp housing have higher mortality rates. They also have an 85% chance of being readmitted to hospital when compared to 56% for children admitted for other reasons.²¹ The magnitude of this problem in New Zealand is severe, with 50% of our houses inadequately insulated, 50% without mechanical ventilation in bathrooms and kitchens, 5% using no form of heating in the winter and nearly half of houses containing visible mould.²²

Management: Recent legislation has reflected the need for improved housing quality in New Zealand, including the 'Warm up New Zealand' insulation program and changes to the minimum standards of rental housing.²³ In addition, public health campaigns and media coverage has widely publicised the issue of damp housing with the aim of increasing public awareness and personal action to improve the ventilation and heating of homes. Regardless of these efforts, the majority of experts believe that the New Zealand Government should be managing this issue more aggressively, for example introducing housing quality assessments and social welfare measure to alleviate poverty.^{17,19,24,25}

Methamphetamine contamination

Definition: Methamphetamine contamination is defined in New Zealand as surface levels of $0.5\mu\text{g}/100\text{cm}^2$ in a residential household that has been used for manufacture, or $1.5\mu\text{g}/100\text{cm}^2$ in a home where methamphetamine has been used. This is a somewhat arbitrary measure, and the estimated minimum level that has the potential to cause harm is $12\mu\text{g}/100\text{cm}^2$.²⁶ Contamination can be caused by manufacture of methamphetamine in a clandestine lab, or lower levels can be attributed to smoke from methamphetamine use. It is impossible to tell the difference from surface readings alone.²⁷

Physical Risk: There is no evidence that contamination from houses where methamphetamine has only been used causes health problems.²⁶ In contrast, there is good evidence that contamination from a home that was previously used as a lab causes health problems, particularly in children.²⁸ Much of this harm is due to the exposure to a variety of toxic ingredients used in the manufacturing process, but also includes some harm from the methamphetamine itself. In the long term, these harms primarily involve neurological disorder (including mental illness, developmental delay and behavioural problems) and respiratory illness.²⁸⁻³⁰ Suggestions that exposure may increase likelihood of future drug addiction are not well supported. Methamphetamine residues may remain at high levels on surfaces for at least several months after manufacture has ceased.²⁸

Management: Housing New Zealand has taken a strong stance against methamphetamine contamination in the social housing pool, with an estimated 500 houses undergoing decontamination measures.³¹ In the private residential market, homeowners are guided by Standards New Zealand on appropriate measurements and action.³² Contamination levels are reviewed and updated regularly under the guidance of the Ministry of Health and the Institute of

Environmental Science and Research.²⁶ Decontamination is usually conducted by private companies, and has developed into its own industry in recent years.

Infectious Diseases

Seasonal Influenza

Definition: Influenza is a contagious viral infection of the respiratory tract. It can be a mild or severe infection, with hospitalisation and death possible in severe infections.³³ Influenza infection occurs throughout each year, but the rates of infection increase significantly in the winter months, hence the term “seasonal influenza”.

Physical Risk: The seasonal influenza virus is a large cause of morbidity and mortality each year in New Zealand, but the mortality of influenza has commonly been under-estimated. A study in 2014 has found that the average yearly mortality rate of influenza from 1990 to 2008 was 17 times larger than the reported value. This equates to an average mortality rate of 401 deaths per year however, this value varies significantly each year with the highest on record being 897 deaths in 2003 and the lowest being 31 deaths in 1991.³⁴

Management: Seasonal influenza is being managed by the Ministry of Health in many different ways. Firstly, a vaccine is offered which is free to high risk populations. This includes pregnant women, people over the age of 65, people from the age of 6 months to 18 who lived in some of the areas recently exposed to earthquakes (e.g. Seddon), people with co-morbidities and health care workers who have occupational exposure.³⁵ The rate of coverage of health care workers was 65 percent in 2016 which is an increase from 45 percent in 2010. This is far higher than the coverage of the general public, which was 24 percent in 2010, although fortunately the coverage of people over the age of 65 was higher at 63 percent.³⁶ When a patient has got influenza, the ministry of health has subsidised various anti-viral medications however, these are usually only given in patients who have signs of severe illness, are pregnant, or have co-morbidities that make it likely for the virus to cause severe illness.³⁷ In other patients, there are instructions to help manage the symptoms and minimise spread.³⁸

Influenza pandemic:

Definition: According to World Health Organisation an influenza pandemic occurs “when a new influenza virus emerges and spreads around the world, and most people do not have immunity. Viruses that have caused past pandemics typically originated from animal influenza viruses.”³⁹

Physical Risk: Influenza pandemics occur sporadically and it is difficult to determine or predict the effect of future pandemics. There is literature on many historic influenza pandemics including the 1918 H1N1 pandemic that killed 8600 New Zealanders and led to the “Health Act” of 1920 which re-organised the health system.⁴⁰ The most recent pandemic is the H1N1 influenza pandemic in 2009 (“swine flu”). In 2009 there was an estimated 1508 hospitalisations from influenza, which is a 4-fold increase from the previous year. 1122 of these are attributed to the H1N1 influenza pandemic and 102 of these patients required ICU treatment.⁴¹ The total mortality rate from this influenza pandemic

was 35 in New Zealand, however, as with seasonal influenza, this number could be underestimated.⁴²

Inequality: The 2009 H1N1 pandemic affected New Zealanders unequally. Māori and Pacific Islanders had significantly higher rates of hospital admission and mortality. Also people of a lower socio-economic status were greater affected, as 39 percent of the mortalities were in levels 9 and 10 of the deprivation index. These inequalities were also found in the 1918 H1N1 pandemic where Māori had a mortality rate of 4.2 percent which was 6-7 times higher than non-Māori.⁴³

Management: The Ministry of Health has developed an action plan (NZIPAP) to deal with a large future pandemic. The pandemic planned for could cause as many as forty percent of the population to be ill from influenza and have a mortality rate of 2 percent, meaning approximately 38,000 deaths.⁴⁴

Their six step action plan is as follows:

- Plan for it (planning and preparedness)
- Keep it out (border management)
- Stamp it out (cluster control)
- Manage it (pandemic management/response)
- Manage it: Post-Peak (response to recovery transition)
- Recover from it (recovery)

This is based on a WHO four step approach. Other features of this action plan are inter-pandemic surveillance systems looking at trends of infectious diseases in other countries, and a Pandemic Influenza Tracking Action Group (PITAG) which directly communicate with the Ministry of Health regarding features of an epidemic or pandemic and make recommendations. Finally, District Health Board emergency planning is set out in an Operation Policy Framework that is part of DHB Planning Package that the Ministry of Health give to DHBs each year.⁴⁵

This action plan also works in tandem with the “Epidemic Preparedness Act” of 2006 which gives the prime minister of the time “special powers” to pass notices in controlling epidemics or pandemics if accepted by the director general of health and the ministry of health. Meanwhile the governor general has authority to make immediate modifications to these notices if suitable or necessary.⁴⁶

Antibiotic resistance:

Definition: Antibiotic resistance is defined by the World Health Organisation as the ability of micro-organisms to stop an anti-microbial working against them.⁴⁷ Currently there are three forms of antibiotic resistance that commonly complicate hospital management of patients in New Zealand. These are methicillin-resistant *Staphylococcus aureus* (MRSA), extended-spectrum beta-lactamase producing *Enterobacteriaceae* (ESBL-E) and carbapenemase-

producing Enterobacteriaceae (CPE).⁴⁸ In the developing world, antibiotic resistance has a large effect in the management of common illnesses like tuberculosis and HIV.

Physical Risk: This is an emerging issue, that's effect on humanity in the future is hard to measure or predict. Currently it is estimated that antibiotic resistance is the cause of 750,000 deaths in the world each year. By 2050, it is estimated to be the cause of 10 million deaths each year worldwide. That is 1.8 million higher than all cancers combined.⁴⁹ In New Zealand however, the mortality rates of antibiotic resistance compared with cancer, both currently and by 2050 will be much lower.

In 2006 the rate of MRSA was 14.3 per 100,000 people over a 1 month testing period. This increased to 25.3 per 100,000 by 2015.⁵⁰ This meant that by 2014 one in ten cases of Staphylococcus aureus causing disease was MRSA. Rates of ESBL-E are also increasing in New Zealand. In 2000, the rates isolated were about 1 per 100,000 people in New Zealand. By 2008 these levels became over 150 per 100,000 people.⁵¹ Similarly, from 2004 to 2011 the rates of bloodstream Enterobacteriaceae that produce ESBL increased from 2.6 percent to 4.7 percent.⁵² In 2012 there were 4000 ESBL producing E.coli and K pneumoniae infections in New Zealand.⁵³ The number of CPE isolated in 2016 was 45, which shows a large increase from 2012 where only 3 cases were isolated, however only 11 of those 45 isolated were from clinical specimens. This study also investigated the source of transmission and found that overseas travel to countries where rates of CPE is higher was a risk factor. This is particularly true of India and China.⁵⁴

Inequality: There are inequities in these numbers as the Northland, Counties Manakau and Tairāwhiti regions have the highest rates of MRSA in New Zealand, and this may be due to having more people of a lower socio-economic status.⁵⁵

Management: The Ministry of Health released an action plan in 2017 to control antibiotic resistance. This action plan sets out five key objectives which are priority areas in management. These are to improve awareness and understanding, increase surveillance and research, improve infection prevention and control, develop better antibiotic stewardship and establish clear governance and finally, collaboration and investment into a sustainable approach to counter antibiotic resistance.⁵⁶ This action plan also sets out instructions for reviewing in subsequent years. Part of this action plan includes working alongside other government-owned agencies to achieve some of these objectives. A good example of this is establishing surveillance networks for antibiotic use and resistance with the Institute of Environmental Science and Research Limited (ESR).⁵⁷ The Ministry of Health also sets out guidelines for management of multidrug-resistant organisms (e.g. ESBL-E) and specifically MRSA, however, these documents date back to 2007 and 2002 respectively and have therefore not been sufficient to inhibit the rise in these entities.^{58,59} There are currently no specific guidelines for treating CPE.⁶⁰

Natural Disasters

Earthquakes

Definition: According to the Oxford English Dictionary an earthquake is: “A shaking or movement of the ground; especially a violent convulsion of the earth's surface, frequently causing great destruction, and resulting from movements within the earth's crust or from volcanic action.”⁶¹

Physical Risk: Earthquakes are a common occurrence, with an estimated 20,000 an year, with about 150-200 of them strong enough to be felt.⁶² Between 1960 and 2016, the number of earthquakes with a magnitude of 4.0 or above is shown in the below graph from GeoNet.⁶²

Table 1. *Frequency of New Zealand Earthquakes (1960 to 2016)*

MAGNITUDE	ANNUAL AVERAGE	MINIMUM	MAXIMUM	"IN GENERAL"
4.0 - 4.9	352.05	124	1,178	1 per day
5.0 - 5.9	27.26	6	109	2 per month
6.0 - 6.9	1.63	0	7	3 per 2 years
7.0 - 7.9	0.26	0	2	1 per 4 years
8.0 or over	0	0	0	1 per century*

Even when considering 2016's record year in earthquakes, with 32,828 recorded earthquakes (and 1,001 earthquakes of magnitude 4 or above, a number second only to 1995), there has not been a trend suggesting the frequency of earthquakes has increased over time.⁶³

Most earthquakes cause no lasting harm, but a few larger magnitude earthquakes have caused severe long-lasting consequences, particularly when they are located near urban centres. On average, between 1855 and 2016 there have been around 2.9 earthquake related deaths per year however, the sporadic nature of severe earthquakes near urban centres must also be considered.⁶⁴

Management: On a national level, disasters such as earthquakes are handled by the Ministry of Civil Defence and Emergency Management (MCDEM). When a disaster occurs, regional Civil Defence Emergency Management (CDEM) groups implement their initial response plan and coordinate with relevant agencies for the first few days until the National Crisis Management Centre (NCMC) can direct a national action plan.⁶⁵

Extreme weather events

Definition: These include flooding, droughts, extremes in temperatures, and high wind speeds. Climate change has a variety of effects on the environment, examples including altering average sea levels, temperature, rainfall and wind speeds.⁶⁶ This has the effect of increasing the frequency and severity of severe extremes of weather hazards, which in turn can affect the health and security of New Zealanders.⁶⁶

Climate change is defined by the New Zealand the Resource Management Act 1991 as: “A change of climate that is attributed directly or indirectly to human activity that alters the

composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.”⁶⁷

Physical Risk

Flooding: Already the most frequent natural disaster needing reparations in New Zealand, it is also the second most expensive behind earthquakes.^{66,68} Flooding risk is increased with prolonged rainfall,⁶⁶ rising sea levels especially in coastal areas⁶⁶ and the frequency of rainfall which may saturate the ground beforehand, thus reducing its capacity to absorb water for subsequent rainfall events, increasing the risk of flooding.⁶⁹ Although individual cases - such as the intense rainfall in Golden Bay in 2011 - have been associated with climate change, so far there has not been a clear association between climate change and increased frequency of flooding.⁷⁰ Despite this, there have been several projections that predict the frequency of major floods may increase in the future. NIWA (National Institute of Water and Atmospheric Research) estimates that the frequency of major flooding could rise from 1 in 440 years to 1 in 100 or even 1 in 50 depending on the progression of carbon emissions.⁷¹

Droughts: Although parts of New Zealand have been experiencing droughts more frequently, more data is needed before it can be definitively linked to climate change, however, future estimations can be made based on current climate data.⁷² Average rainfall is projected to decrease in the northeast parts of the North Island and South Island.⁷³ The below figure from Royal Society of New Zealand's 2016 report provides a graphical depiction of historical and potential future drought frequency.⁶⁶

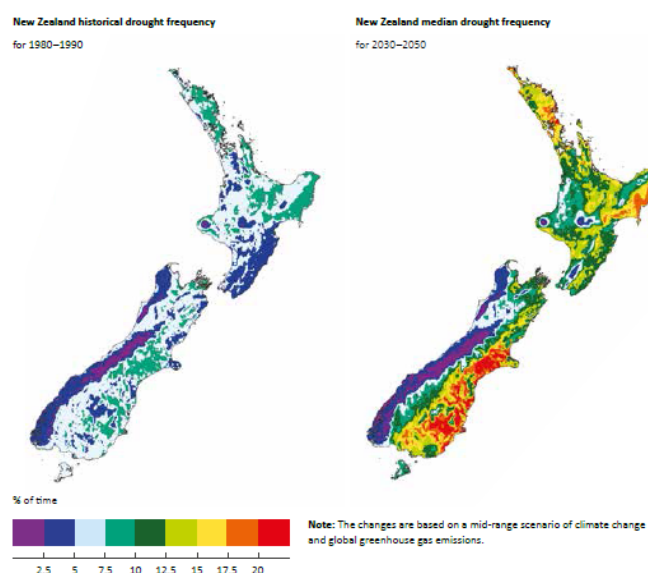


Figure 1. Projected Changes in Draught Frequency Across New Zealand Under a Climate Change Scenario Midway Between Low- and High- Carbon Futures

Notably, in Canterbury and Otago, which experience drought for about 10% of a year, this figure is estimated to rise to 20% by 2040. Furthermore, areas of New Zealand which were not drought prone before are projected to experience an increase in droughts as shown in the diagram.

Extremes in temperature: With a general trend towards warming temperatures, climate change will affect the extremes of temperatures New Zealand experiences. NIWA's report based on the Intergovernmental Panel on Climate Change's (IPCC) 5th Assessment provides a few specific figures. By 2040, there is a projected 30%-50% decrease in frosty nights (0°C or lower) with a 40%-100% increase in hot days (25°C or higher).⁷⁴

High wind speeds: Wind speeds are also affected by climate change. There is a projected increase of 10% more extreme winds in parts of the country such as the southern part of the North Island and the entirety of the South Island.⁷⁴

Management: Management of these risks revolve around the "4 Rs": reduction, readiness, response and recovery.⁷⁵ For example, reduction of flooding damage through pre-emptive measures to establish flood-resistant infrastructure, readiness to ensure people are ready to respond in the event of a flood, effective responses to a flood, and subsequent recovery from the disaster.⁷⁵

On a broader scale, climate change induced extreme weather is ameliorated by combating climate change itself. New Zealand takes part in various ways. It advocates for the removal of fossil fuel subsidies to help reduce global emissions.⁷⁶ It maintains its Emissions Trading Scheme (ETS) to encourage businesses to reduce emissions and invests in public infrastructure (such as public transport) for the same objective.⁷⁶ It also invests money into research about climate change; in 2015-2016 it invested \$31 million for this purpose.⁷⁶

Violence

International Terrorism

Definition According to Encyclopaedia Britannica, terrorism is "systematic use of violence to create a general climate of fear in a population and thereby to bring about a particular political objective."⁷⁷ In this study, we narrowed down our hazardscape to solely research acts of international terrorism against New Zealand.

Physical risk: In the most recent annual report from the NZSIS for the year 1 July 2015 – 30 June 2016, the following has been reported: "New Zealand is a small and geographically isolated country with a broadly tolerant and inclusive society. The terrorism threat level in New Zealand remains at 'low' – a terrorist attack is assessed as possible but not expected however, New Zealanders also travel widely, increasing the chances of being caught up in an offshore terrorist event."⁷⁸

According to the annual report from the Inspector-General of Intelligence and Security there has been only one potential threat that needed to be visualized by the NZSIS in the past year.⁷⁹

Management: The New Zealand Security Intelligence Service (NZSIS) is a public service agency that was formed in 1956. Working alongside the Government Community Services Bureau, New Zealand Police and New Zealand Defence Force, their purpose is to cooperate and “respond to an imminent threat to life or safety.”⁸⁰ We also have a number of pieces of relevant legislation, including:

International Terrorism (Emergency Powers) Act 1987: If an international terrorist emergency, defined as threats or actions, with the intention to kill, injure, damage property or intimidate either the government or persons, develops in New Zealand, this act allows the prime minister of New Zealand to call on at least three ministers of the Crown to declare a state of emergency, giving them “emergency powers” for 7 days unless extended by parliament.⁸¹

Terrorism Suppression Act 2002: This act made it illegal for anyone in New Zealand to participate or recruit for terrorist groups and by inhibiting the financial assistance of these groups, therefore the participation of New Zealanders in terrorist acts was inhibited.⁸¹

The Counter Terrorism Bill 2003: This bill was passed with the aim to increase both the powers made available to the government in response to terrorism and the criminal penalties applied against terrorism. One of the key amendments to this bill was the right to obtain interception warrants; where under appropriate circumstances, the government can overrule the right to confidentiality and access private information for the safety of New Zealanders.⁸¹ Though New Zealand is currently at a ‘low’ risk of any act of international terrorism, the legislation and protective groups that the government consistently have in place serve to equip and protect us to a standard of international excellence.

Physical Assault:

Definition: According to New Zealand’s Crimes Act 1961, assault is defined as “...the act of intentionally applying or attempting to apply force to the person of another, directly or indirectly, or threatening by any act or gesture to apply such force to the person of another, if the person making the threat has, or causes the other to believe on reasonable grounds that he or she has, present ability to effect his or her purpose; and to assault has a corresponding meaning.”⁸²

Physical Risk: In the year July 2014 – July 2015, there were 172,580 reported assaults, this suggests that approximately 3.9% of New Zealander’s were reported as victims of assaulted. In the year July 2015 – July 2016 approximately 3.8% were reported as victims of assault. Comparing this to the most recent statistics for the year July 2016 – July 2017, with a population of 4.69 – 4.79 million,⁸³ 3.7% of New Zealander’s were reported as victims of assault, suggesting that the incidence of assault is dropping by 0.1% per year.⁸³

Inequality: A retrospective case-only study published in 2012 concluded that males accounted for 76% of cases of assault, with 38% of these males being 15-24 years of ages. Both male and female cohorts had significantly larger numbers reporting as Māori ethnicity (31.7% and 47.8% respectively). As this study looked at the severe end of the spectrum (that being only

hospitalized assaults), the absolute numbers are not completely applicable to our wider hazard of “physical assault”, however the demographics reported are of significant interest.⁸⁴

Management: The New Zealand Police attempt to minimise and manage the threats of physical violence through prevention programs, community involvement and victim support.^{85,86} Additionally, The New Zealand Violence Protection Association is a group of professionals who are committed to seeing a reduction in any form of violent acts amongst New Zealanders. They provide services to advocate for the individual persons, families and communities. Services supported by NZVPA include “Man Alive” and “Manline” and have a strong emphasis on reaching out to Māori communities.⁸⁷

Table 2: *Actual Burden of Ten Major Hazards Ranked According to Current Risk to the Health of New Zealanders*

	Hazard	Physical risk
1	Damp housing	Children admitted to hospital with a condition associated with damp housing have higher mortality rates. 85% chance of being readmitted to hospital vs 56% for children admitted for other reasons.
2	Physical assault	Affects 3.9% of New Zealanders per year
3	Seasonal flu	Kills an average of 401 New Zealanders per year, widespread seasonal morbidity.
4	Lead paint contaminated housing	Underrated, associated with 93% of variation in crime rates (which has downstream effects on physical and mental health)
5	Earthquakes	Occur frequently but rarely large enough to cause harm, over the last 100 years earthquakes have killed an average of 2.9 New Zealanders per year.
6	Flu Pandemic	Occur infrequently. The 2009 pandemic killed 35 New Zealanders
7	Extreme weather events	Occur frequently. Increasing in frequency and severity. Little data on harm to New Zealanders.
8	Antibiotic resistance	Emerging hazard that is currently low risk to most New Zealanders
9	Meth contaminated housing	No official record. Believed to be largely overestimated according to experts.
10	International Terrorism	One 'potential threat' in the past year. One recorded death from international terrorism in New Zealand's history.

Method

The hazards included in this study were limited to 10 for the purpose of time and limited resources. These 10 hazards were divided into 4 comparable groups and chosen based on a number of factors. The comparable groups were violence (assault and terrorism), infectious diseases (pandemic flu, seasonal flu, antibiotic resistance), housing (lead paint contaminated housing, methamphetamine contaminated housing, damp housing) and natural disasters (earthquakes, climate change induced extreme weather events).

Factors influencing the choice of hazards included ensuring a range of hazard types, hazards with likely differences in actual risk vs. perceived risk, hazards with perceived uncertainty or unpredictability, hazards ranging in degree of perceived locus of control, and hazards managed by a range of government agencies. A table summarising these factors can be seen in Appendix 6.

Study Design

This was an observational cross-sectional study undertaken from 3rd – 11th October 2017. Quantitative information was gathered from 155 members of the public via a public specific online survey and face-to-face recruitment within Wellington City. Quantitative information was gathered from 7 key informants via a key informant specific online survey. Qualitative information was gathered from 6 key informants via a semi-structured phone interview.

Study Participants and Recruitment

Participants from the public were approached to participate in the quantitative aspect of the study via Facebook, in particular, free online trading and discussion forums ('Vic deals', 'Otago Flattening Goods' and 'Buy and Sell in Auckland'). A total of 109 participants were recruited via social media.

Face-to-face recruitment was used within Wellington City to further increase the number and range of participants by widening our reach past social media. Approaching a member of the general public was defined as verbally asking for participation in the study. The purpose of the research was explained and consent was gained before beginning the survey. Street surveys were completed at various locations within Wellington City. Locations and response rates for individual locations are shown in Table 3. Overall, the response rate was 46%. This is shown in Figure 2.

Table 2: *Actual Burden of Ten Major Hazards Ranked According to Current Risk to the Health of New Zealanders*

Location	Survey responses	Total approached	Response rate
Cuba street, Wellington CBD	16	35	46%
Courtenay place, Wellington CBD	12	25	48%
Kilbirnie shopping centre	5	13	38%
Kilbirnie Pak n Save	5	10	50%
Karori New World	4	10	40%
Newtown New World	4	8	50%
Total	46	101	46%

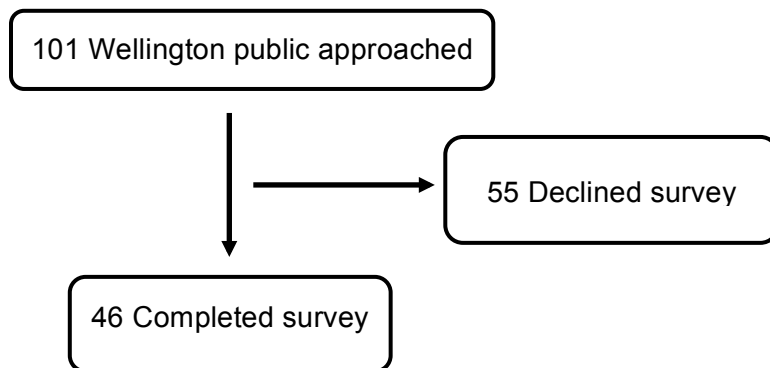


Figure 2: Recruitment of Wellington public

Key Informants were included in the study if they had a risk assessment/management role in a relevant government agency and/or expertise about risk management and the New Zealand literature. Key informants were identified through a review of relevant literature, consensus with research supervisors and personal and professional networks. Snowball sampling was then used to further recruit professionals with an involvement in risk assessment/management in New Zealand.

Key informants were approached via an email and follow-up phone call. This contained information regarding the purpose of the research, access to the key informant specific online survey and invited participation in the semi-structured phone interview. 7 out of 24 key informants approached completed the online survey (response rate 30%). 6 of these key informants also agreed to take part in the semi-structured phone interview, 1 key informant declined (response rate 25%). This is demonstrated in Figure 3.

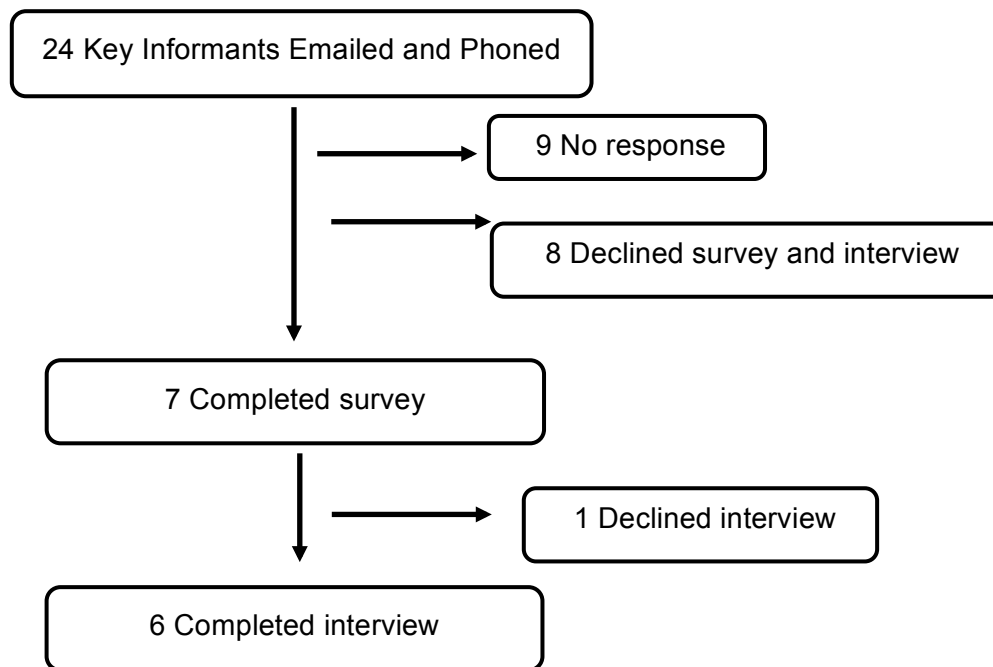


Figure 3: Recruitment of Key Informants

Study Instruments

Short, closed-ended questionnaire

Our questionnaire (Appendix 7) was made using Google Forms, and was made for both the general public and our key informants. The questionnaire was the same for both groups but was hosted on two different forms, in order to keep the results separate. The questionnaire consisted of a set of five questions with multiple-choice answers for each of the ten hazards. There were also some optional questions at the end of the survey, which were used to collect demographic data for analysis.

Open-ended question phone interview

After having filled out the survey, our key informants were invited to take part in a semi-structured phone interview. This interview consisted of open-ended questions that were concerned with the role of their organisation in the New Zealand hazardscape, their thoughts on the government's control over the hazardscape, and how well they think New Zealand individuals understand and control hazards. By following a set of predetermined questions, interviewer bias was minimised.

It was left up to the interviewers to organise a time that suited the informants to undertake the interview. Once a time had been agreed upon, interviewers were able to call their key informant and interview them on speakerphone, using another device to record the interview.

At the start of the interview the informants were reminded that the interview would be recorded, but that the recording would remain confidential and all published information would be anonymised unless the informant wished to be referenced. After the interview was concluded the interviewer transcribed the informants answers and anonymised them, before sending the transcription to the analysis team and deleting the recording.

We analysed our data using a mixed method approach:

Quantitative

In this study, for all the questions we asked apart from the demographics, a Likert scale with five word options were used. For the purpose of data analysis, the word responses were all converted to a numerical value.

For the first question, 'How likely is it for a typical New Zealander to be exposed to this hazard?', the word options are listed below with the numerical value assigned to them.

1- Rare 2- Unlikely 3- Possible 4- Likely 5- Almost Certain

For the second question, 'How severe are the usual consequences of this exposure?', the word options are listed below with the numerical value assigned to them.

1- Insignificant 2- Minor 3- Moderate 4- Major 5- Catastrophic

For the third and fourth questions, 'How much control do you think you have over this hazard occurring and its consequences?' and 'How much control do you think the government has over this hazard occurring and its consequences?' The word options are listed below with the numerical value assigned to them.

1- No control 2- Little Control 3- Moderate Control 4- High Control 5- Complete Control

For the fifth question, 'How worried are you about this hazard?' the word options are listed below with the numerical value assigned to them.

1- Not worried 2- Slightly worried 3- Worried 4- Very Worried 5- Extremely Worried

Furthermore, using the assigned numerical values, we have calculated the mean, average of all values, to use in our analysis.

Categorical Analysis:

Violence: Physical assault, International terrorism

Infectious Diseases: Seasonal Flu, Flu Pandemic, Antibiotic Resistance

Housing: Damp Housing, Lead paint contaminated housing, Meth contaminated housing

Natural Disasters: Earthquakes, Extreme weather events

Qualitative

Transcriptions of the recorded phone interviews were sent to the data analysis team after each interview was completed. The transcripts were then collaborated to identify trends and themes within the answers to the research questions, as well as any additional information obtained from the key informants.

Ethical Approval

Approval for this project was granted by the University of Otago Human Ethics Committee, under the category B criteria.

Results

Quantitative Result Analysis

1. General Public Participant Demographics

As part of the survey, we collected demographic data on age-group, gender, ethnicity and occupation. There were 155 respondents in total who participated in the survey. The results are shown below.

1.1 Age-group

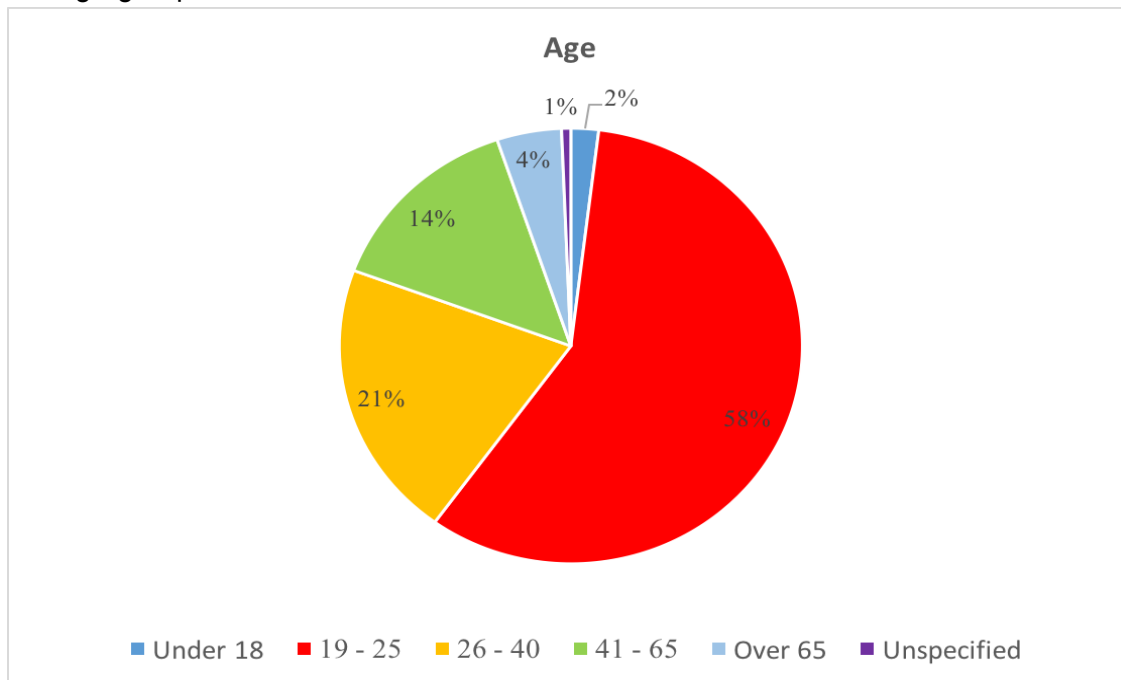


Figure 4. Age-Group Demographics

Table 4. Age-Group Demographics

Age-group demographics		Percentage
Under 18	3	1.94%
19 - 25	90	58.06%
26 - 40	32	20.65%
41 - 65	22	14.19%
Over 65	7	4.52%
Missing	1	0.65%
Total	155	100.00%

The main age-group from the survey was “19 - 25”, showing 58.06% of the total age-group demographic. This was followed by “26 - 40”, “41 - 65”, “Over 65” and “Under 18” - 20.65%, 14.19%, 4.52% and 1.94% respectively. One respondent did not give the age-group.

1.2 Gender

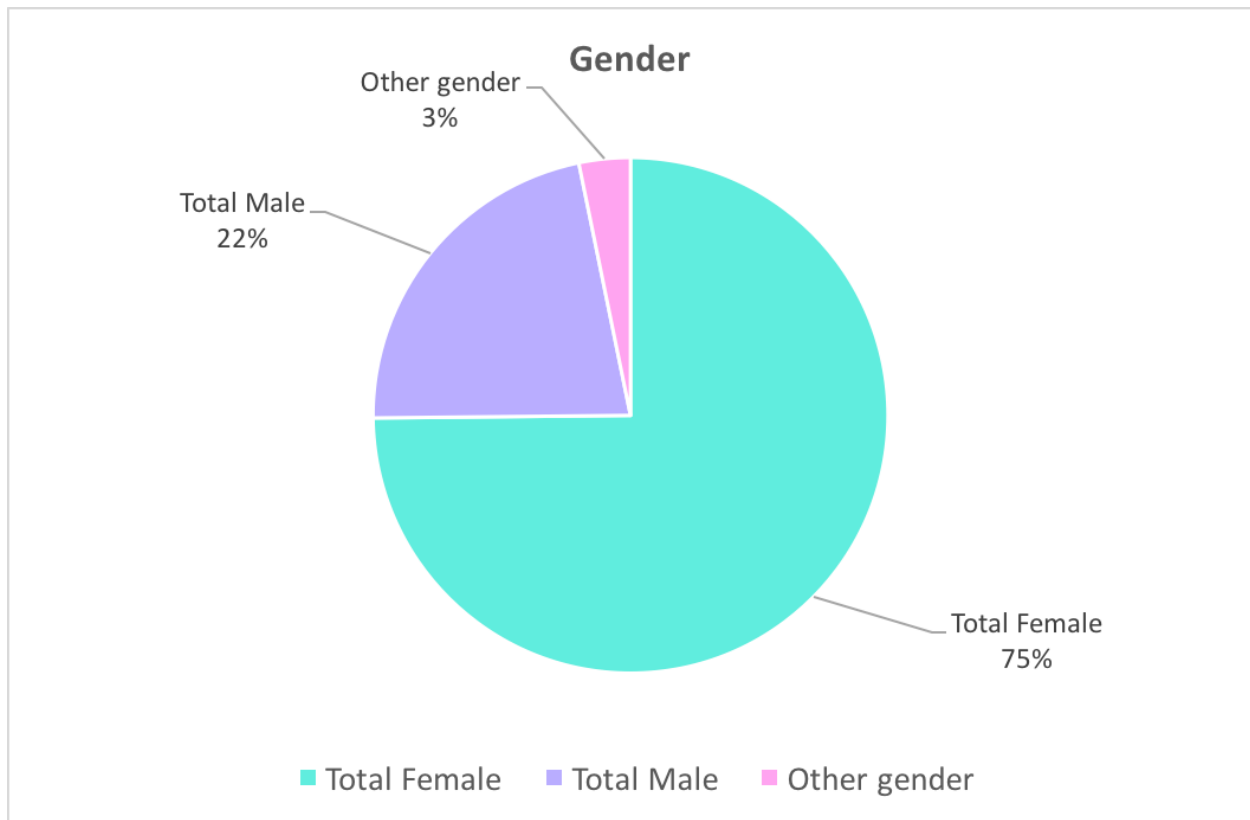


Figure 5. Gender Demographics

Table 5. Gender Demographics

Gender demographics		Percentage
Total Female	116	74.84%
Total Male	34	21.94%
Other	5	3.23%
Total	155	100.00%

There was a higher proportion of female respondents (74.84%) compared to the proportion of male respondents (21.94%). Other responses included - 1 Transgender, 2 Agender, 1 None and one did not provide gender.

1.3 Ethnicity

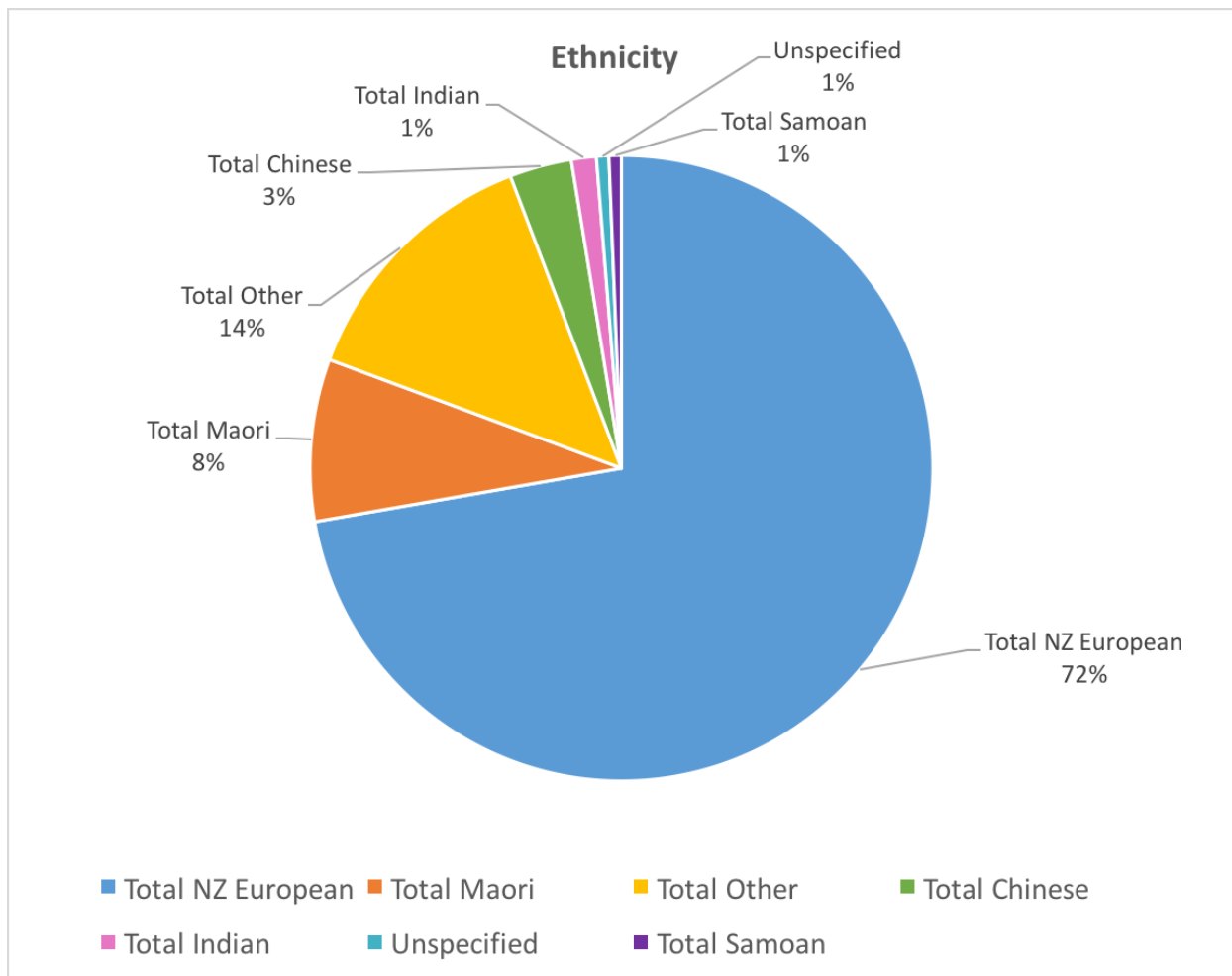


Figure 6. Ethnicity Demographics

Table 6. *Ethnicity Demographics*

Ethnicity demographics		Percentage
Total NZ European	112	72.26%
Total Māori	13	8.39%
Total Other	21	13.55%
Total Chinese	5	3.23%
Total Indian	2	1.29%
Total Samoan	1	0.65%
Unspecified	1	0.65%
Total	155	100.00%

The majority of the respondents identified as NZ European (72.26%), followed by Other (13.55%), Māori (8.39%), Chinese (3.23%), Indian (1.29%), Samoan (0.65%) and One respondent did not provide ethnicity.

1.4 Occupation

Table 7. *Occupation*

Occupation Category	Number of Respondents	Percentage
Students	60	38.71%
Working	77	49.68%
Retired	7	4.52%
Other	3	1.94%
Unspecified	8	5.16%
Total	155	100.00%

The respondents had varied occupations. The majority of our respondents were Working (49.68%) from various professions. This was followed by Students (38.71%), Retired (4.52%) and Other (1.94%). There were 8 respondents (Unspecified; 5.16%) who did not provide their occupation. Other category included stay at home parents (SAHM; Parent).

Key Informant Demographics

There were 7 key informants in total who responded to the survey. They were from various areas of expertise, working at different sectors within New Zealand. 4 out of 7 were male and 3 out of 7 were female. 5 out of 7 were NZ European and 2 out of 7 were Māori.

Survey Questionnaire Analysis

1. Likelihood of Exposure

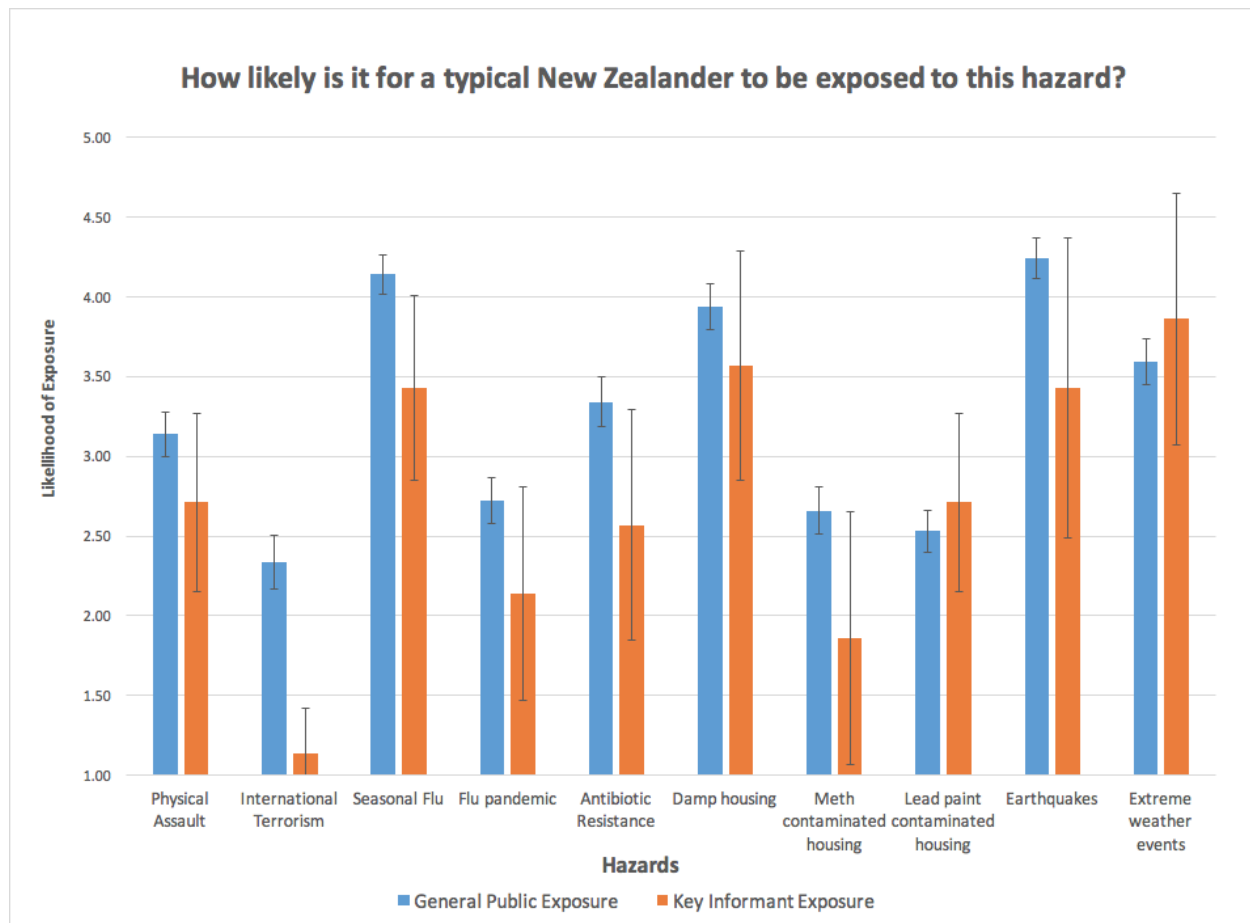


Figure 7. Perception of the Likelihood of Exposure for a Typical New Zealander by the General Public vs Key Informants. **Refer to appendices for exact values of confidence intervals and p-values of all hazards*

Survey results show that the general public believed that a typical New Zealander is most likely to be exposed to 'Earthquakes' and 'Seasonal Flu', followed by 'Damp housing' (means around the value '4' - 'likely' on the Likert scale provided - means 4.24, 4.12 and 3.94 respectively; CI 95% 0.13, 0.12 and 0.14 respectively) than the rest of the hazards. The general public thought that 'International terrorism' was the least likely for exposure (mean 2.34 ± 0.17 ; CI 95%).

As for the key informants, they thought 'Extreme weather events' (3.86 ± 0.79 ; CI 95%) was most likely for exposure, followed by 'Damp housing' (3.57 ± 0.72 ; CI 95%), 'Earthquakes' and 'Seasonal Flu' (having the same mean values of 3.43; CI 95% 0.94 and 0.58 respectively). Large confidence intervals should be kept in mind - the means for key informants may not represent true mean values for these hazards. The results also indicate that 'International

terrorism' (1.14 ± 0.28 ; CI 95%) was also least likely for exposure - close to 'rare' on the Likert scale.

The most statistically significant difference was seen for 'International terrorism' (General Public = 2.34 ± 0.17 vs Key Informant = 1.14 ± 0.28 ; CI 95%; p-value<0.05; 0.004) - the general public rated the likelihood of exposure to be higher. Other significant differences were seen for 'Earthquakes' (General Public = 4.24 ± 0.13 vs Key Informant = 3.43 ± 0.94 ; CI 95%; p-value<0.05; 0.012), 'Seasonal Flu' (General Public = 4.14 ± 0.12 vs Key Informant = 3.43 ± 0.58 ; CI 95%; p-value<0.05; 0.021), 'Meth Contaminated Housing' (General Public = 2.53 ± 0.13 vs Key Informant = 1.86 ± 0.79 ; CI 95%; p-value<0.05; 0.031) and 'Antibiotic resistance' (General Public = 3.34 ± 0.16 vs Key Informant = 2.57 ± 0.72 ; CI 95%; p-value<0.05; 0.047) - In general, the general public perceived the likelihood of exposure to be higher for these hazards. Other hazards did not show any statistically significant differences.

Table 8. *Table of Likelihood of Exposure of Hazards Ranked from the Highest Perceived Exposure to the Lowest Perceived Exposure from the Two Different Groups.*

Rank of Likelihood of exposure	General Public	Key Informants
1	Earthquakes	Extreme weather events
2	Seasonal Flu	Damp housing
3	Damp housing	Seasonal Flu
4	Extreme weather events	Earthquakes
5	Antibiotic Resistance	Physical Assault
6	Physical Assault	Lead paint contaminated housing
7	Flu pandemic	Antibiotic Resistance
8	Meth contaminated housing	Flu pandemic
9	Lead paint contaminated housing	Meth contaminated housing
10	International Terrorism	International Terrorism

Categorical comparison

Violence: General public responses show the Physical assault exposure (3.14 ± 0.14 ; CI 95%) was more likely than International terrorism (2.34 ± 0.17 ; CI 95%) for a typical New Zealander. The perception likelihood of International terrorism was close to 2 on the Likert scale meaning 'unlikely'. The key informant group responses show the same pattern as the general public, but the difference is wider (Physical assault = 2.71 ± 0.56 vs International Terrorism = 1.14 ± 0.28 ; CI 95%). As mentioned above, the level of perception of likelihood of exposure of International terrorism was statistically significant between the two groups. Physical assault was not significantly different (p-value = 0.21).

Infectious Diseases: For the general public, the order of likelihood of exposure from most to least for the category is as follows - Seasonal flu (4.14 ± 0.12 ; CI 95%), Antibiotic resistance (3.34 ± 0.16 ; CI 95%) and Flu pandemic (2.72 ± 0.14 ; CI 95%). Seasonal flu was indicated 'likely' and was also the second among the ten major hazards of the general public. The Key informants responses show the same pattern as the general public - Seasonal flu (3.43 ± 0.58 ; CI 95%), Antibiotic resistance (2.57 ± 0.72 ; CI 95%) then followed by Flu pandemic (2.14 ± 0.67 ; CI 95%). Although both groups considered Seasonal flu as the highest within this category, the group has significantly differing perception (p-value 0.021), with the general public viewing the hazard more likely to occur. Also the perception of Antibiotic resistance was significantly different (p-value = 0.047), higher likelihood in the general public group.

Housing: General public responses indicate that a typical New Zealander is most likely to be exposed to Damp housing over either Meth contaminated housing or Lead paint contaminated housing. The difference in the perception of likelihood of exposure for Damp housing was noted as being almost a scale higher on the Likert scale - Damp housing (3.94 ± 0.14 ; CI 95%; closer to 'Likely'), Meth contaminated housing (2.66 ± 0.15 ; CI 95%; closer to 'Possible') and Lead paint contaminated housing (2.53 ± 0.13 ; CI 95%; closer to 'Possible'). Key informants responses differed in that they showed Lead paint contaminated housing (2.71 ± 0.56 ; CI 95%) was more likely than Meth contaminated housing (1.86 ± 0.79 ; CI 95%), but Damp housing (3.57 ± 0.72 ; CI 95%) was shown to be the highest likelihood of exposure which was in consensus with the general public within this category. Perception of meth contaminated housing was significantly different (p-value = 0.031) with the general public rating it higher in the likelihood of exposure.

Natural Disasters: General public responses indicate that Earthquakes (4.24 ± 0.12 ; CI 95%) were slightly more likely as compared to Extreme weather events (3.59 ± 0.14 ; CI 95%). Both hazards were among the higher ranked hazards on the perception of likelihood of exposure for a typical New Zealander for both the general public and the key informants. The key informants showed an opposite pattern to the general public, as the key informants responses indicated that Extreme weather events (3.86 ± 0.79 ; CI 95%) were more likely for exposure than Earthquakes (3.43 ± 0.94 ; CI 95%) - perception of Earthquakes showed significant difference (p-value = 0.012) within the two groups. Extreme weather events as a hazard, ranked highest among all ten hazards for likelihood of exposure for key informants while Earthquakes were deemed to be the top hazard for likelihood of exposure for the general public.

2. Severity of the Consequences

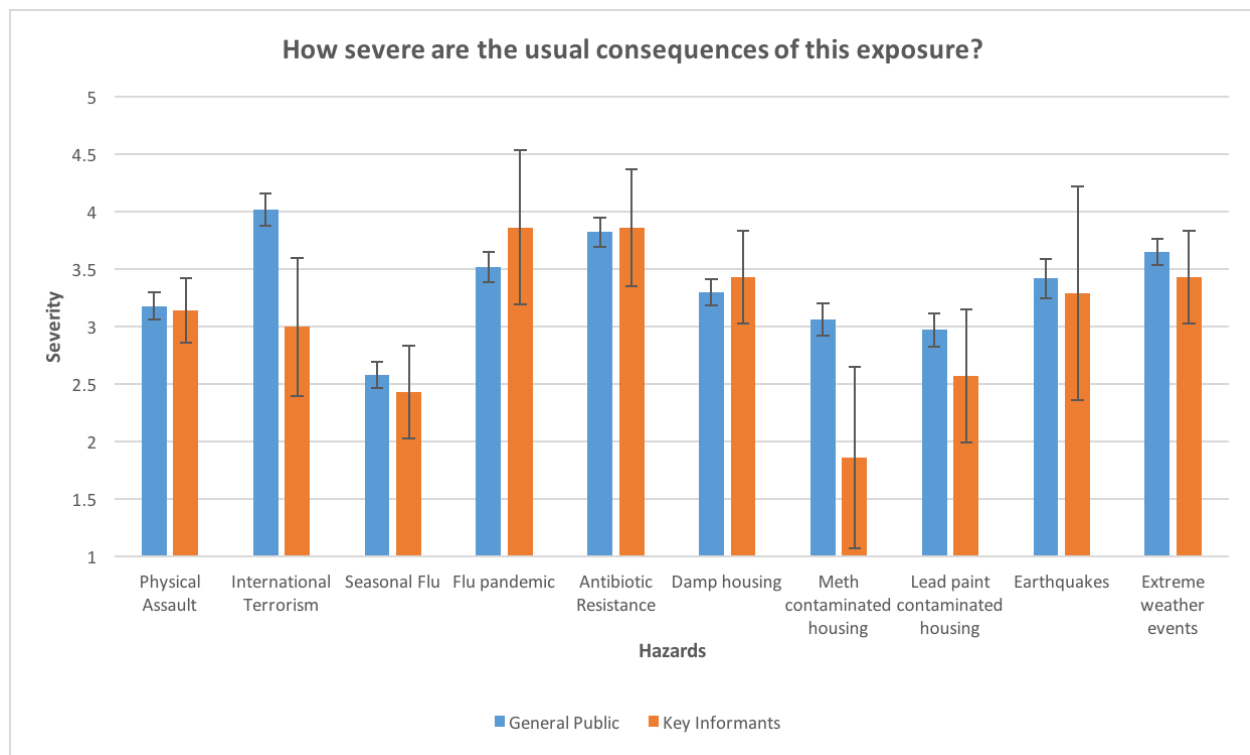


Figure 8. Perception of the Severity of Consequences by the General Public vs Key Informants. **Refer to appendix for exact values of confidence intervals and p-values of all hazards*

The hazards that the general public thought was the most severe in its consequences was 'International terrorism' (4.02 ± 0.139 ; CI 95%), indicating that it was 'major' in severity. They considered 'Seasonal flu' (2.58 ± 0.12 ; CI 95%) to be the least severe in its consequences. As for the key informants, they thought that both 'Flu pandemic' (3.86 ± 0.67 ; CI 95%) and 'Antibiotic resistance' (3.86 ± 0.51 ; CI 95%) were most severe in its consequences. The key informants believed that the usual consequences of 'Meth contaminated housing' were the least severe (1.86 ± 0.79 ; CI 95%). There were statistically significant differences (p-value <0.05) in mean perception for the severity of consequences of 'International terrorism' (general public = 4.02 ± 0.139 , key informants = 3.00 ± 0.60 ; CI 95%; p-value <0.05; 0.003) and 'Meth-contaminated housing' (general public = 3.06 ± 0.14 , key informants = 1.86 ± 0.79 ; CI 95%; p-value < 0.05; 0.0008) between the two groups.

Table 9. *Table of Severity of Hazards Ranked from the Highest Perceived Severity to the Lowest Perceived Severity from the Two Different Groups*

Rank of Severity	General Public	Key Informants
1	International Terrorism	Flu pandemic
2	Antibiotic Resistance	Antibiotic Resistance
3	Extreme weather events	Damp housing
4	Flu pandemic	Extreme weather events
5	Earthquakes	Earthquakes
6	Damp housing	Physical Assault
7	Physical Assault	International Terrorism
8	Meth contaminated housing	Lead paint contaminated housing
9	Lead paint contaminated housing	Seasonal Flu
10	Seasonal Flu	Meth contaminated housing

Categorical comparison

Violence: The general public had very similar responses to the severity of consequences of Physical assault as the key informants, 3.18 ± 0.12 (CI 95%) and 3.14 ± 0.28 (CI 95%) respectively. Thus, they consider Physical assault as being close to 'moderate' its severity of consequences. As for international terrorism, there were marked discrepancies between general public and key informants, as aforementioned. General public considered the consequences of terrorism to be 'major', while the key informants only considered it to be 'moderate' in severity. The general public perceived the consequences of International Terrorism to be more severe than Physical assault; however, the key informants perceive it otherwise.

Infectious Diseases: Antibiotic resistance and Flu pandemic were considered to have greatest severity of consequences in the category of Infectious Diseases, for both the general public and key informants. The general public placed Antibiotic resistance with greater level of severity (3.82 ± 0.13 ; CI 95%; close to 'major') in terms of consequences than Flu pandemic (3.52 ± 0.13 or in between 'moderate' and 'major'). These two hazards were considered by the key

informants to have equal severity in consequences, both close to 'major' (Flu pandemic = 3.86 ± 0.67 ; CI 95%, Antibiotic resistance = 3.86 ± 0.51 ; CI 95%). Seasonal flu was seen as 'minor' to 'moderate' in severity of consequences for both general public (2.58 ± 0.12 ; CI 95%) and key informants (2.43 ± 0.4 ; CI 95%).

Housing: Both the general public and key informants considered Damp housing to be greatest in severity compared to Meth-contaminated housing and Lead-paint contaminated housing, with mean perception of severity for Damp housing being 3.3 ± 0.12 (CI 95%) for general public, and 3.43 ± 0.4 (CI 95%) for key informants. Based on the column graphs, the severity of consequences of Meth-contaminated housing was thought by the general public to be more severe than Lead-paint contaminated housing; a mean perception of 3.06 ± 0.14 (CI 95%; 'moderate') for Meth-contaminated housing and 2.97 ± 0.15 (CI 95%; close to 'moderate'). On the contrary, the key informants thought that 'Lead-paint contaminated housing' was more severe than Meth-contaminated housing. Lead paint contaminated housing had a mean perception by the key informants of 2.57 ± 0.58 (CI 95%), and thus was in the 'minor' to 'moderate' range while Meth-contaminated housing had a mean perception of 1.86 ± 0.79 (CI 95%), which translates to less than 'minor' severity (between 'insignificant' and 'minor' but leaning closer to 'minor'). However, the confidence intervals are wide in the key informants group for with substantial overlap between the two hazards Lead-contaminated housing and Meth-contaminated housing; therefore we cannot accurately conclude on their perception of which type of housing toxin/chemical causes more repercussions in the true population.

Natural Disasters: There were insufficient evidence to reject the null hypothesis of a difference in the general public and key informants' perceptions of severity of consequences for each of the hazards, Earthquakes and Extreme weather events. The p-values for these hazards were 0.75 and 0.45 respectively, and as ≥ 0.05 , indicating that the apparent differences observed could have been due to chance. The key informant's confidence interval on their perception of the severity of Earthquakes (3.39 ± 0.93 ; CI 95%) is very wide. This shows that there is marked variation in opinions on its severity of consequences within the group of experts. Between the hazards Earthquakes and Extreme weather events, there is overlap in the confidence intervals between these hazards, for both groups. Although both groups considered the severity of Extreme weather events (general public = 3.65 ± 0.12 , key informants = 3.43 ± 0.4 ; CI 95%) to be more severe than Earthquakes (general public = 3.42 ± 0.17 , key informants = 3.29 ± 0.93 ; CI 95%) in our survey, we also cannot conclude which of the two hazards either group thinks is more severe because of this.

3. Personal Locus of Control (LOC)

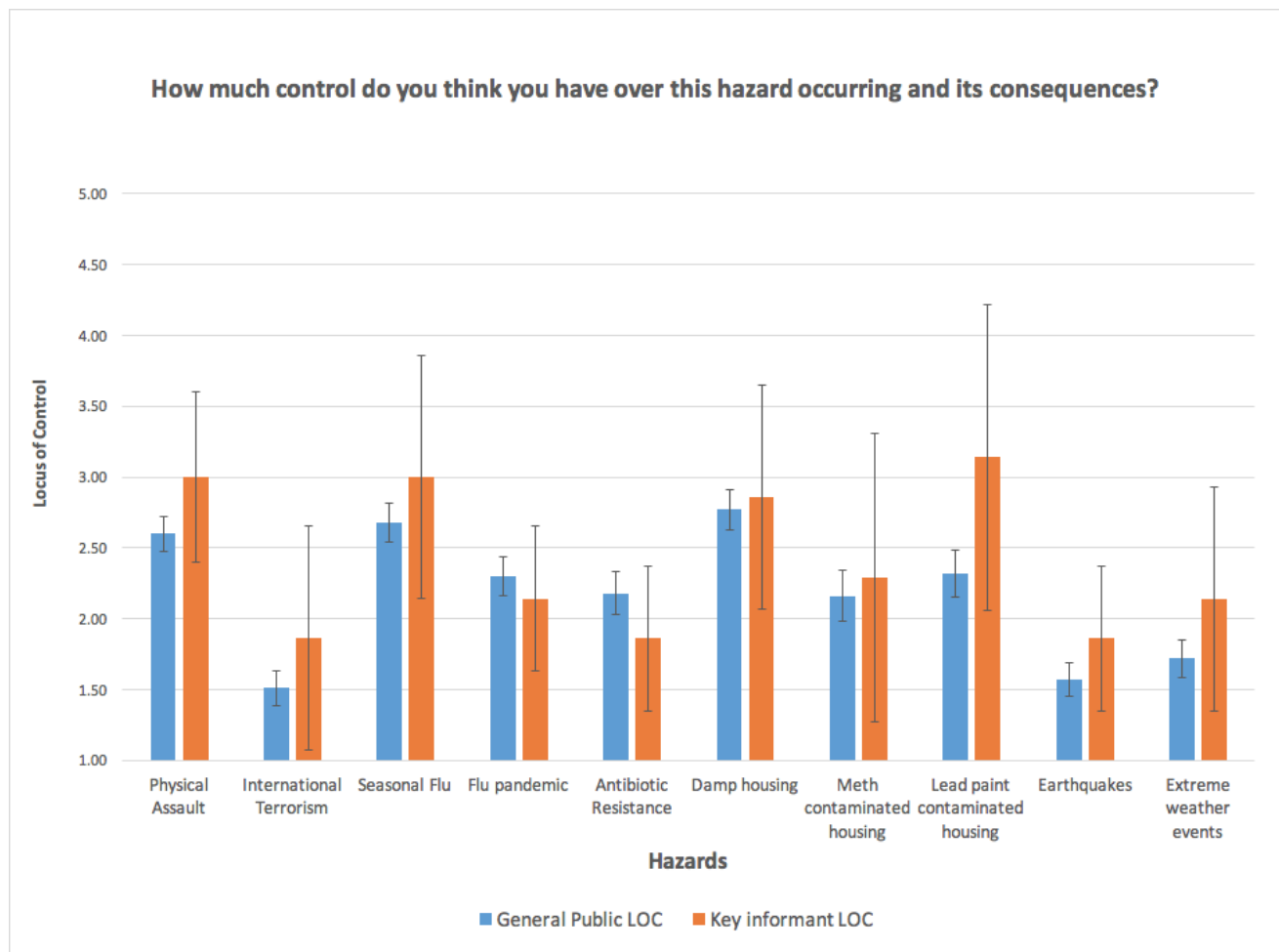


Figure 9. Perception of the Personal Locus of Control by the General Public vs Key Informants

The general public respondents considered 'Damp housing' (2.77 ± 0.14 ; CI 95%) as the hazard with most personal control. However, the mean indicated the value was only close to '3 - Moderate control' on the Likert scale provided. This was followed by 'Seasonal flu' (2.68 ± 0.14 ; CI 95%) and 'Physical assault' (2.60 ± 0.12 ; CI 95%) with similar mean values. The key informants considered 'Lead paint contaminated housing' (3.14 ± 1.08 ; CI 95%) as having most personal control. Similarly this was followed by 'Physical assault' (3.00 ± 0.6 ; CI 95%) and 'Seasonal flu' (3.00 ± 0.86). The large confidence intervals suggest a large variation in the responses within the experts and therefore may not be accurately representative of this group. The least personal control was deemed to be 'International terrorism' (1.51 ± 0.13 ; CI 95%) for the general public and three of the same mean were shown for 'Earthquakes' (1.86 ± 0.51 ; CI 95%), 'Antibiotic resistance' (1.86 ± 0.51 ; CI 95%) and 'International Terrorism' (1.86 ± 0.79 ; CI 95%) for the key informants; sample size limitation was visible and thus was difficult to extract true mean and rank of the hazards for the experts.

Significant difference was only seen in 'Lead paint contaminated housing' (General Public = 2.32 ± 0.17 vs Key Informant = 3.14 ± 1.08 ; CI 95%; p-value = 0.05) among top ten hazards. The large confidence intervals indicate limited sample size and accuracy in the perception of the control over hazards. Overall the means were generally higher for the key informants in the perception of personal locus of control.

Table 10. *Table of Personal Locus of Control over hazards ranked from the highest perceived LOC to the lowest perceived LOC from the two different groups.*

Rank of Personal LOC	General Public	Key Informants
1	Damp housing	Lead paint contaminated housing
2	Seasonal Flu	Physical Assault
3	Physical Assault	Seasonal Flu
4	Lead paint contaminated housing	Damp housing
5	Flu pandemic	Meth contaminated housing
6	Antibiotic Resistance	Flu pandemic
7	Meth contaminated housing	Extreme weather events
8	Extreme weather events	International Terrorism
9	Earthquakes	Antibiotic Resistance
10	International Terrorism	Earthquakes

Categorical comparison

Violence: General public responses showed that they considered to have more control of Physical assault (2.60 ± 0.12 ; CI 95%; closer to 'Moderate control') over International terrorism (1.51 ± 0.13 ; CI 95%; closer to 'Little control'). The Key informant group results show the same pattern but with higher means - Physical assault (3.00 ± 0.6 ; CI 95%) and International terrorism (1.86 ± 0.79 ; CI 95%) - although with large confidence intervals. There were no significant differences in the groups within this category.

Infectious Diseases: The order of personal control from most control to least control for the category is as follows - Seasonal flu (2.68 ± 0.14 ; CI 95%), Flu pandemic (2.30 ± 0.14 ; CI 95%) and Antibiotic resistance (2.18 ± 0.15 ; CI 95%). Key informant responses had a similar pattern - Seasonal flu (3.00 ± 0.6 ; CI 95%), Flu pandemic (2.14 ± 0.51 ; CI 95%) and Antibiotic resistance (1.86 ± 0.51 ; CI 95%). There were no significant differences between the groups within this category.

Housing: General public responses show that they had more personal control of Damp housing (2.77 ± 0.14 ; CI 95%) over Lead paint contaminated housing (2.32 ± 0.17 ; CI 95%) and Meth contaminated housing (2.16 ± 0.18 ; CI 95%). The pattern was different in the key informant group where they believed that most personal control was possible for Lead paint contaminated housing (3.14 ± 1.08 ; CI 95%) followed by Damp housing (2.86 ± 0.79) and Meth contaminated housing (2.29 ± 1.02 ; CI 95%). As Lead paint contaminated housing was rated as having the highest personal control by the key informants, there was a significant difference in the responses between the general public and the key informants ($p = 0.05$). Other hazards did not vary significantly within this category.

Natural Disasters: Responses from both groups show hazards within 'Natural disasters' are generally of low personal control. The general public considered to have slightly higher control of Extreme weather events (1.72 ± 0.13 ; CI 95%) over Earthquakes (1.57 ± 0.12 ; CI 95%) - however both mean values were close to 'Little control' on Likert scale. The key informants showed the same pattern as the general public - Extreme weather events (2.14 ± 0.79 ; CI 95%) and Earthquakes (1.86 ± 0.51 ; CI 95%). These two groups did not show any significant differences in the perception of personal LOC within this category.

4. Government Locus of Control

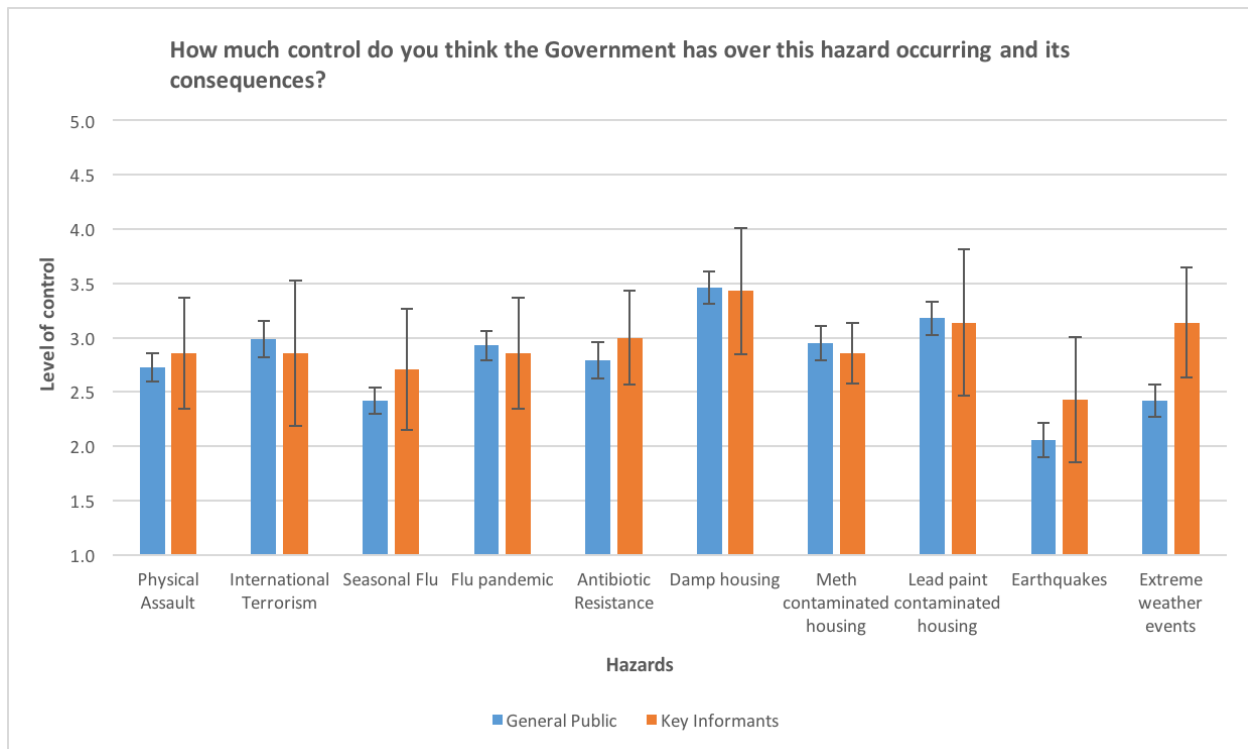


Figure 10: Perception of Government Locus of Control of the General Public and Key Informants

'Damp housing' was the hazard that the general public (3.46 ± 0.146 ; 95% CI) and the key informants (3.43 ± 0.528 ; 95% CI) thought the government had the most level of control over. 'Earthquakes' was the hazard that the general public (2.06 ± 0.159) and the key informants (2.43 ± 0.528) thought the government had the lowest level of control over. There were no statistically significant differences for perception of level of government control between the general public and key informants for each of the hazards.

Table 11. *Table of Government Locus of Control Over Hazards Ranked from the Highest Perceived LOC to the Lowest Perceived LOC from the Two Different Groups.*

Rank of Government LOC	General Public	Key Informants
1	Damp housing	Damp housing
2	Lead paint contaminated housing	Lead paint contaminated housing
3	International Terrorism	Extreme weather events
4	Meth contaminated housing	Antibiotic Resistance
5	Flu pandemic	Physical Assault
6	Antibiotic Resistance	International Terrorism
7	Physical Assault	Flu pandemic
8	Seasonal Flu	Meth contaminated housing
9	Extreme weather events	Seasonal Flu
10	Earthquakes	Earthquakes

Categorical comparison

Violence: Both the general public and key informants showed similar perceived level of government control over Physical assault (2.73 ± 0.131 and 2.86 ± 0.510) and International terrorism (2.99 ± 0.166 and 2.86 ± 0.670). There was no statistically significant differences for perceived level of government control between the general public and the key informants for these two hazards. Ranking from the highest perceived level of government control to the lowest, International terrorism ranked third for the general public whilst Physical assault ranked seventh. This is four rankings apart. For the key informants, Physical assault and International terrorism ranked closely together at fifth and sixth respectively.

Infectious diseases: Both the general public and key informants showed similar perceived level of government control over a Flu pandemic (2.93 ± 0.136 and 2.86 ± 0.510). For Seasonal flu, key informants showed a slightly higher perceived level of government control over the general

public (2.71 ± 0.560 vs 2.41 ± 0.122). Similarly for Antibiotic resistance, key informants showed a slightly higher perceived level of government control over the general public (3.00 ± 0.430 vs 2.79 ± 0.43). However, there was no statistically significant differences for perceived level of government control between the general public and the key informants for these hazards.

The general public and the key informants viewed Seasonal flu to having the lowest level of government control out of these hazards. However, Flu pandemic ranked higher than Antibiotic resistance for the general public but Antibiotic resistance ranked higher than Flu pandemics for the key informants.

Housing: Both the general public and key informants showed similar perceived level of government control over Lead paint contaminated housing (3.18 ± 0.153 vs 3.14 ± 0.67), Meth contaminated housing (2.95 ± 0.159 vs 2.86 ± 0.280) and Damp housing (3.46 ± 0.146 vs 3.43 ± 0.58). However, there was no statistically significant differences for perceived level of government control between the general public and the key informants for these hazards.

Both the key informants and general public showed Damp housing to have the highest level of government control in terms of ranking. In terms of environmental toxins and chemicals, both key informants and the general public perceive Lead paint contaminated housing to have a higher level of governmental control compared to Meth contaminated housing.

Natural disasters: For Earthquakes and Extreme weather events, key informants show a higher perceived level of government control (2.43 ± 0.580 and 3.14 ± 0.510) when compared to the general public (2.06 ± 0.159 and 2.42 ± 0.510). However, there was no statistically significant differences for perceived level of government control between the general public and the key informants for these hazards.

Both key informants and the general public perceived the level of government control over earthquakes to be the lowest amongst all the hazards. There was a large difference in the level of government control in terms of ranking for Extreme weather events. For this, Extreme weather events placed 3rd in terms of ranking for key informants but only 9th for the general public.

5. Level of Worry

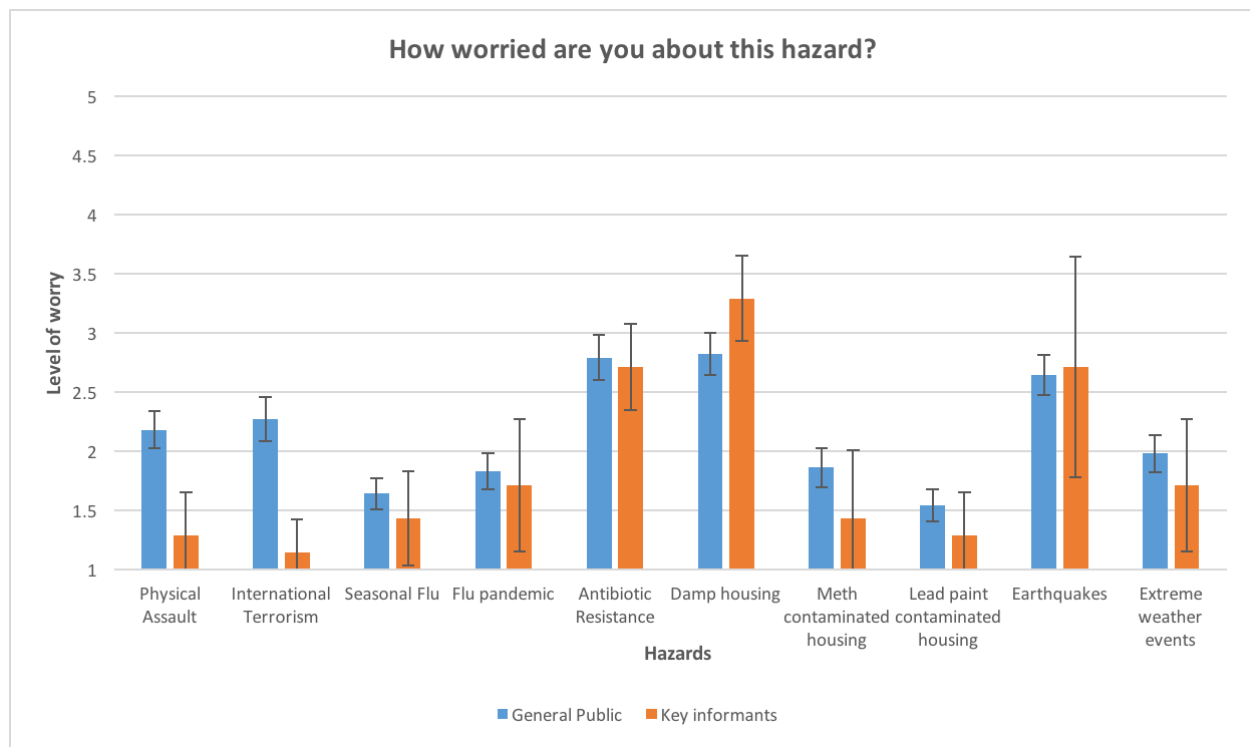


Figure 11. Level of Worry about Hazard from General Public vs Key Informants

The hazards that people in the general public were most worried about were ‘Antibiotic resistance’, ‘Damp housing’ and ‘Earthquakes.’ They were least worried about ‘Lead paint contaminated houses’ and the ‘Seasonal flu’. The overall level of worry that was reported from the general public was not as high as expected; across all hazards the average level of worry ranged from ‘slightly worried’ to ‘worried.’ No hazard resulted in an average rating of ‘very worried’ or ‘extremely worried.’ Additionally, none of the hazards received a rating of ‘not worried.’ A low level of worry was seen across all hazards.

The hazards that key informants were most worried about were also ‘Damp housing’, ‘Antibiotic resistance’ and ‘Earthquakes.’ It is interesting that the top 3 most worrying hazards were the same for both groups. The key informants were least worried about ‘International terrorism’, ‘Physical assault’ and ‘Lead paint contaminated housing’. Key informants ranged from not worried to worried across all hazards; there was nothing that they were very or extremely worried about.

Table 12. *Table of Level of Worry about Hazards Ranked from the Highest Level of Worry to the Lowest Level of Worry from the Two Different Groups*

Rank of level of worry	General public	Key informant
1	Damp housing	Damp housing
2	Antibiotic resistance	Antibiotic resistance
3	Earthquakes	Earthquakes
4	International terrorism	Flu pandemic
5	Physical assault	Extreme weather events
6	Extreme weather events	Seasonal flu
7	Meth contaminated housing	Meth contaminated housing
8	Flu pandemic	Lead paint contaminated housing
9	Seasonal flu	Physical assault
10	Lead paint contaminated housing	International terrorism

Categorical comparison

Violence: The general public was slightly worried about Physical assault and International terrorism, (2.18 ± 0.16) and (2.27 ± 0.19) respectively. Contrastingly, key informants were not worried at all about these hazards, (1.29 ± 0.36) and (1.14 ± 0.28) respectively. The P values for these comparisons were 0.018 and 0.025 respectively, making these comparisons statistically significant.

Infectious diseases: The general public was worried about Antibiotic resistance (2.79 ± 0.19). This was one of the hazards that they were most worried about across all categories. They were slightly worried about Seasonal flu and Flu pandemics. Key informants were worried just as much as the public about Antibiotic resistance (2.71 ± 0.36). They were not as worried about Seasonal flu and Flu pandemics as the public but these differences were not statistically significant.

Housing: The general public and key informants were most worried about damp housing across all categories, although the key informants were more worried (3.29 ± 0.36) compared to the general public (2.82 ± 0.18). The p-value for this comparison was 0.284. Both groups were more worried about Meth contaminated housing than they were about Lead paint contaminated housing, although the key informants were 'not worried' and the public was 'slightly worried.'

Natural disasters: The general public was slightly worried about Extreme weather events, and worried about Earthquakes. Earthquakes were rated third most worrying for the general public across all hazards (2.64 ± 0.17). The key informants had similar levels of worry to the public for both Earthquakes and Extreme weather events and also rated Earthquakes their third most worrying hazard (2.71 ± 0.93).

Survey Factor Comparisons

We carried out a comparative analysis on a scatter plot to visualize any potential correlations between the two chosen factors of perception within the general public:

1. Severity vs Worry
2. Likelihood of Exposure vs Worry
3. Personal LOC vs Worry
4. Personal LOC vs Government LOC

1. Severity vs Worry

How does the severity of consequences of a hazard compare to how worried the general public are in regard to the hazard?

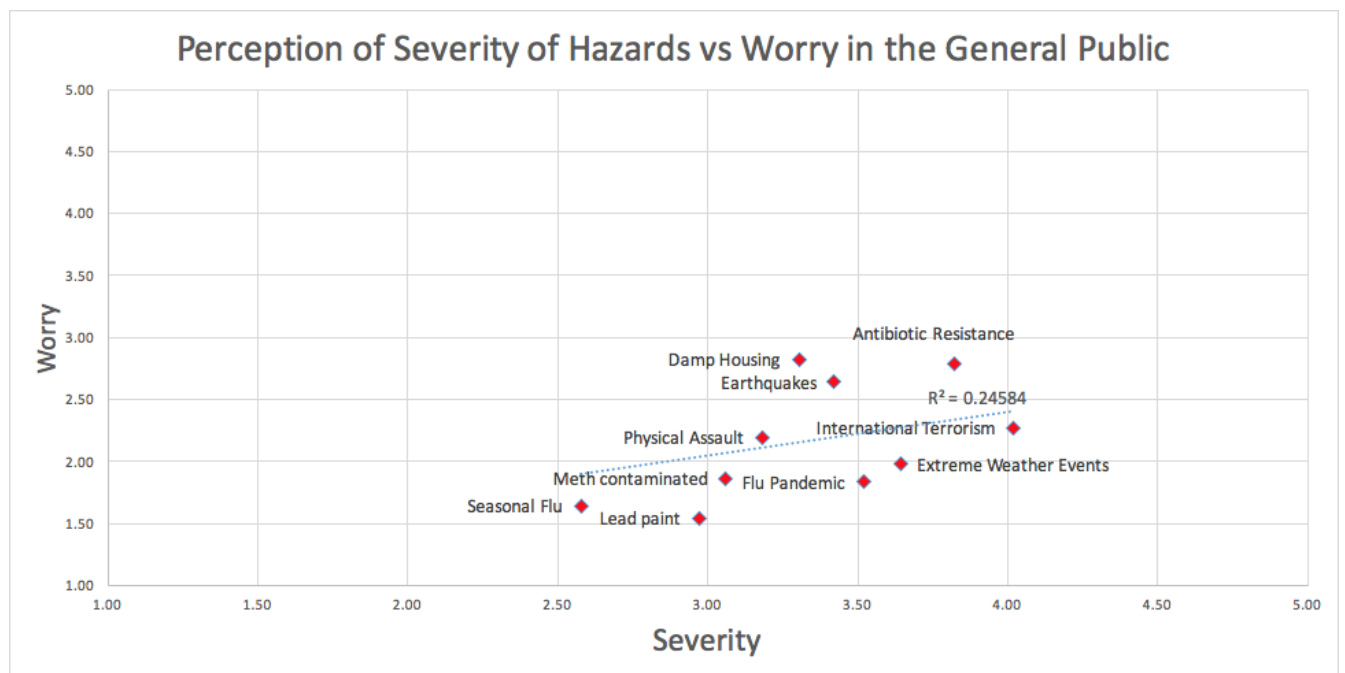


Figure 12. The Perception of Severity of Hazards vs Worry of the General Public among Ten Major Hazards. $R^2 = 0.246$ - positive regression

Perception of Severity of Hazard vs Worry in the General Public

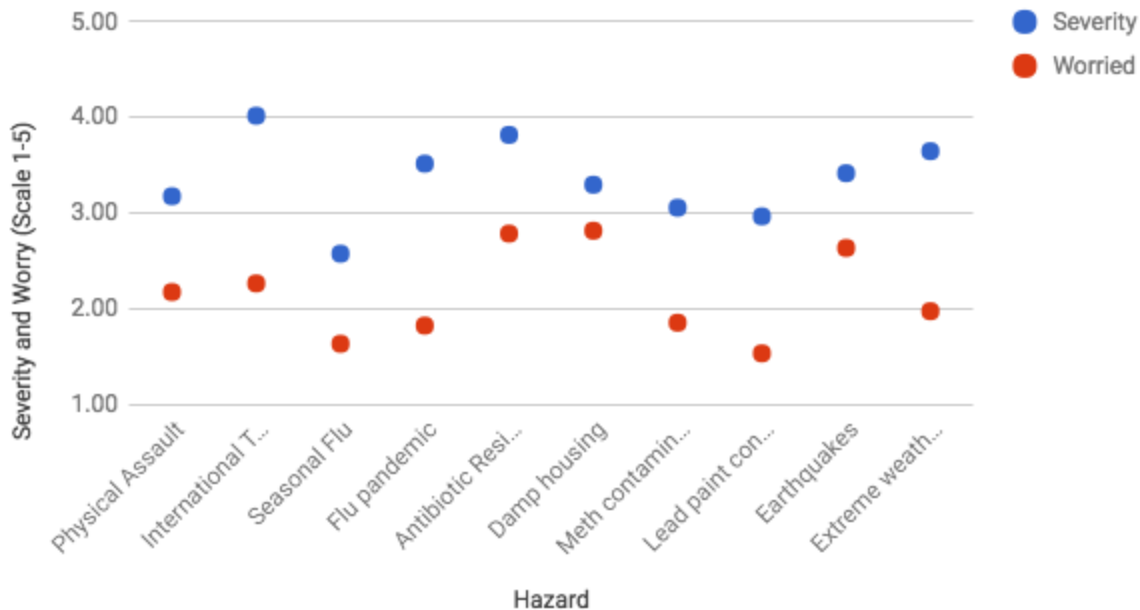


Figure 13. The Perception of Severity of Hazards vs Worry of the General Public among Ten Major Hazards

Of the ten hazards that were surveyed, all ten were perceived to have more severe consequences than the worry they induced (on a scale of 1-5). Apart from this, there was slight correlation seen between severity and worry for all ten hazards; we expected worry to increase if severity did, and this was seen in Figure 12 with the trend line showing a gradual increase and a reasonable R^2 value of 0.246 indicating that the regression model accounted for 24.6% of the variance.

Some hazards had significantly different levels of perceived severity and the worry associated with it; for example, International terrorism was seen on average as having major consequences (4.02 on scale), but on average only induced slight worry (2.27). Lead paint contaminated housing, in a similar fashion, was perceived to have moderately severe consequences (2.97), but only induced slight to no worry (1.54). The hazard that had the closest correlation between severity of consequences and worry was Damp housing, with severity of consequences being labelled as moderate (3.30), and the general public was worried (2.87).

2. Likelihood of Exposure vs Worry

How does the likelihood of exposure to a hazard compare to how worried the general public are in regard to the hazard?

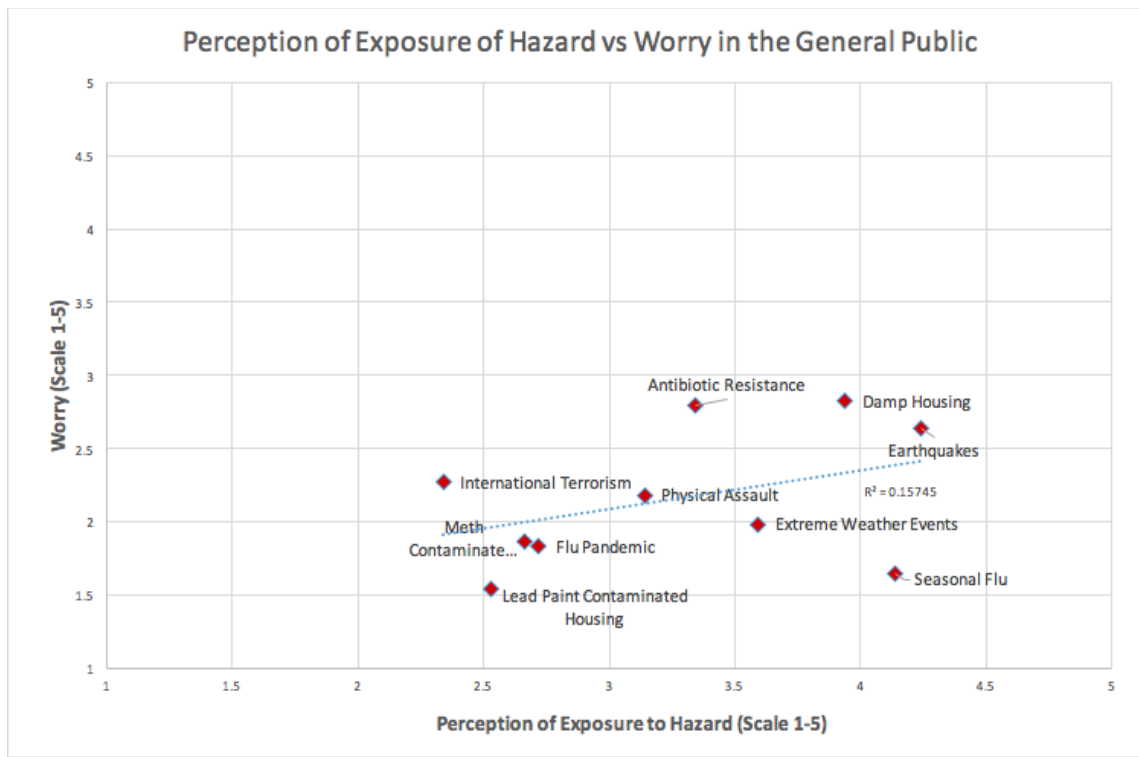


Figure 14. The Perception of Exposure of Hazards vs Worry of the General Public among Ten Major Hazards

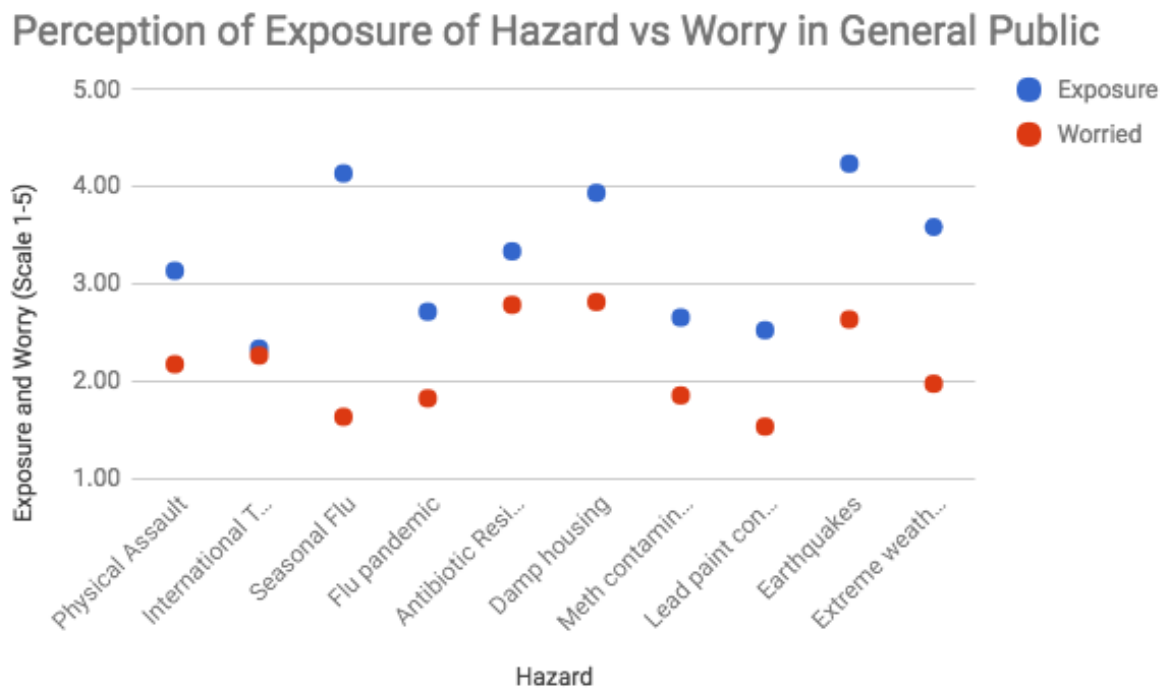


Figure 15. The Perception of Exposure of Hazards vs Worry of the General Public among Ten Major Hazards

Of the ten hazards that were surveyed, all ten were perceived to have significantly higher exposure than the worry they induced (on a scale of 1-5), apart from International terrorism in which the connection between the exposure and worry was very closely correlated. Some hazards had significantly different levels of perceived exposure and the worry associated with it; for example, Seasonal flu was seen on average as having high exposure or very likely (4.14 on scale), but on average only induced slight worry (1.64). Earthquakes, in a similar fashion, was perceived to be very likely (4.24), but rather more surprisingly only induced slight to moderate worry (2.64). The hazard that had the closest correlation between exposure and worry was International terrorism, with exposure to hazard being labelled as unlikely (2.34), and the general public were slightly worried (2.27).

Through Figure 14, we can see that as the exposure to hazard increases, there is an increase in worry- although there is only a slight correlation as the R^2 is low at 0.157, indicating that this regression model only accounts for 15.7% of the variance seen. However, it is expected that we see a low R^2 value, as we are dealing with imprecise human feelings of worry and perception of exposure as opposed to physical processes. The hazards that are furthest away from the line of best fit are Seasonal flu, with a high exposure and low worry, and Antibiotic resistance, with a higher than expected worry level for the level of exposure.

3. Personal LoC vs Worry

How does the perception of personal locus of control of a hazard compare to how worried the general public are in regard to the hazard?

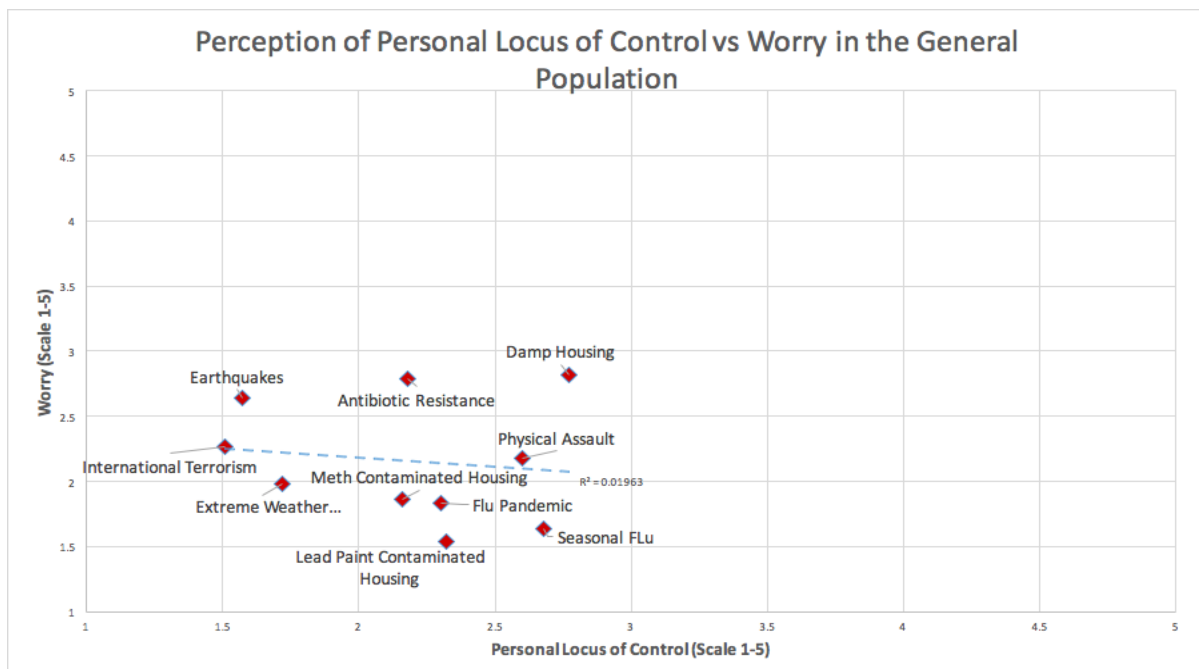


Figure 16. The Perception of Personal Locus of Control vs Worry of the General Public among Ten Major Hazards

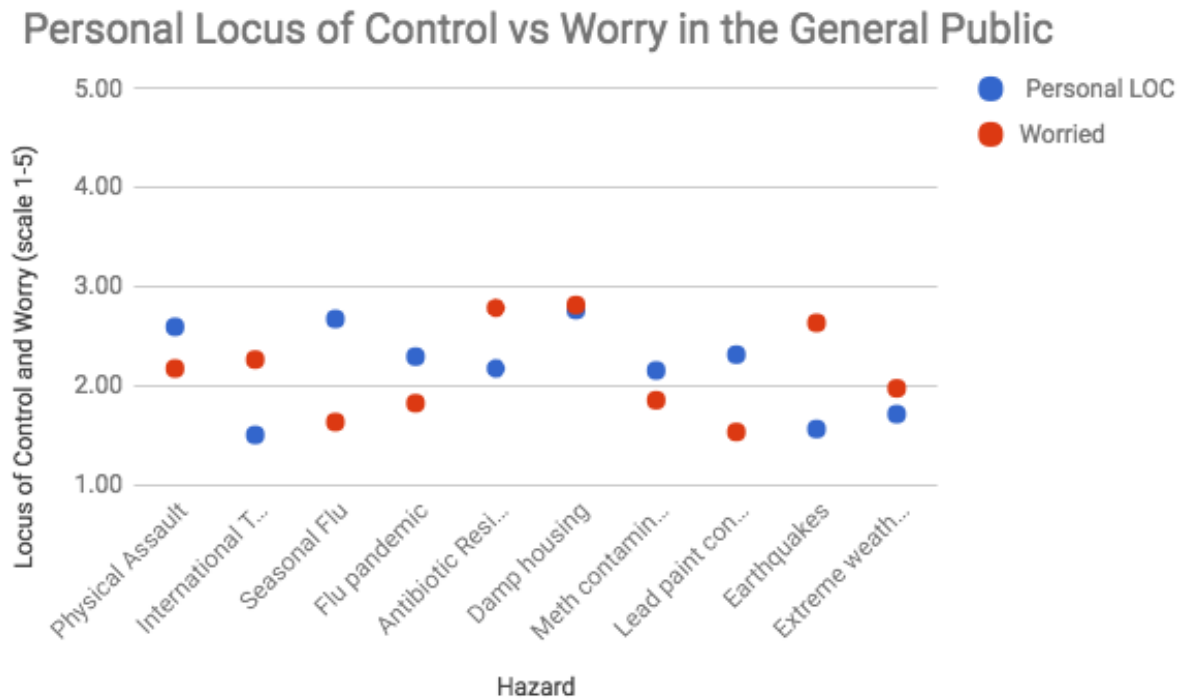


Figure 17. The Perception of Personal Locus of Control vs Worry of the General Public among Ten Major Hazards

Of the ten hazards that were surveyed, five were perceived to have higher personal locus of control (Physical Assault, Seasonal Flu, Flu Pandemic, Meth Contaminated Housing and Lead paint contaminated Housing) than the level of worry they induced, while International Terrorism, Antibiotic resistance, Earthquakes and Extreme Weather conditions all induced a higher level of worry than the perception of personal locus of control on a scale of 1-5. Damp Housing was the only hazard where there was significant correlation between the personal locus of control, and the the level of worry it induced- with personal locus of control seen as 2.77 (moderate control) and worry being seen as 2.82 (worried).

We expected to see the worry decrease as personal locus of control increased, and this was visible in our result, albeit only a very slight correlation. The line of best fit showed this, but the R^2 value was very small, with a numerical value of 0.0196, indicating that this model only accounts for 2% of the variance seen, which may be too small to come to any real conclusion.

The hazards that were furthest away from the line of best fit/trend line were Damp housing, Antibiotic resistance and Lead paint contaminated housing. Damp housing had a significantly higher worry factor associated to it (worried, although it also had a higher personal locus of control than most other hazards (moderate control), rendering it significantly displaced from the line of best fit. Antibiotic resistance was similar, being higher on the worry scale than expected- there was moderate control and yet worry was rated 2.82. Lead paint contaminated housing

registered less worry than expected according to the line of best fit, being one of the hazards that people were least worried about.

4. Personal LoC vs Government LoC

How does the level of personal control compare to level of perceived Governmental control?

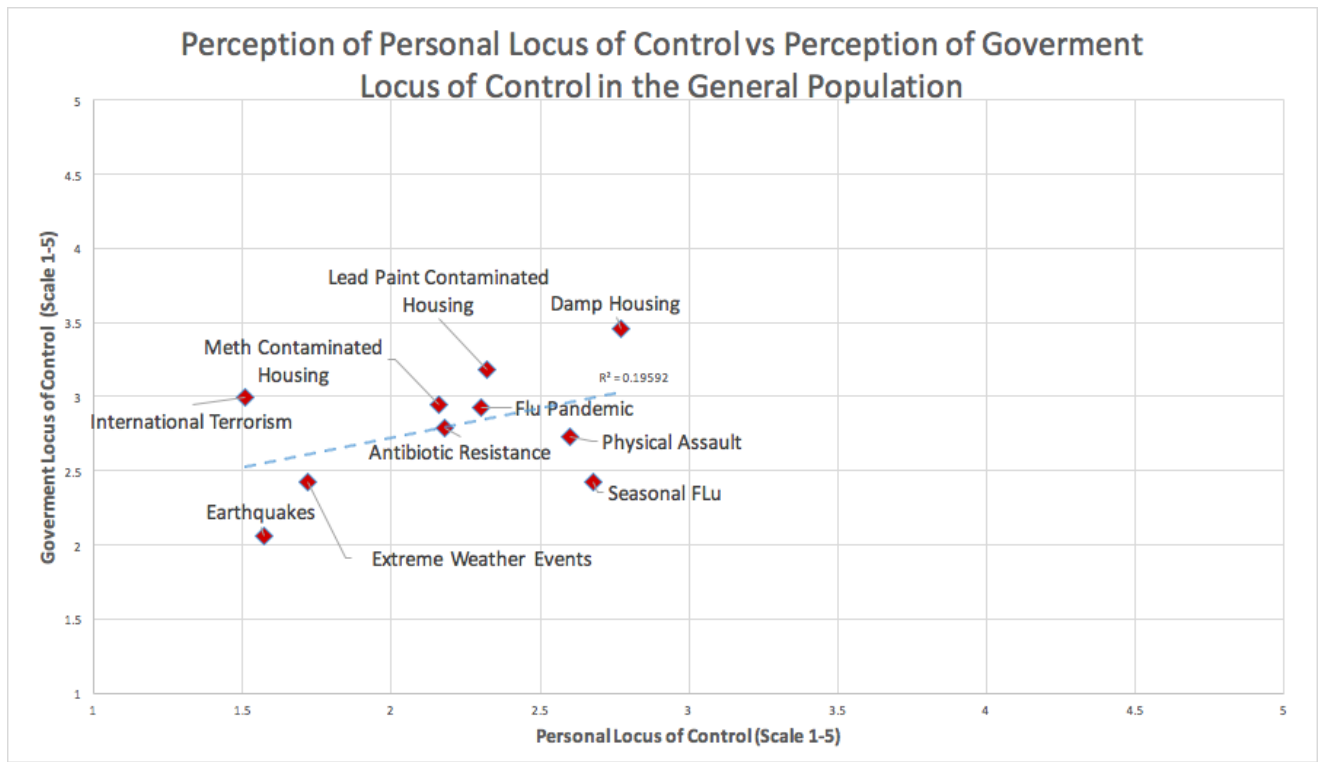


Figure 18. The Perception of Personal Locus of Control vs Perception of Government Locus of Control among Ten Major Hazards

Personal Locus of Control vs Government Locus of Control for individual hazards (General Public)

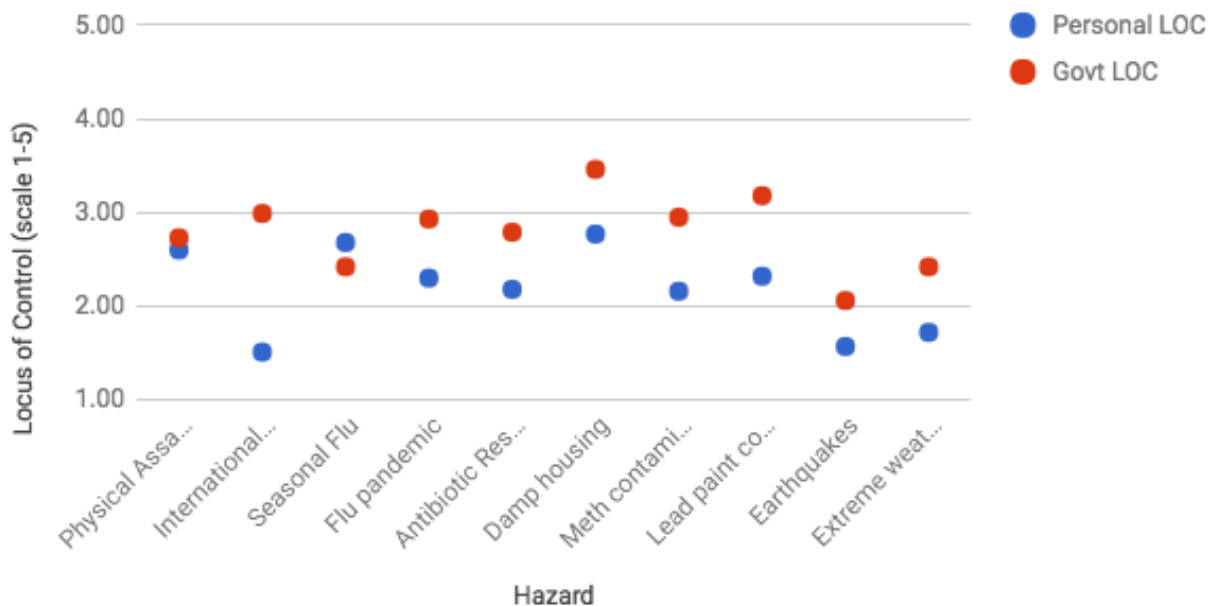


Figure 19. The Perception of Personal Locus of Control vs Perception of Government Locus of Control among Ten Major Hazards

Of the ten hazards that were surveyed, the general public thought that the government locus of control was higher than personal locus of control for every hazard apart from Seasonal flu, for which personal locus of control was slightly higher. The difference in personal locus of control and government was very minor for Physical assault, with the general public thinking that the government and themselves have little to moderate control.

As the personal locus of control increased, so did the government locus of control with a positive gradient trend line although the hazards themselves weren't particularly close to the line of best fit. The R^2 value was 0.196 and indicated that 20% of variation was accounted by this regression model. This could be a bidirectional relationship, wherein the increased government locus of control meant that people also felt like they had more power, or when people felt like they had more control, they believed that the government would as well. It could also be solely due to the nature of the hazard itself; with people believing that Seasonal flu was under their control more than the government.

The hazards that were furthest away from the line of best fit/trend line were Damp housing, Seasonal flu, and International Terrorism. Damp housing and International terrorism had a significantly higher government locus of control compared to the line of best fit indicating and the personal locus of control. Seasonal flu as mentioned earlier had a lower government locus of control than expected on line of best fit.

Data Stratification

Survey results were stratified into different demographic groups of gender, ethnicity and age to identify any differences within the subcategory of those groups. We carried out independent t-tests to see if any differences seen were statistically significant.

Gender: Males vs Females

We stratified the data collected from the general public by gender to see if there were any significant differences between males and females in how they ranked our hazards. We thought there would be some interesting variation in the way males and females perceived hazards such as Physical assault. We used column charts with side-by-side gender comparisons to compare the results for each of our survey questions, and calculated 95% confidence intervals and p-values for each to find out whether the differences were significant.

Likelihood of Exposure:

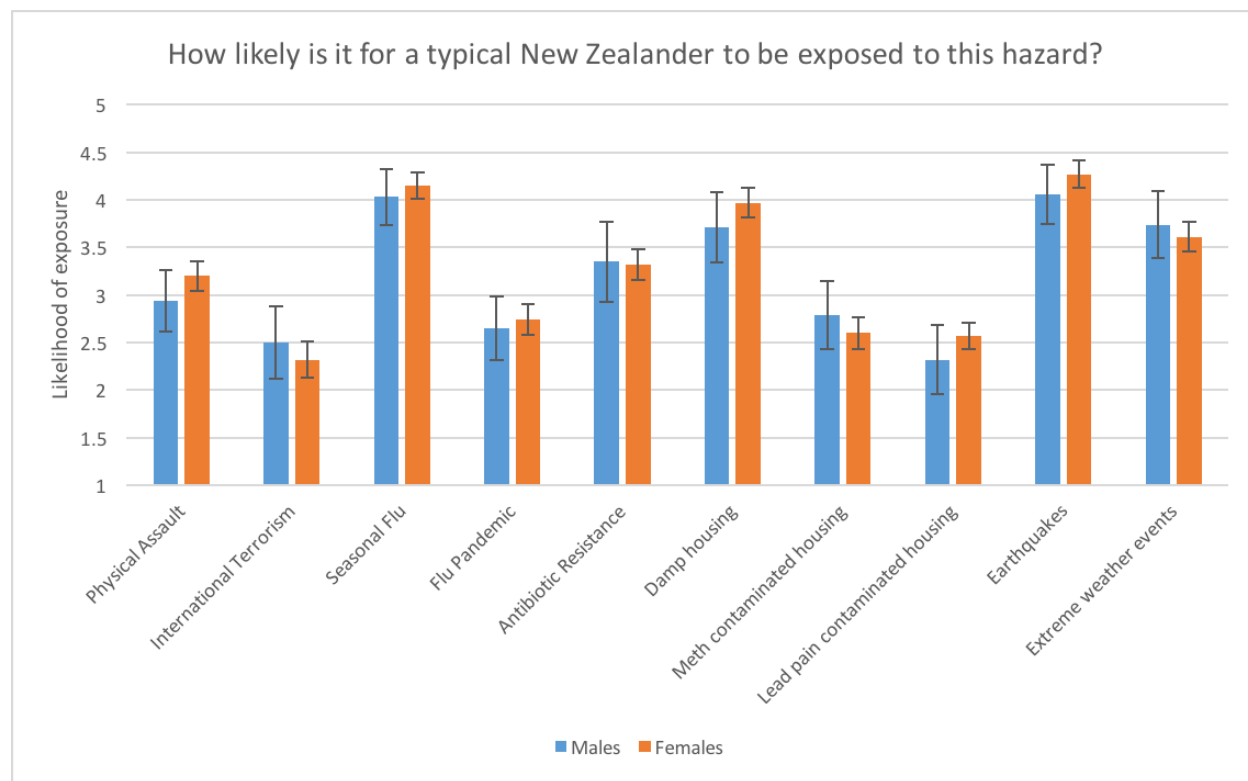


Figure 20. Male and Female Perception of Likelihood of Exposure to Hazards

Males and females had very similar responses to the question, How likely is it for a typical New Zealander to be exposed to this hazard? There were no significant differences in their perception of how likely these hazards were to occur.

Severity of Consequences:

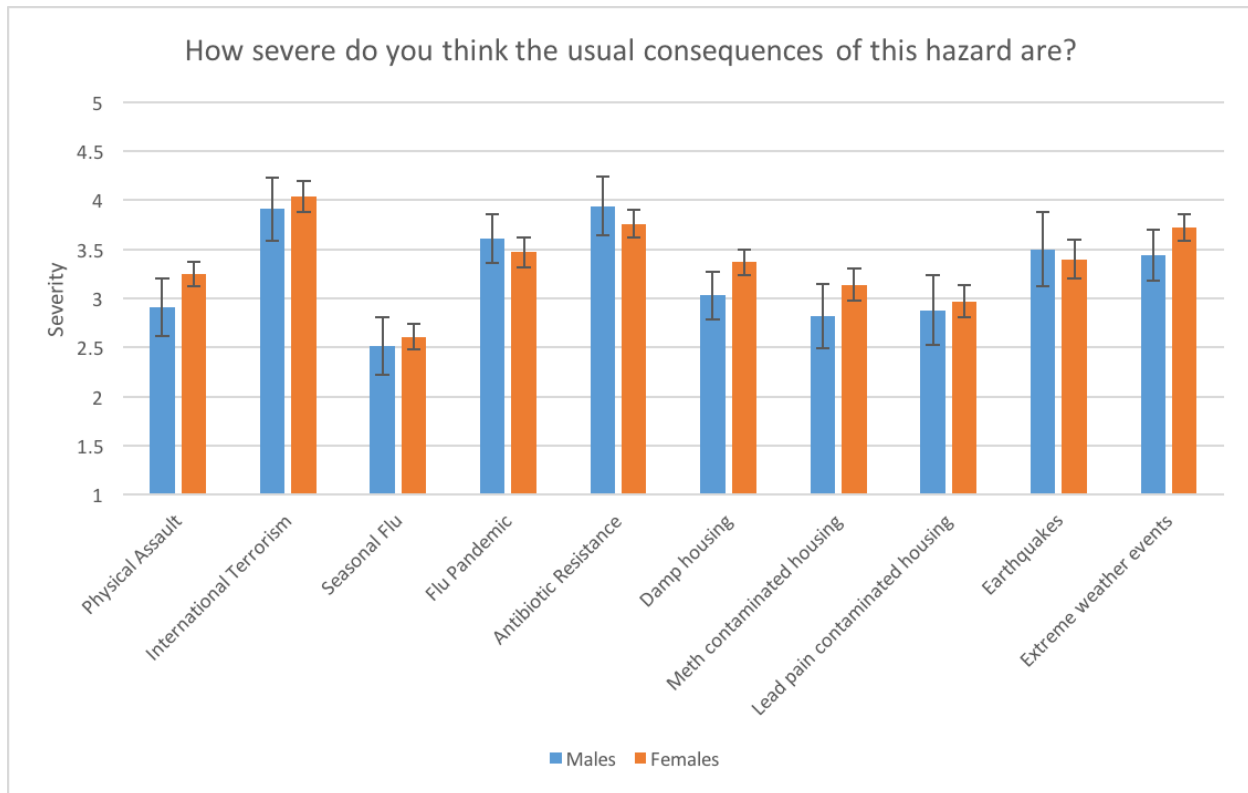


Figure 21. Male and Female Perception of Severity of Consequences of Hazards

Across all of the hazards, females ranked the level of severity higher than males for all except Flu pandemics and Earthquakes. Females thought that Damp housing, Meth contaminated houses and Physical assault were significantly more severe than males did. However, these differences did not work out to be statistically significant when confidence intervals were calculated.

Personal Locus of Control:

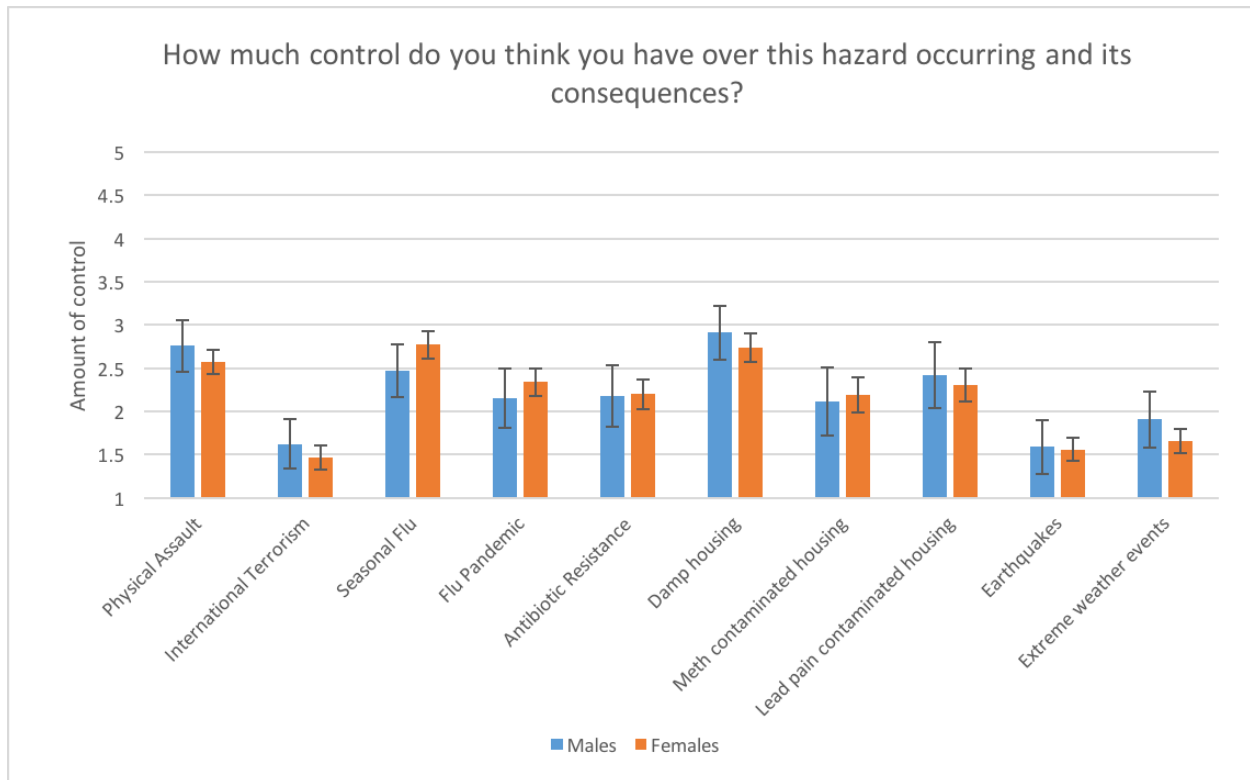


Figure 22. Male and Female Perception of Locus of Control of Hazards

Males thought they had greater personal control over Physical assault, International terrorism, Damp housing and extreme weather events, whereas females thought they had greater control over Seasonal flu and Flu pandemics. These differences were not statistically significant when the confidence intervals were compared.

Government Control:

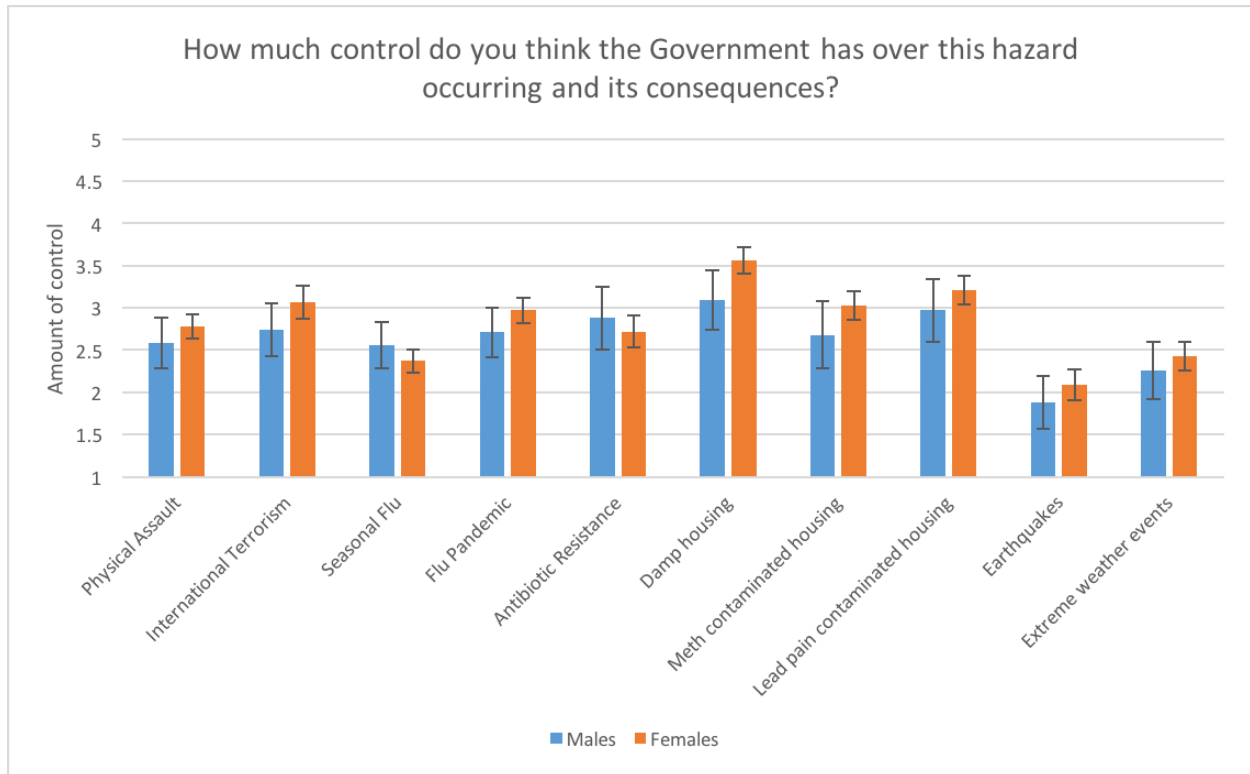


Figure 23. Male and Female Perception of Government Control over Hazards

Overall, females seemed to think that the Government had more control over the hazards and their consequences than males did, although these difference were not all statistically significant. Females rated government control over Damp housing 'high' (3.56 ± 0.16) whereas males rated Government control 'moderate' (3.09 ± 0.36). The p-value for this comparison was 0.01.

Level of Worry:

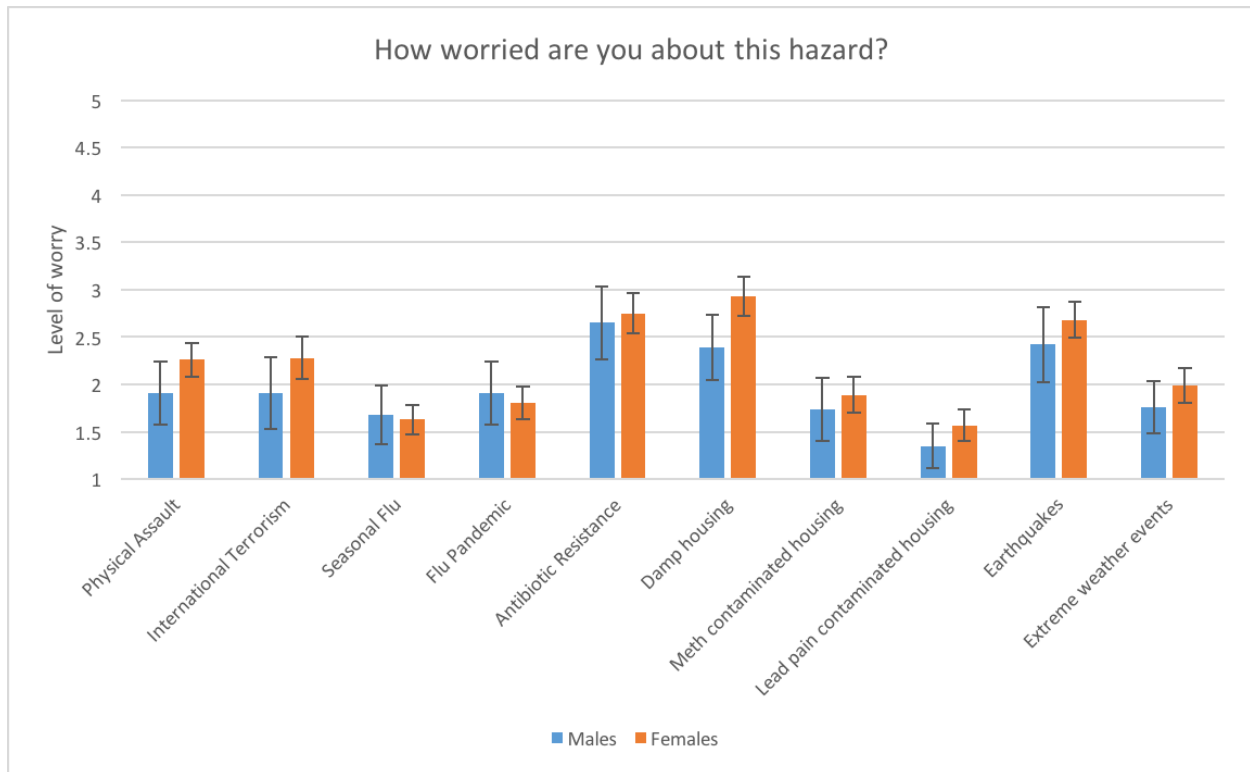


Figure 24. Male and Female Perception of Level of Worry about Hazards

Females were more worried than males for every hazard except seasonal flu and flu pandemics. However, when the confidence intervals for these difference in levels of worry were calculated, they were not statistically significant.

Ethnicity: Māori vs Non-Māori

We stratified the data collected from the general public by ethnicity to see if there were any significant differences between Māori and non-Māori in how they ranked our hazards. We used column charts with side-by-side ethnicity comparisons to compare the results for each of our survey questions, and calculated 95% confidence intervals and p-values for each to find out whether the differences were significant.

Likelihood of Exposure:

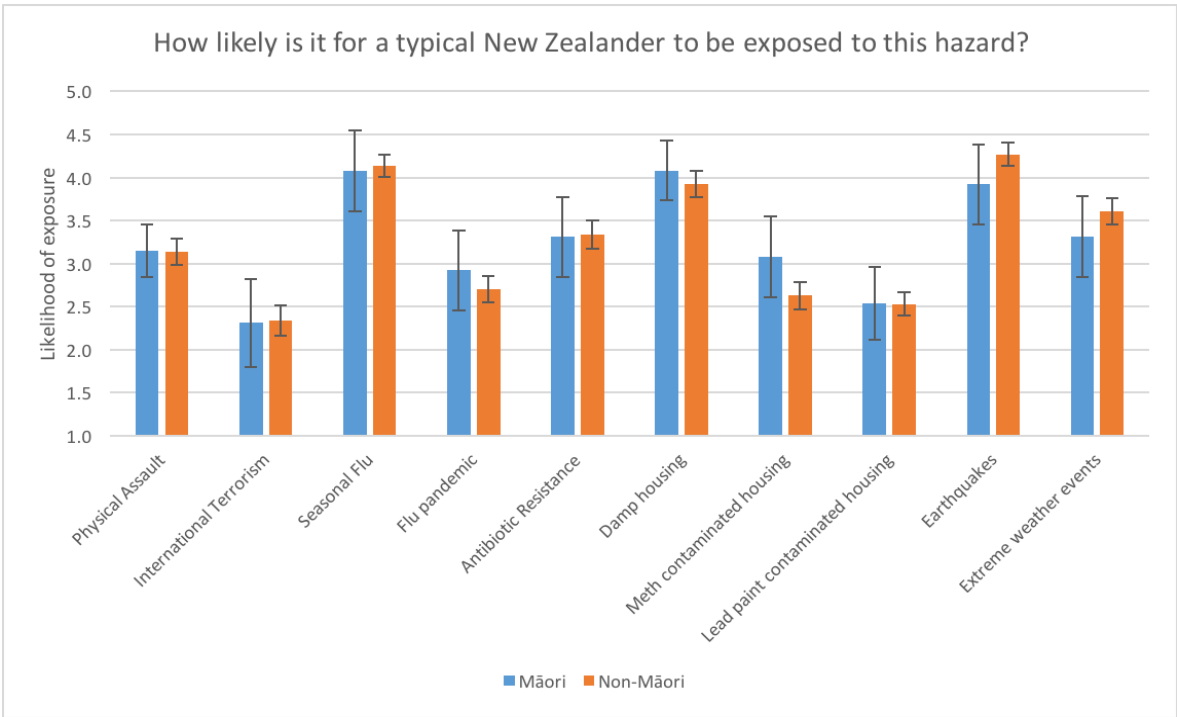


Figure 25. Māori and Non-Māori Perception of Likelihood of Exposure to Hazards

No statistically significant differences was found between Māori and Non-Māori perception of the likelihood to be exposed to each of the 10 hazards.

Severity of Consequences:

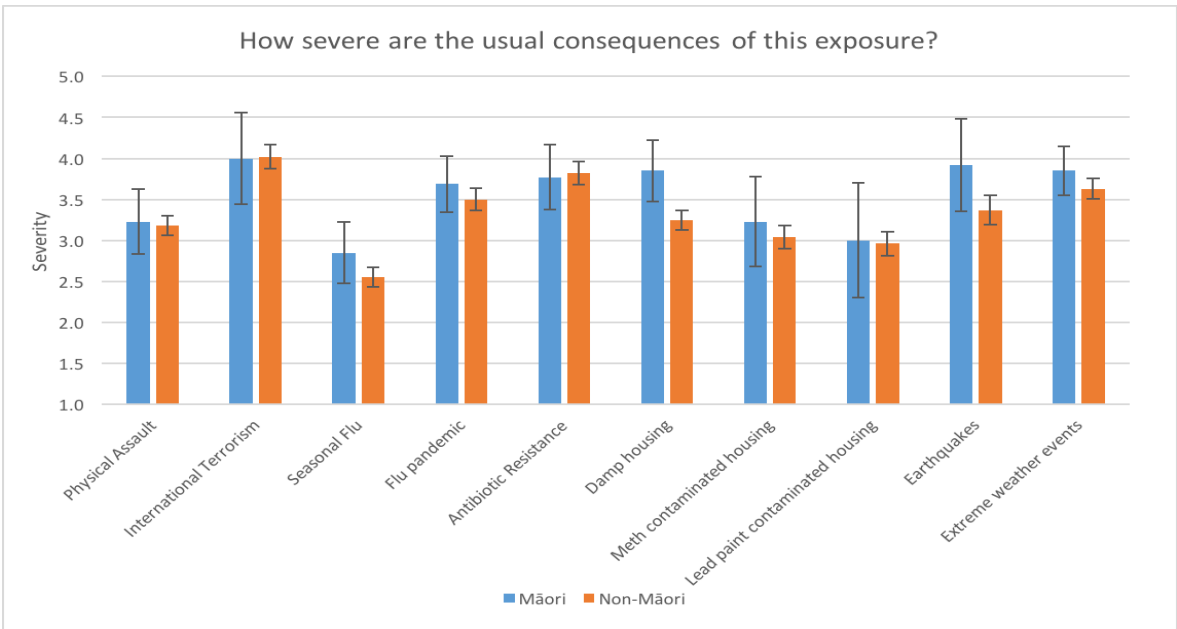


Figure 26. Māori and Non-Māori Perception of Severity of Consequences of Hazards

The mean Māori perception of the usual consequences of Damp housing (3.85 ± 0.375 ; 95% CI) is more severe than Non-Māori perception of the usual consequences of Damp housing (3.25 ± 0.118 ; 95% CI). This is a statistically significant difference ($p\text{-value} = 0.0049$) where $p < 0.05$ is considered significant. All other perception of the usual consequences to the hazards showed no statistically significant differences between Māori and Non-Māori.

Personal Locus of Control:

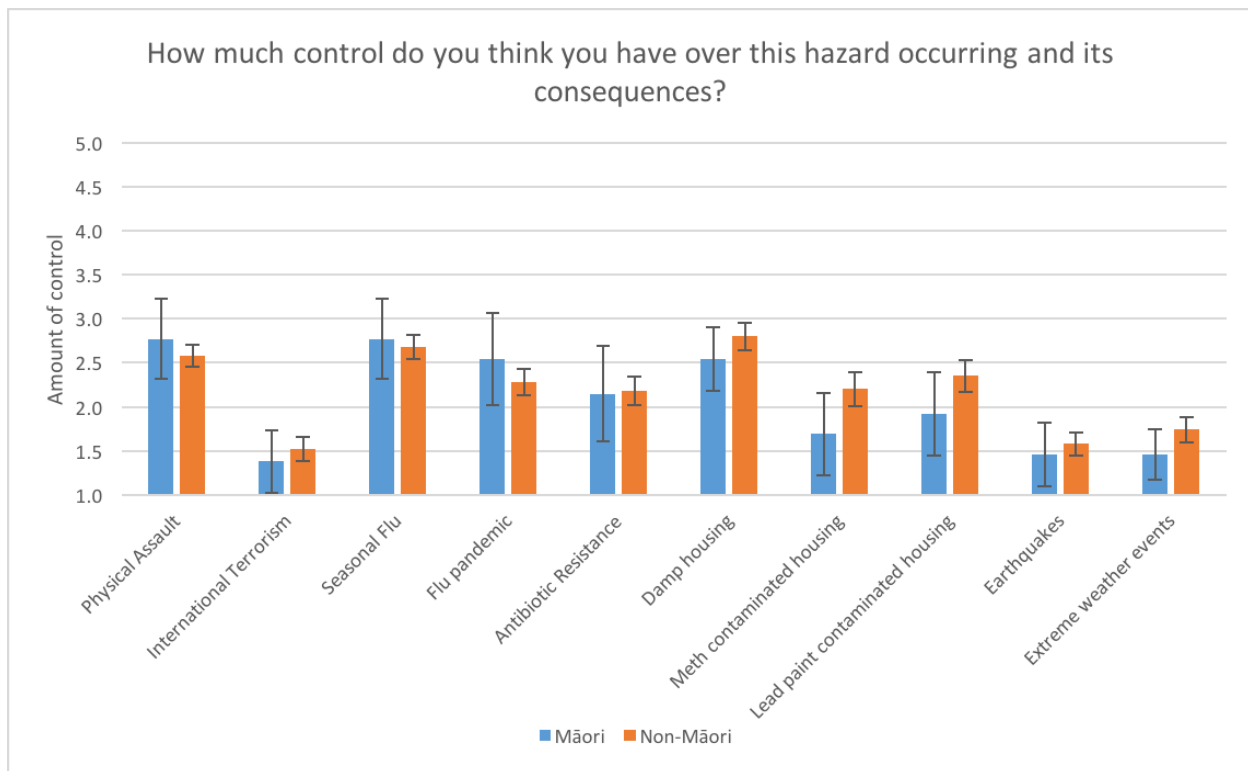


Figure 26. Māori and Non-Māori Perception of Severity of Consequences of Hazards

No statistically significant differences was found between Māori and Non-Māori perception of their own locus of control over the 10 hazards.

Government Control:

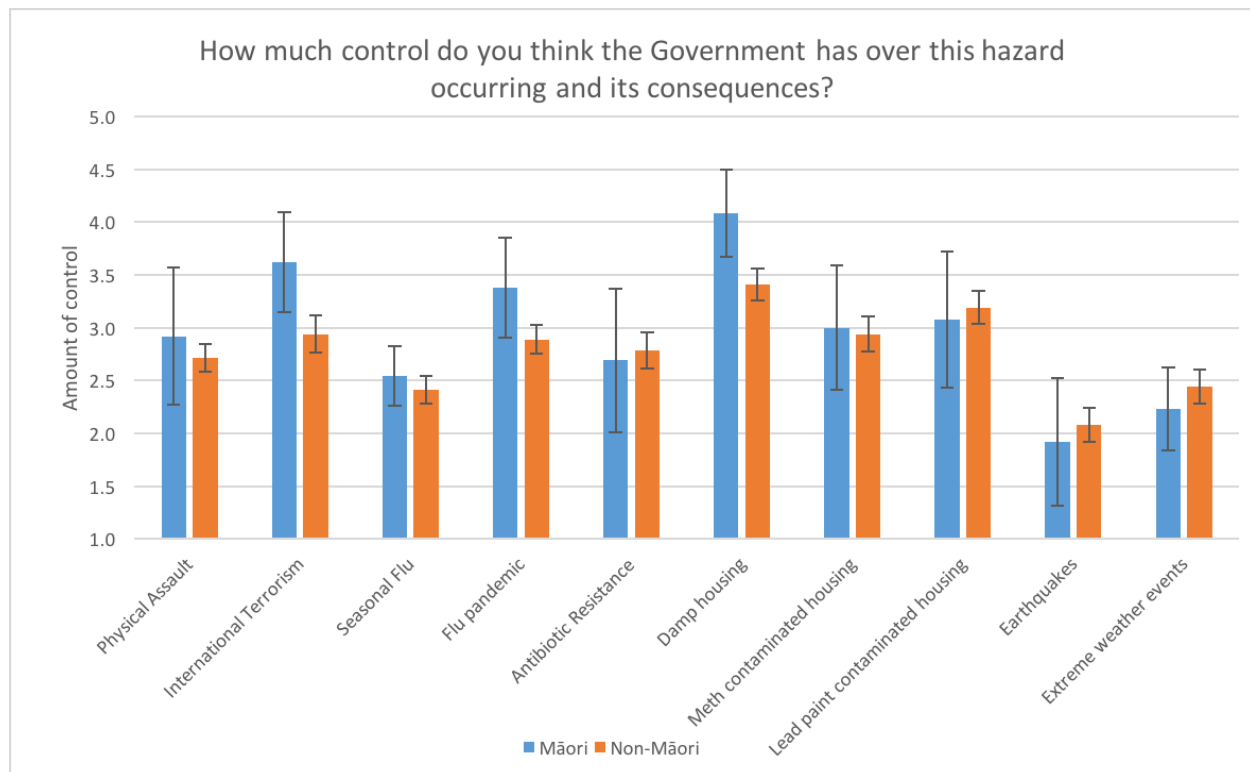


Figure 28. Māori and Non-Māori Perception of Government Control over Hazards

The mean Māori perception of government control of International terrorism, Flu pandemic and Damp housing (3.62 ± 0.473 , 3.38 ± 0.473 and 4.08 ± 0.413 respectively; 95% CI) is higher than the mean Non-Māori perception of these hazards (2.94 ± 0.173 , 2.89 ± 0.140 and 3.41 ± 0.152 respectively; 95% CI). These are statistically significant differences (p -value = 0.0253, 0.0459 and 0.0124) where $p < 0.05$ is considered significant. All other hazards showed no statistically significant differences between Māori and Non-Māori.

Level of Worry:

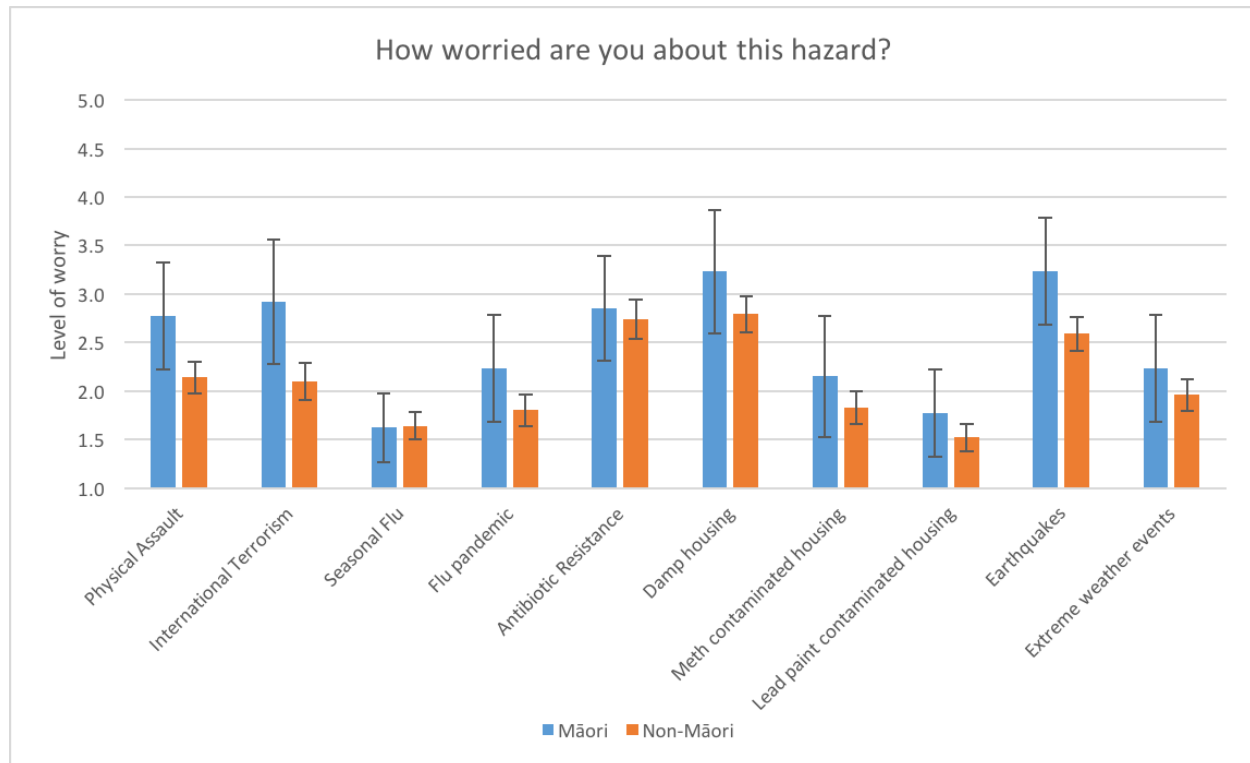


Figure 29: Māori and Non-Māori Perception of Level of Worry about Hazards

The mean Māori worriedness over Physical Assault, International terrorism and Earthquakes (2.77 ± 0.551 and 3.23 ± 0.551 respectively; 95% CI) was higher than mean Non-Māori worriedness (2.14 ± 0.162 and 2.59 ± 0.174 respectively; 95% CI). These are statistically significant differences ($p\text{-value} = 0.0298$ and 0.0370) where $p < 0.05$ is considered significant. All other hazards showed no statistically significant differences between Māori and Non-Māori.

Age: Under 25, 26-40, Over 40

The data collected from the general public was also stratified by age; in order to discern differences in hazard perceptions between different age groups in this study sample. The age groups were divided into five groups when undertaking the survey: under 18, 19-25, 26-40, 41-65, and over 65 years of age. For the purpose of easier comprehension of the observed graphical differences between the age groups, we combined the data for under 18 years with 19-25 years to form the under 25 age group, and 41-65 years with over 65 years to form the over 40 age group. This achieved three age groups for analysis; under 25, 26-40, and over 40.

The column charts depicts the responses of the age groups to the five questions proposed in our survey, grouped to each hazard accordingly. The vertical axis shows incremental numerical values (Likert scale 1-5) of the general public groups' mean perception for each dimension of our survey. We calculated 95% confidence intervals to compare differences between the three

age groups, as shown by the error bars below. Sample t-tests were unable to be conducted due to the nature of three age groups as opposed to two, and thus p-values did not apply in this case of stratification. Due to time constraints, a one-way ANOVA (to determine whether there are any statistically significant differences between the means of two or more independent groups) was not conducted.

As the stratified age groups were of different sizes in number of participants, the confidence intervals are large in width for two of the age groups, namely 26-40 and over 40 age groups. This accounts for greater uncertainty of the estimate of the true parameter. Hence, descriptions of the perceptions of these smaller sized age groups on the five questions of the survey are less valid, if commented at all.

Likelihood of Exposure:

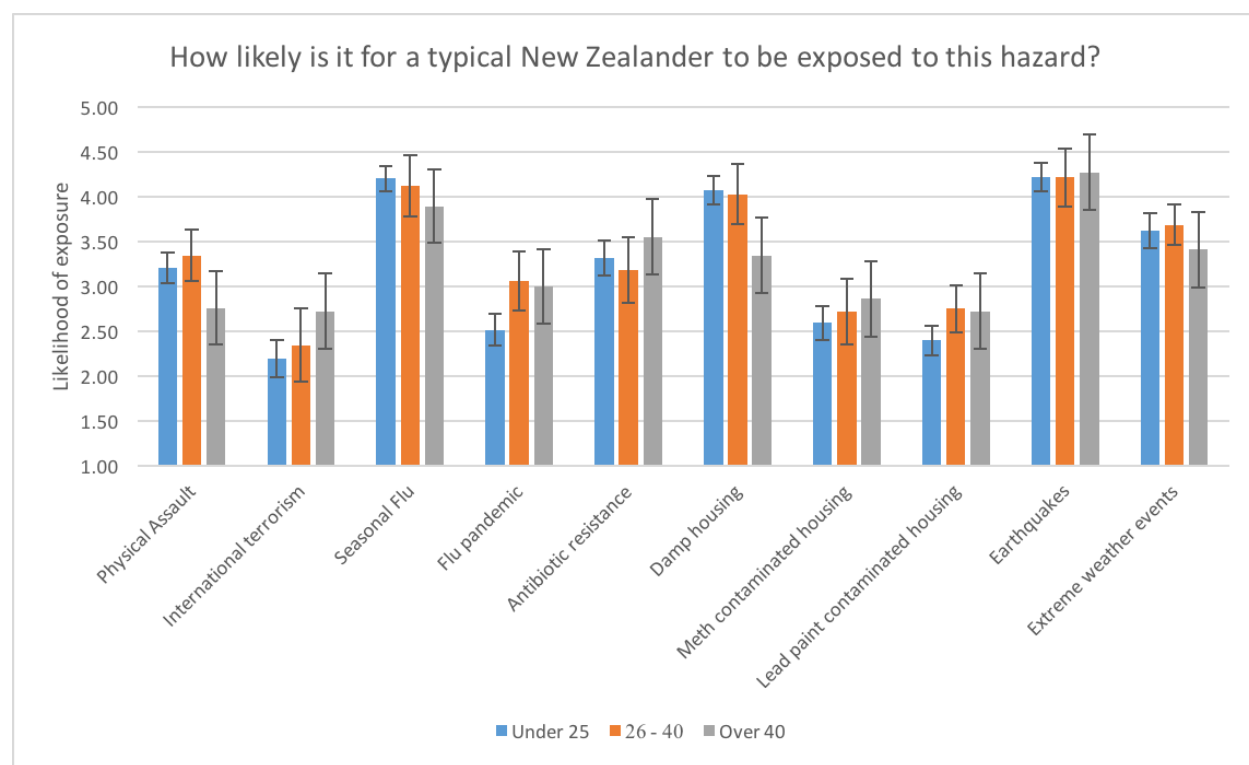


Figure 30. Age Stratified Perception of Likelihood of Exposure to Hazards

Damp housing is a hazard in which there were apparent differences in perception between the groups; on average, the under 25 age group perceived the exposure of Damp housing to be greater at 4.08 ± 0.16 (CI 95%) for likelihood of exposure, whereas the over 40 age group perceived it being 3.34 ± 0.42 (CI 95%) for likelihood. The confidence intervals did not overlap, and therefore we can confirm a statistical difference in perception between the under 25 and the over 40 age group.

International Terrorism was one of the hazards with the least likelihood of exposure ranked by the under 25 (2.2 ± 0.21 ; CI 95%), which can be translated as 'unlikely'. The other hazards that were considered to be low in likelihood of exposure in the under 25 group were Flu pandemic (2.52 ± 0.17 ; CI 95%), Meth-contaminated housing (2.59 ± 0.19 ; CI 95%), and Lead-contaminated housing (2.4 ± 0.16 ; CI 95%).

Severity of Consequences:

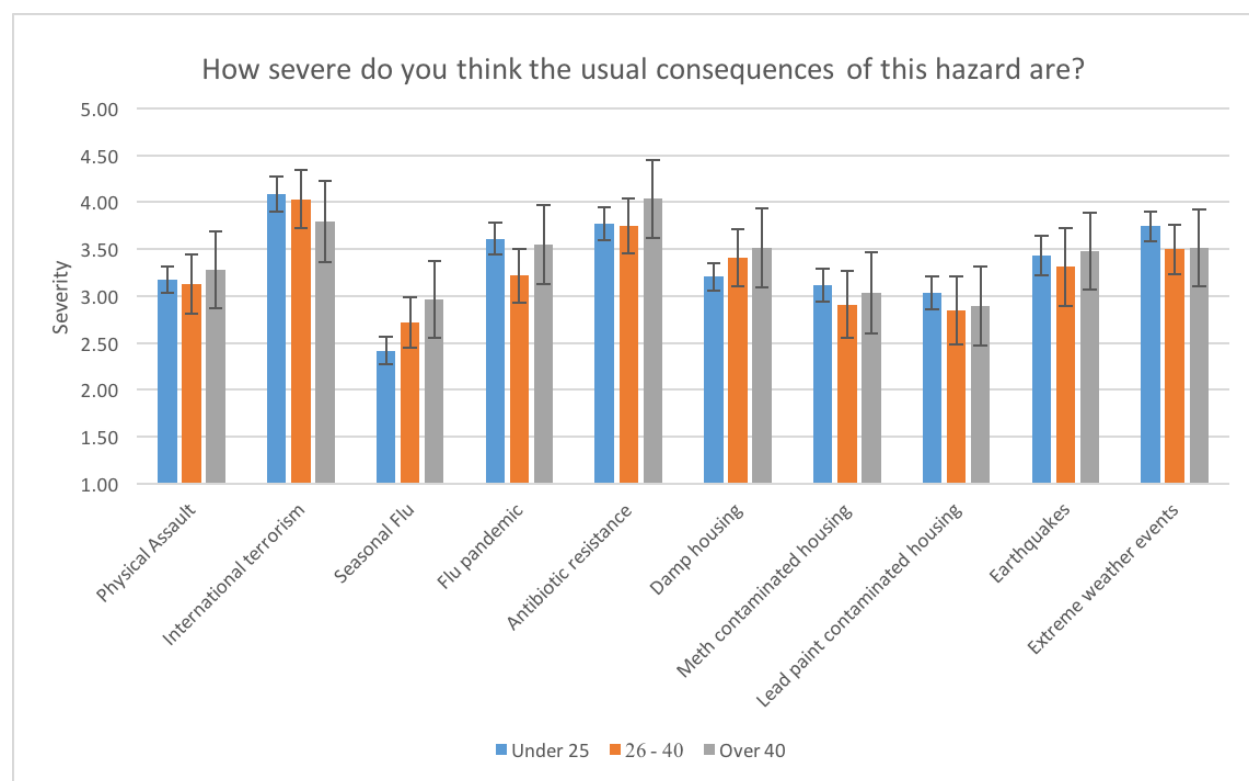


Figure 31. Age Stratified Perception of Severity of Consequences of Hazards

There were no statistically significant differences in the mean perception of the level severity of consequences for each of the ten hazards in the three age groups, shown by the overlapping of the confidence intervals.

The severity of the consequences of international terrorism was ranked the highest by the groups under 25 years with a mean perception of severity of 4.09 ± 0.18 (CI 95%; 'major'). There is however overlap with the under 25 confidence intervals of Antibiotic resistance (3.77 ± 0.18 ; CI 95%) and Extreme weather events (3.74 ± 0.16 ; CI 95%). The under 25 age group considered Seasonal flu as having the least severity of consequences, with a mean perception of severity of 2.42 ± 0.14 (CI 95%; between 'minor' and 'moderate' in severity). The confidence intervals of the other age groups are too wide to make appropriate inferences on what hazards they considered to be of major and minor severity.

Personal Locus of Control:

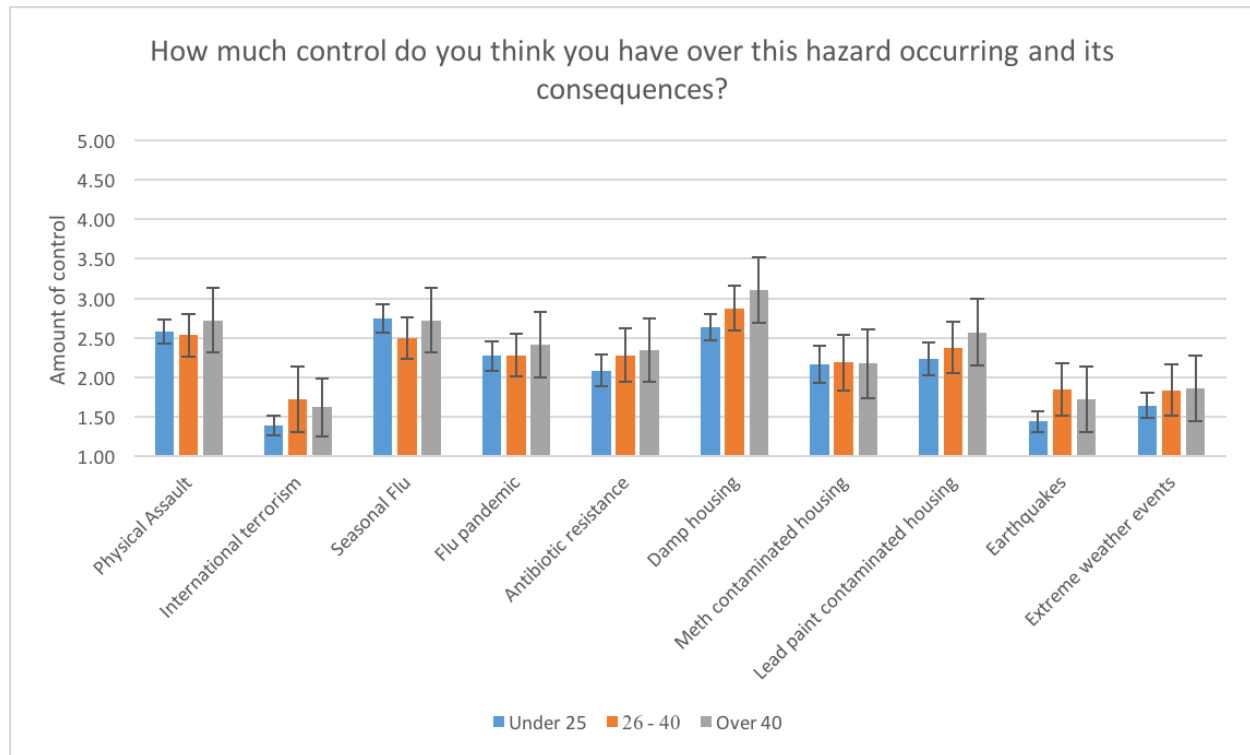


Figure 32. Age Stratified Perception of Locus of Control over Hazards

There were no statistically significant differences in the mean perception of the amount of personal control over each hazard and its consequences between the three stratified age groups.

The under 25 age group thought that they had the highest control over Seasonal flu and its consequences (2.74 ± 0.18 ; CI 95%), but this overlaps with the confidence intervals of Damp housing (2.63 ± 0.17 ; CI 95%) and Physical assault (2.58 ± 0.15 ; CI 95%).

International terrorism (1.39 ± 0.12 ; CI 95%), Earthquakes (1.44 ± 0.13 ; CI 95%), and Extreme weather conditions (1.65 ± 0.16 ; CI 95%) were the three hazards that the under 25 age group consider themselves having least control over - with the mean amount of control <2 for all the groups (between 'no control' and 'little control'). The confidence intervals of the perceptions of LOC for these three hazards in the under 25 age group do not overlap with the confidence intervals other hazards, therefore we are able to interpret that these are the hazards the under 25 age group thought they had least control over.

Government Control:

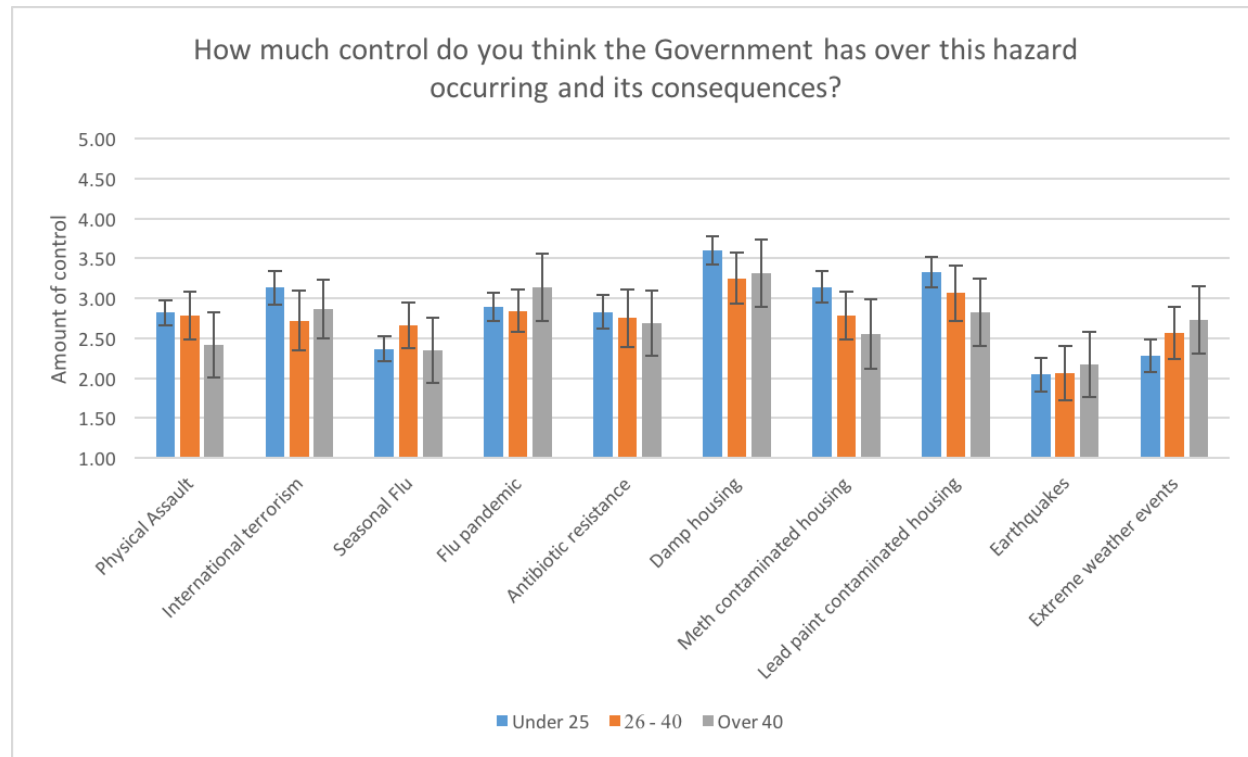


Figure 33. Age Stratified Perception of Government Control over Hazards

There were no statistically significant differences in the mean perception of the amount of government control for each hazard and its consequences between the three stratified age groups. The groups were rather synchronous in their perception of the amount of government control for each hazard.

The under 25 age group thought that the government has greatest control over Damp housing, with the mean perception of amount of control as 3.60 ± 0.18 (CI 95%; 'moderate control' to 'high control'). There is some overlap with mean perception of government control over Lead paint contaminated housing (3.33 ± 0.19 ; CI 95%), and therefore we cannot conclude that the true population of under 25 year-olds think that Damp housing being the hazard with the greatest government control.

The under 25 and 26-40 year olds ranked Earthquakes as the hazard that the government had the least control over it happening and its consequences, 2.04 ± 0.21 (CI 95%), and 2.06 ± 0.34 (CI 95%) respectively. This translates to 'little control' the government has over Earthquakes. For both these groups, however, the 95% confidence interval for government control of Earthquakes overlapped with that of Extreme weather events, and therefore we cannot conclude on its statistical significance.

Level of Worry:

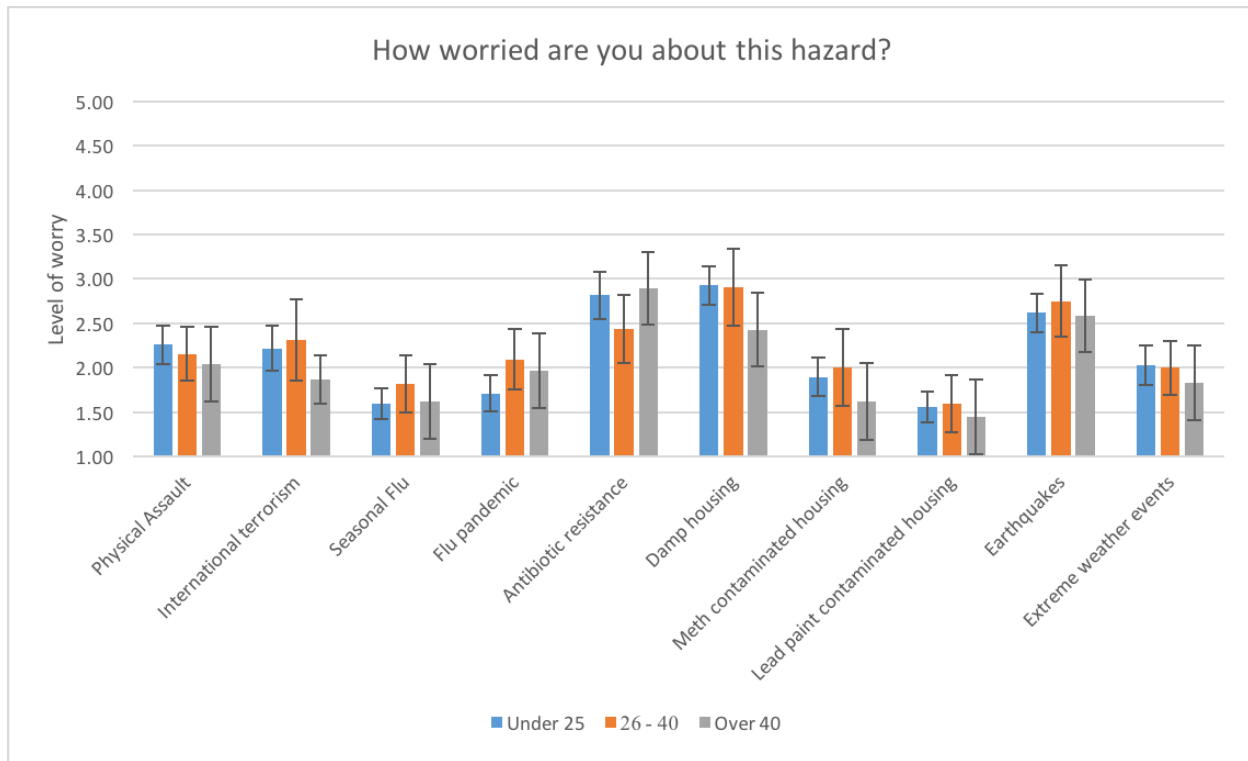


Figure 34: Age Stratified Perception of Level of Worry about Hazards

There were no statistically significant differences in amount of worry for each hazard and its consequences between the three stratified age groups. The presence of multiple confidence interval overlaps in the three age groups' worry for each hazard, and such overlaps within age groups for different hazards, mean that it is impossible to give a hierarchical ranking to the hazards in order of greatest concern to least concern for each age group.

The hazards that the age group under 25 were most worried about include Damp housing (2.92 ± 0.22), Antibiotic resistance (2.82 ± 0.26), and Earthquakes (2.62 ± 0.22). This indicates that they are 'slightly worried' or 'worried' in regard to these hazards. Seasonal flu (1.59 ± 0.17) and Lead paint contaminated housing (1.56 ± 0.17) were two hazards that the age group under 25 are least worried about, which can be deciphered as between 'not worried' and 'slightly worried'. The precise order of these hazards by level of worry is, however, affected by the overlapping confidence intervals and the uncertainty of statistical significance.

Qualitative Results Analysis

Key Informant Interviews

For the qualitative part of our research, we interviewed six key informants who worked in various roles which gave them an expert knowledge of health hazards facing New Zealand and how we currently manage those hazards. We analysed the qualitative data from our interviews with these key informants and chose nine themes which we found ran throughout the various interviews.

The themes are:

- General public understanding and discrepancies in the perception of health hazards
- Personal control over hazard effects
- Inequalities
- Emerging hazards
- Influences on hazards chosen to focus on
- Is enough being done currently?
- Reactive vs proactive response to hazards
- Fear of the unknown
- Recommendations for the future

Thematic Analysis

Theme 1: General public understanding and discrepancies in the perception of health hazards

A common theme that emerged from these interviews is that none of the key informants believed that the general public had a realistic understanding of the human health hazards. Answers ranged from 'Most New Zealanders don't have a clue' to 'Probably not'. One of our informants used chlorinated water as an example, as how there are people who think the risk associated with chlorinating water is higher than without chlorination, which is incorrect.

Another key informant mentioned that media and social media are the sole drivers of perception of risk, and thus what the public think is vastly influenced by misleading information published by media for headlines.

Additionally, an idea that was mentioned was how 'intangible concepts' aren't understood as well; an example of this is climate change. Intangible risks are risks where we don't see direct associations and thus people don't think it's a problem/or will be affected by it.

It was also said that individual circumstances shape a person's perception of risk- risks are different based on a whole range of things with SES being a main aspect; so if you're rich and well housed, things like housing issues and physical violence may not be of huge concern to them.

A key informant mentioned that risk perception is skewed also in health professionals - apparently 600 GPs attended a conference to hear about Ebola, when realistically none or very

few of them would have seen it in their practice. It's difficult when there is a disproportionate interest in certain risks.

Quotes from the key informants...

"Clearly don't understand risks"

Key informant 6

"If you look at climate change, most people don't... it's an intangible concept. They don't know how it affects them and a lot of them don't think they will be affected by it. But if you look at Wellington weather, we have got it now"

Key informant 4

"If you've grown up in a nice house and in a flash area then your understanding of the way in which poor housing can affect you, you know you might not understand that."

Key informant 3

"There's a lot of she'll be right"

Key informant 2

Theme 2: Personal control over hazard effects

The key informants work at different health specialities in regards to public health. They shared similar views that the general public have the ability to prepare for hazards individually as a way to exercise their own locus of control. However, the general public usually choose not to prepare for hazards at all or not well enough due to a lack of understanding of the risks and severity of the hazards, or that they just do not wish to do so. Although they can be prepared for the consequences of the hazards, one key informant commented that individuals in the general public usually do not have control over the hazard occurring.

Quotes from the key informants...

"People focus on very abstract risks and quite often the more gruesome and more horrible they are, the more focused they are going to be [on them] rather than those that are actually going to affect or impact them."

- Key informant 2

"There are some that they could control, which they don't, and just accept, and there are other hazards which they get very upset and worried about, which they don't need to worry about."

- Key informant 5

Theme 3: Inequalities

There was a general consensus amongst the key informants that lower SES groups were disadvantaged in terms of preparedness and exposure to health hazards. With lower incomes and hence disposable income, lower SES groups have greater difficulty in buying necessities to

prepare for certain hazards. Furthermore, they have poorer access to treatment and are also more likely to live in poorer conditions that put their health at risk. Ethnic inequalities was also brought up by one key informant however this was not explored further and the focus remained on low SES groups. One key informant mentioned that the Ministry of Health is aware of the issues surrounding inequality, however other agencies may be less aware and willing to work on these issues.

Quotes from the key informants...

“Unsurprisingly the correlation would be with lower socioeconomic groups that don't have that opportunity to have some of the elements of personal preparedness because they're living almost hand-to-mouth, day to day”

- Key informant 2

“Disadvantaged populations live in worse quality houses. There have been efforts to make landlords insulate, to provide clean heat, there have been changes in legislation but we know there are huge numbers of people in poor quality, damp houses.”

- Key informant 5

Theme 4: Emerging hazards

There was a general consensus among the key informants that 'climate change' would be one of the major emerging hazards. They were agreeing on the fact that climate change would lead to numerous other detrimental hazards. Some have mentioned that it is already on the government's radar but needs further work up in terms of management for its potential damage in the future. In addition, antibiotic (antimicrobial) resistance and its current management was mentioned by a few key informants as it was encompassed by their organization's interest. Both were deemed important emerging hazards but some were uncertain of their accurate potential impact.

Quotes from the key informants...

“Climate change is an area where the government has been slow to react and even when they are reacting they are not reacting fast enough or broad enough. That is one area I think that could be improved.”

Key informant 1

“The two main ones I can think of that the group I am working in is starting to look at is antimicrobial resistance... We anticipate that that could become a major issue, or that it is already is and will get worse.”

Key informant 1

“I think you've got factors like climate change and climate variability that has exacerbated the vulnerability of populations to a wide range of hazards... One of the public health consequences as a secondary hazard following that flooding event, or, what are the risks around our climate

and habitation becoming more attractive to vectors establishing in New Zealand and introducing a range of the emerging soil epidemics like Dengue in New Zealand.”

Key informant 2

“Antimicrobial resistance – done in a proactive way by having guidelines for best practice for prescribers. Looking at our own, you know there are some antibiotics that are under special authority criteria restrictions and that’s done in consultation with clinical input to make sure they’re used in the appropriate situation for the appropriate duration”

Key informant 4

“Climate change, definitely, and anything that is going to be exacerbated by climate change. We expect there are going to be more extreme weather events, so more drought, more floods, there will be flow on impacts on infrastructure like sewage and water schemes, on housing, some communities may not be able to live in their current communities and move...we’ll have climate refugees, and these will be unique issues, and that’s not something we’ve ever really grappled with.”

Key informant 5

Theme 5: Influences on hazards chosen to focus on

Different organizations have different ways that they decide on which hazards to focus on. There are various influences that can contribute to this discretion. Some key informants mentioned that the organisation they work for focuses on the hazards that are of interest to other organizations above them in the hierarchy - for example the central government. These organizations will usually have a legislative framework defined as their main aim of work. Therefore, other organizational influence and political direction were present in some of their plan for attack for particular hazards. In addition, funding may be available for scientific research and applications for researching certain hazards would be assessed by the higher government organizations. Also, general surveillance programmes in place guide them towards which hazards to focus on and where put them on the agenda. Media and genuine public concern was also a way that influenced the experts toward certain potential hazards.

Quotes from the key informants...

“We’ve got good access to domestic and global health surveillance ... so that’s looking for unusual or emerging diseases, that includes work with MPI [Ministry for Primary Industries] and other agencies...We obviously have good historical information, genealogical understanding of things like previous influenza pandemics.”

Key informant 2

“We do have legislation requirements around natural hazards and that’s probably only going to increase with recent changes to the RMA [Resource Management Act] which introduced greater emphasis around the threat of natural hazards to the development.”

Key informant 3

“obviously we are open to that [media/public health concern] and more importantly we will consult with interested parties on any of our decisions before they are made.”

Key informant 4

“we’ve done a lot of work on things like cell phones and cell sites. There’s no risk, the levels of exposure are extremely low, but the perceived risk was very high. So we’ve had to do a lot of work, not because of the public health risk, but to convince people that it wasn’t a public health risk, that they weren’t going to get cancer and die.”

Key informant 5

“The area of work that the ministry does do I guess changes slightly with time as the government may decide that a particular area of work is better done by one ministry than the other.”

Key informant 6

Theme 6: Is enough being done currently?

In regard to the question *“Do you think the government is doing enough to manage the existing human hazardscape in NZ”*, the key informants gave varied answers. Some believed that there is room for improvement:

“I think there can be particular improvements. There are a number of places where we are doing some work but it could be improved. There are other places where it could be greatly improved.”

Key Informant 1

However, this key informant then followed on to addressing the positive aspects of government management:

“Antimicrobial resistance, for example is something that has been on the agenda and I think the work is well underway to try and combat that and to plan for that in the future...Other positive areas I guess include pandemic preparedness and preparing for the health consequences of disasters and earthquakes and flooding. I think we do relatively well with that.”

Key informant 1

One key informant thought that as the local governments may not be confronted with the same issues simultaneously, each council’s responses may be independent of any guidance from central government:

“...Each local area is dealing with not necessarily the same issue at the same time but a similar concept of people living in areas where they’re at risk. And each council is individually trying to figure out ways to deal with those issues and there isn’t any national consistency or guidance around how that should happen.”

Key informant 3

This key informant also did not think that enough is being done to manage the NZ hazardscape:

"If we were going to take the threat of climate change seriously we probably wouldn't be putting in drilling for more coal."

Key informant 3

One key informant believed that there is no limit to government management; however the evolution of such risks and the latency of its consequences, meant that there is genuine uncertainty in appropriate management. The key informant believed that the major ones are being addressed and treated seriously:

"There's always more that can be done and more you should be doing, and the risk will be changing over time as well....I think, the major areas that are being addressed – you see people addressing earthquakes. You see councils taking it seriously with climate change and raising sea levels, so you can see people doing it. But it still doesn't say if it's enough because we don't know. We don't know when sea levels are going to rise and by how much, my suspicion is that like most things in nature it will be a sudden change, not a gradual one. It will be a tipping point so we should be working really hard now, and we are."

Key informant 4

One key informant thought that more could be done, but the scope of management is largely determined by the availability of resources and funding:

"I think you could always do more with more resources and more funding but it's probably proportionate to the risk."

Key informant 2

Nevertheless, this key informant commented on the government's past successes in hazard management:

"I think we had a pretty effective response to the very low risk of Ebola virus disease in 2015 that involves work across multiple agencies especially customs at the border to provide enhanced surveillance to returning healthcare workers. And I think that the Ministry of Health has mounted credible and appropriate responses to the recent civil defense emergencies including Kaikoura and flooding. So, I think we're reasonably well positioned in that area."

Key informant 2

One key informant agreed that more could be done, but also raised an example of a current constructive, government-level management of hazards:

"You can always do more, but one of the big innovations in the last year is the setup of the hazard and risk board, so that ties together the whole government and all the risks are identified....they all have risk assessments that are discussed by chief executives across all the different agencies. So all that's coordinated....all the different threads of government can actually come together. The central coordination is actually very good. Having this group that meets at a very high levels and talks about and identifies all the different hazards and looks at

the mitigations, and looks at the risk profiling once all the mitigations are in place, is very helpful. I mean it doesn't mean that everything is answered, but it means that at the very highest levels people are thinking about, where are the managed risks, which ones are the most pressing and which risks need more attention."

Key informant 5

As to the question "Are there any specific human health hazards in NZ you think could be managed better", varied responses were again elicited:

"In my personal opinion, climate change is an area where the government has been slow to react and even when they are reacting they are not reacting fast enough or broad enough. That is one area I think that could be improved."

Key informant 1

This is in contrast to another key informants' opinion about the hazard, climate change:

"Climate change reduction is something that has involved looking at long term system trend. That we are definitely looking at it with a view of does it increase the attractiveness of New Zealand to vectors or harm and have we got appropriate border measures in place for it."

Key informant 2

This key informant also addressed another hazard, earthquakes, and the public health approaches that could be done to increase readiness:

"I think the real opportunity is around advancing community resilience and taking the discussion from 3 days of personal preparedness to 10-14 days of personal preparedness, and know the range of hazards like the Wellington earthquake, which would trap 300,000 people effectively isolated within the Wellington region. The greater level of water and food and supplies that they can have at home, the better."

Key informant 2

Infectious disease transmission was identified by a key informant as a hazard that could be managed better:

"People don't understand the risk of transmission of disease, and we really do need people using alcohol hand wipes more frequently, staying away from work when they're sick. So it's the hazardous spread of disease. Food standards – preparation of food, they're my personal bug bearers."

Key informant 4

A hazard that was mentioned by a key informant as a potential area of improvement is the quality of drinking water:

"Drinking water definitely. We'd need to revise the health act, we'd need to revise the drinking water standards. We need more drinking water assessors and health protection officers in the

field. We need to do more with our analysis of the info we have about water supply, and lift the compliance rates of water supplies.”

Key informant 5

Theme 7: Reactive vs proactive response to hazards

Many of the organisations recognised a balance of reactive and proactive response to hazards. These organisations may have subgroups focusing on specific aspects of public health, and therefore that balance of reactive and proactive response may alter according to the interests of the particular subgroups.

Much of the reactive response is incident-dependent, involving the mitigation of the effects of calamities or other national emergencies; much of the proactive response involves the creating guidelines or preparedness plans. Examples of reactive work that were a common thread throughout the interviews include response to earthquakes such as the medication distribution in Kaikoura and Christchurch earthquakes; or in the Hawke's Bay gastroenteritis outbreak, organising medical officers of health and health protection officers to support the community. Prevention of communicable diseases through vaccination programmes were also proactive measures that some interviewers alluded to. Some of the organisations' responses are defined in legislation, leading and coordinating the health sector response to hazards such as crises that have an impact on human health. On the other hand, some of the proactive work mentioned by the organisations includes preventative type approaches such as supporting initiatives to improve lifestyle factors, releasing a Wellington Resilience Strategy, and formulating Antimicrobial Resistance (AMR) action plans. One interviewer of an agency mentioned the use of the 4R's, which are Reduction, Readiness, Response, and Recovery. This summarises the use of both reactive and proactive actions that their organisation commits to.

Many of the organisations have surveillance or research input, which would provide information to aid both control and prevention. This feeds into the course of action an organisation may take on in tackling a hazard and evaluating the effectiveness of response, and thus having implications on whether a shift to either a more reactive or proactive response is necessary. It is apparent that much of the reactive responses warrant ongoing surveillance, which may fuel further proactive work (e.g. seasonal influenza, where there may be early warning signs from surveillance that call for action).

Quotes from the key informants...

“Often there is a lot of work going on behind that with surveillance, preparedness and that type of work. For some groups it's both being prepared and reacting to when things happen... There is also being prepared for emergencies and issues that arise as well. Other groups probably have a bit more scope for proactive work... do a whole lot of work on guidelines and supporting initiatives that improve nutrition. They're probably slightly more proactive in that they support ways to try and improve health rather than reacting to things that have actually occurred.”

Key informant 1

“Reduction activity might be stuff like the Antimicrobial Resistance action plan which has been released in the last couple of months with the MPI and the Ministry of Health. So, actually trying to prevent or reduce the likelihood of a hazardous event occurring...we try to mainstream readiness activities and try to build it into sector capability. Response activity...might include things like the provision of technical expertise or facilitating deployment of clinical staff around the country.”

Key informant 2

“.....Trying to sort of make [a] decision about how we locate people in relation to areas subjected to hazards and how we can help people be prepared.”

Key informant 3

“We have our vaccination programmes, but the response to outbreaks we are there to facilitate rather than manage....Antimicrobial resistance - done in a proactive way by having guidelines for best practice for prescribes.... Seasonal flu that’s something that we have an immunisation subcommittee which is assessing which vaccines are going to be made available for the coming season, so that is proactive – receiving information from WHO and other agencies, and in partnership with MoH making a decision there.”

Key informant 4

“We would like to have an even mixture of proactive and reactive but quite often we get overwhelmed with the reactive work.”

Key informant 5

“A bit of both I guess in that there are....The work that we do, there are groups that carry on more research that tends to look forwards and keeping an eye on what is developing in that area of research. But there is also reactive work, for example with the Havelock North water supply outbreak last year... also collection of information and analysis to how to respond in some idea as to the way the epidemic was spreading. So it is a question of both.”

Key informant 6

Theme 8: Fear of the unknown

An interesting theme that emerged was one regarding the general public’s understanding of hazards and the relationship this understanding might have with the level of fear they have towards that hazard. It was thought that even though some of the more common hazards have a higher risk and are more likely to occur, people tend to be less fearful of the hazards they knew a lot about than those hazards which were more mysterious and unknown.

It was thought that a large part of this was due to media coverage of certain hazards. Some hazards, for example road traffic accidents, which are common but preventable and understood by the public, get a lot of media coverage but it has become so common to see a story about an accident these days that it doesn’t seem to strike as much fear into people as it used to. Contrastingly, lesser-known hazards like climate change get occasional media coverage but usually only when there has been a devastating event because of it, such as a hurricane. This

results in the public associating the hazard with total devastation without much context, and only thinking about it when something terrible has happened. The public still may not understand all that much about the hazard but what they do understand about it, they fear perhaps disproportionately to the true risk.

Quotes from the key informants...

"... for example road traffic accidents, they might have a particular fear of that happening and it might be relatively accurate [compared to] looking at one that is a bit less understood like climate change and antimicrobial resistance."

Key Informant 1

"People focus on very abstract risks and quite often the more gruesome and more horrible they are, the more focused they are going to be rather than those that are actually going to affect or impact them."

Key Informant 2

"I think people are very driven by what they see in the media, by what they see on social media. The media will catastrophize, and they're not very good at doing risk comparisons, everything is a headline."

Key informant 5

Theme 9: Recommendations for the future

The main idea that arose when talking about possible methods of improving hazard perception in New Zealand was to improve education around the various hazards and how threatening they truly are. Most of the key informants we spoke to said that the key was education, preferably starting at a young age.

Another idea that was emphasised was media coverage of hazards. This was thought to have both positive and negative impacts in overall public perception. In some ways, any coverage is welcomed because it heightens awareness and gets people thinking about prevention. On the other hand, it can be detrimental in some ways because of the over-representation of some hazards and the under-representation of others, leading to a skewed perception of the realistic risk.

Quotes from key informants...

"There's a lot of good work being done with education of kids and school and that's quite an effective mechanism of getting back to the caregivers. I'm not sure if many adults actively engage in it but we welcome the occasion of media articles on hazards and threats ... I think there is a range of education available to people but there's always going to be a challenge with engaging and reaching every single group. We have various materials available and formats that are suitable for culturally and linguistically diverse communities."

Key informant 2

“I think that education in schools would be a good place to start ... educating kids to then take those messages back into the home, once adults are out it’s hard to target a mass group of people in the same way you can with schools.”

Key informant 3

Well, there’s not going to be one way that’s going to work for everybody. It can’t be threatening, you have to get people on board. If people get threatened or scared they will probably close their minds to reacting to it or managing it effectively. So, it comes from a long process of education that will take a generation or two. Starting off with starting in schools so people will learn about all sorts of hazards...”

Key informant 4

Discussion

General Public Perception of Risk

Table 13: *Actual burden vs general public level of worry*

	Actual Burden (discrepancy)	General public level of worry
1	Damp housing (0)	Damp housing
2	Physical assault (-3)	Antibiotic resistance
3	Seasonal flu (-6)	Earthquakes
4	Lead paint contaminated housing (-6)	International terrorism
5	Earthquakes (+2)	Physical assault
6	Pandemic influenza (-2)	Extreme weather events
7	Extreme weather events (+1)	Meth contaminated housing
8	Antibiotic resistance (+6)	Flu pandemic
9	Meth contaminated housing (+2)	Seasonal flu
10	International Terrorism (+6)	Lead paint contaminated housing

The general public’s level of worry about a variety of hazards does not match the actual level of burden to New Zealanders. International terrorism had the largest discrepancy between actual level of risk and public perception. We judge the public level of worry as unrealistic compared with actual risk, this may reflect the feeling of helplessness surrounding a terrorist attack. The

level of worry could also be inflated by sensationalised media coverage of attacks overseas where the frequency and severity may be higher than in New Zealand.⁸⁸ Interestingly, the general public are more worried about international terrorism than physical assault. This perception is unrealistic as physical assault affects 3.9% of New Zealanders every year,⁸³ while there has only been one death from international terrorism in New Zealand's history. This may reflect the stigma associated with physical assault (especially domestic violence and sexual assault) and the perceived high level of control meaning the general public do not want to acknowledge their own personal risk.

The public is also worried about antibiotic resistance, this is an emerging hazard and the actual level of risk is currently low in New Zealand.⁴⁹ This discrepancy may represent the general public's fear for the future. This is also an issue that has received extensive media coverage which may account for some of the level of worry.

In terms of housing, the general public have a realistic level of concern with regards to damp housing but they have a much higher level of worry around methamphetamine contaminated housing than lead paint contamination. We expected to see this discrepancy as methamphetamine contamination has gained media attention recently and methamphetamine decontamination is a growing industry. Lead poisoning is known by experts to be a notoriously underrated problem in New Zealand.

The general public are also more worried about the risks of pandemic flu than seasonal flu, even though seasonal flu is more frequent and harmful. The word "pandemic" has connotations with high levels of risk so this may explain the level of worry, as well as the recency of the bird flu pandemic in 2009. The general public also believe that they are more likely to be able to protect themselves from seasonal flu than pandemic flu (presumably through vaccination or personal hygiene), which accurately reflects the actual transmission of these illnesses, but once frequency is taken into account does not influence the true burden.

The general public seems to have a good understanding of extreme weather events, as their understanding closely reflects the true burden. The level of worry surrounding earthquakes is slightly higher than the actual risk, likely reflecting the recency and severity of the Canterbury earthquakes. This discrepancy could also reflect the lack of control over earthquake occurrence.

Key informant perception of Risk

Table 14: *Actual burden vs key informant level of worry*

	Actual burden (Discrepancy)	Key informant level of worry
1	Damp housing (0)	Damp housing
2	Physical assault (-7)	Antibiotic resistance
3	Seasonal flu (-3)	Earthquakes
4	Lead paint contaminated housing (-4)	Flu pandemic
5	Earthquakes (+2)	Extreme weather events
6	Flu Pandemic (+2)	Seasonal flu
7	Extreme weather events (+2)	Meth contaminated housing
8	Antibiotic resistance (+6)	Lead paint contaminated housing
9	Meth contaminated housing (+2)	Physical assault
10	International Terrorism 0)	International terrorism

Our key informant analysis showed that the experts believe the general public has little understanding of the true risks of many hazards. This proved to be correct, but when analysing the key informant responses to the same questions, we also found some misconceptions.

The key informants' level of worry around damp housing and international terrorism is the equivalent to their level of burden in New Zealand. This could reflect the recent public health campaigns raising awareness about damp housing, and the lack of terrorist incidents in New Zealand.

The burdens with the largest disparities were physical assault, antibiotic resistance, and lead paint contaminated housing. Physical assault had the largest discrepancy with the second highest burden, but it was ranked second lowest by the key informants. This may reflect the key informants' perceived control over the likelihood of being physically assaulted. This is reflected in the key informants rating physical assault as having the second highest personal locus of control. Antibiotic resistance had the second highest discrepancy, potentially due to the effect of both media and healthcare workplace influences, which may overemphasise the current burden of antibiotic resistance. Moreover antibiotic resistance had the second lowest personal locus of control, so perhaps our key informants are worried because they have fewer personal ways of controlling antibiotic resistance as a hazard. Lead paint contaminated housing had the third highest discrepancy, which again reflects the lack of media coverage on this issue.

As well as important discrepancies, there are also two important trends in the results. Firstly, seasonal flu is ranked above influenza pandemics in terms of actual burden, but the key informants ranked their worry of influenza pandemics above seasonal flu. This is possibly due to the effects of recency bias and media coverage that covers pandemics more compared to the seasonal effects of flu. We also believe that there may be a general lack of understanding of the burden of seasonal influenza, as it is commonly under-estimated. Secondly, the key informants ranked meth contaminated housing one place higher than lead paint contaminated housing. This is very different to the actual burden in New Zealand. This emphasises the effect of media in determining peoples' perception of risk, especially in rental homes, but does not accurately represent the actual burden.

Comparing general public perception of risk to key informants

Table 15: *Key informant level of worry vs general public level of worry*

	Key informant level of worry	General public level of worry
1	Damp housing	Damp housing
2	Antibiotic resistance	Antibiotic resistance
3	Earthquakes	Earthquakes
4	Flu pandemic	International terrorism
5	Extreme weather events	Physical assault
6	Seasonal flu	Extreme weather events
7	Meth contaminated housing	Meth contaminated housing
8	Lead paint contaminated housing	Flu pandemic
9	Physical assault	Seasonal flu
10	International terrorism	Lead paint contaminated housing

There are several clear trends found when comparing the level of worry of the general public with our key informants. Both the general public and key informants are most worried about damp housing, antibiotic resistance and earthquakes. We think the high rating of damp housing reflects the actual burden, however the high ratings of antibiotic resistance and earthquakes probably reflect media attention, and conceived future threat. The general public tended to rate burdens involving violence higher than the key informants, whilst the key informants rated burdens involving infection higher than the general public. This may reflect personal experiences, as the key informants work in public health where assessing the burden of

infectious disease is commonplace. Similarly our key informants are more likely to occupy higher socioeconomic statuses than the general public, so may perceive violence as less of a threat to them. Moreover they may feel as though they have more control over the burden of violence than infections. Interestingly, both the general public and the key informants are more worried about methamphetamine contamination in housing than lead, despite the burden being far greater in lead contamination. We think this reflects media coverage, although it surprised us that even key informants were influenced by this despite their expertise.

Finally, both the general public and the key informants are more worried about pandemic influenza than seasonal influenza despite the annual mortality rates of seasonal influenza being greater than the total number of deaths in the last influenza pandemic in 2009. We think this is probably due to the unpredictability of such an event, and a lack of coverage on the actual burden of seasonal influenza, which is commonly under-estimated.

Inequalities between Māori and non-Māori

Although not statistically significant, the survey of the general public showed that Māori had a higher level of worry about all hazards than non-Māori. This may be confounded by differences in socioeconomic status, or could represent an internalised feeling of vulnerability. Historically, Māori have suffered disproportionately from a number of risks (eg pandemic flu) so the memory of this could increase the level of fear.⁴³ Even hazards that don't have a history of inequality between Māori and Non-Māori worried Māori more (such as international terrorism), which we speculate could be associated with the history of systemic discrimination in health, justice and government.

Locus of control

Different hazards have different levels of internal and external loci of control. In our study we found that the general public believe themselves to be most in control of damp housing and least in control of international terrorism. The key informants believed themselves to be most in control of lead paint contaminated housing, and least in control of international terrorism. For the hazards with large discrepancies between actual burden and level of worry, locus of control is likely a key driver. An example is the ranking of physical assault. Both the general public and key informants underestimated the risk of physical assault, with the key informants rating the hazard much lower than the general public. Our study found that key informants perceived a higher internal locus of control (although this was not statistically significant). We theorise that a greater perceived internal locus of control correlates with a lower level of worry and perceived risk. In contrast, physical assault was rated much higher by the general public, this means that they believe themselves to be less able to stop this hazard from affecting them. The higher internal locus of control from the key informants may be influenced by their status as working professionals. They likely occupy higher socioeconomic statuses compared to the general public, and may feel that they can avoid unsafe environments.

Emerging hazards

Evidence suggests that extreme weather events and antibiotic resistance currently pose a low risk to New Zealanders, ranking seventh and eighth out of the ten hazards. The general public

however, respectively ranked these risks at sixth and second out of the ten hazards, suggesting that their fear of these two hazards are well above the actual risk of experiencing these hazards. An explanation for this could be that the general public have recognized that these are emerging hazards - hazards that may not be immediately affecting New Zealanders but that pose huge, imminent threats for the future of New Zealand. Interestingly, the key informants also ranked these risks higher than the actual risk, at fifth and second out of the ten for extreme weather events and antibiotic resistance respectively, suggesting that they also are aware of the severe threat that these emerging hazards pose. Four of the seven key informants specifically identified antibiotic resistance and extreme weather events (secondary to climate change) in their qualitative interviews as "...an area where the government has been slow to react..." (key informant 1) and "...we anticipate that that [antimicrobial resistance] could become a major issue, or that it is already and will get worse" (key informant 1).

Strengths

Survey

The survey was posted on multiple Facebook pages, including 'Vic Deals', 'Otago Flatting Goods' and 'Buy & sell in Auckland' which equalled around 210,000 members, with age demographics mainly in the 18-35 age group. All members of the page were able to access the survey and participate. We received 109 online responses. We also conducted 46 face to face surveys in Wellington, hence the combination of methods produced a reasonable sample size of 155 individual responses.

The survey (Appendix 7) was comprehensive, with multiple questions per hazard including: measure of an individual's likelihood and consequences of exposure; personal and governmental locus of control being recorded, and how worried individuals are of the hazard occurring measured using a word scale. Breaking down each hazard into these questions allowed a more complete picture of an individual's thoughts which could then be interpreted to analyse trends. Using a word scale with descriptions improved accuracy as individuals are able to internalise their feelings, and choose an option which best reflects this. The data collection team was semi-blinded to the results, as they were unaware of the findings of the literature review when collecting data, hence minimising interviewer bias. The survey enabled stratification by ethnicity, this was important in identifying disparities between Māori and Non-Māori perception and locus of control of the hazardscape of New Zealand.

Key Informants

Interviews were conducted in a semi-structured manner, this allowed the key informant to elaborate on what was important to them which was analysed thematically. The anonymity of informants was beneficial, since the views they shared with us were their own and not representing the agency they worked for, this ensured they were forthcoming and honest with their answers.

Limitations

Survey

The survey posed a number of limitations to this study. The survey was designed to be quick and easy for the general public, however by being a simple quantitative survey participants were not able to submit qualitative information. Commentary boxes to explore the reasons why participants choose specific categories could have provided valuable information.

Each major hazard in the survey was presented as a heading with an example where possible. This caused a limitation since the ten major hazards were subjected to individual interpretation. Hence, the interpretation for the ten major hazards cannot be concluded to be consistent across all participants. Additionally, during face-to-face recruitment there was no protocol when explaining the definition of each hazard. As a result, participants may have been given slightly different definitions for the ten major health hazards and therefore answered the questions accordingly.

Selection bias was a limitation of this study. The majority of respondents were sourced through the survey link. Therefore, those who participated in the survey via the survey link would have to be individuals on social media or emailed by members of the wider research team. To mitigate this bias, the research team also aimed to recruit participants from the streets of Wellington city. However, this could have also introduced volunteer bias since those with an interest in health hazards would have been more likely to participate in the study.

Key Informant Interviews

Interviews with key informants were a time consuming and resource intensive process. As a result, the whole research team was employed to complete this section of the project and detoured from other tasks. The interviews were arranged following an initial written invite and caused logistical challenges. Many of the interviews had to be done by phone rather than face to face. This allowed sufficient information to be collected, however phone interviews lack rapport development and detection of non-verbal cues, which are present in face to face interviews.

Key informants were selected through consultation with the supervisors of this project and covered a broad range of expertise. Limitations such as the time constraint of the project, low response rate and no having valid contact details resulted in a small number of key informants participating in interviews. Therefore, key informants from all areas of hazard assessment and management were not included in this study and data saturation was not achieved.

Limitations of analysis

The ethnic distribution of this study was 7.1% Māori and 92.9% non-Māori. This is not representative of the New Zealand population, which is made up of 15.6% Māori and 84.4% non-Māori.⁸⁹ There was also large over representation of females and under 25 years in this study. The gender distribution of New Zealand is 51.3% female and 48.7% male,⁹⁰ while this study included 79.2% female, 18.6% male and 2.2% as other. Under 25 years make up 33.3%

of the New Zealand population, however under 25 year made up 50.8% of the study participants. These demographic differences suggest that results of this study may not be applicable to the New Zealand population.

A key limitation of analysing this study is the small sample size of key informants compared to the large sample size of the general public. Due to the great difference in sample size the comparisons concluded are less statistically significant. Another limitation when analysing the study results was converting the word scale to a numerical study. The scales were then compared to each other, however since there was no consistent tool to measure “worry” against “severity” the results are slightly subjective.

Conclusion

At the beginning of this study, we hypothesised that there would be a difference in the general public and key informant’s perceptions of these hazards. We thought that there would be large discrepancies within our hazard categories, for example that the public would be more concerned about international terrorism than they were about physical assault. We also thought our key informants would have contrasting views to the public.

From the results of the survey, the degree of difference in perception between the public and key informants were not as great as anticipated. Our expectation was that there would be less concordance in the perception of likelihood of exposure, severity of consequences, personal locus of control, government control, and the level of worry over a range of hazards between the general public and the key informants. In general, the general public perceived the likelihood of exposure to be higher for international terrorism, earthquakes, seasonal flu, meth-contaminated housing and antibiotic resistance. As for the severity of consequences, there were statistically significant differences in mean perception for the severity of consequences of international terrorism and meth-contaminated housing between the two groups. A significant difference between general public and key informants was only seen in lead paint contaminated housing for personal locus of control. There were no statistically significant differences for perception of level of government control between the general public and key informants for each of the hazards. There were also statistically significant differences between the two groups in worry - the general public was ‘slightly worried’ about physical assault and terrorism, but contrastingly, key informants were ‘not worried at all’ about these hazards.

In the violence category, international terrorism was perceived by both groups to be a bigger hazard than physical assault, more noticeably so by the general public. In the infectious diseases category, surprisingly, antibiotic resistance was perceived to be the biggest hazard by both groups, followed by flu pandemics then seasonal flu. In the housing category, damp housing was thought to be by far the biggest hazard, followed by meth contaminated housing then lead paint contaminated housing. This applied to both groups, which was surprising as we had thought the key informants would have rated meth contaminated housing much lower than lead paint contaminated housing. In the natural disasters category, earthquakes were rated

more of a hazard than extreme weather events, contrary to what we thought would be the case; we hypothesised that the general public would be more worried about climate change related hazards than they were.

We concluded that to consider perception of risk in the general public, worry would be the main determinant. Considering that all three of exposure, severity and personal locus of control were correlated with worry, we identified that all of these three aspects contributed to worry, which can then be used as the final measure for looking at risk perception.

There was reasonable discrepancies in perception between the groups we stratified - gender, ethnicity and age. Damp housing is a hazard in which there were apparent differences in perception between the stratified groups: females and Māori perceived the severity and government level of control for damp housing to be higher than males and Non-Māori in comparison; the under 25 age group perceived the exposure to damp housing to be greater in likelihood than the over 40 age group. Māori perceived the government had a higher level of control for International terrorism and flu pandemic when compared with Non-Māori. Furthermore, Māori was more worried about physical assault and earthquakes when compared with their Non-Māori counterparts. The other dimensions of the survey did not show statistically differences in perceptions between the three age groups stratified.

Our qualitative results had a number of themes that were relevant to our research questions and supported our survey results. The key informants thought that there would be large discrepancies in the general public's perception of hazard severity; that they would think certain hazards such as international terrorism were much more of a hazard than they really were. They also thought that the general public wouldn't think they had very much control over some hazards, and thought this could be due to people focussing on sensationalised hazards that are very unlikely rather than more common hazards that might actually affect them. Another theme that arose was around emerging hazards and whether or not enough was being done proactively to prepare for these hazards. It was thought that climate change and antibiotic resistance were the main emerging hazards, and while key informants thought that a lot was being done about antibiotic resistance, they thought more needed to be done about climate change. Another important theme we focussed on involved recommendations for how the general public could be better informed of the realistic risks these hazards pose, and many of them thought that this could be achieved with more education, starting at a young age in schools. They also thought that media coverage should be more representative of the true risk.

Many of our results were statistically insignificant, with overlapping confidence intervals, indicating that chance could have played a role in the results. While confidence intervals are important to prove significance, since many insignificant results have matched our hypothesis, we would definitely attempt to do the same research again with a larger sample size of both General Public and Key Informants to decrease the role of chance. We would also consider changing our sample of key informants, as we found that contacting key agencies to find key informants led to a high attrition rate and thus a very small sample size of key informants. Furthermore, key informants found through this method may have biases towards their

specialisations and thus we recommend using health care professionals as our comparison group; we are looking at health hazards and thus health professionals are expected to have a greater knowledge on all health hazards as opposed to chosen ones.

Recommendations

Our literature review and results have highlighted some key themes and areas where we thought there was room for improvement. We have developed our recommendations using the Ottawa Charter principles to guide us.

1. Building healthy public policy

Our research highlighted the importance of consulting the scientific evidence when evaluating the risk and appropriate management of hazards. There is a discrepancy between what the current evidence shows and the common perception of the hazards risk. Due to the nature of politics, this can result in public perception driving disproportionate allocations of resources to hazards that do not merit it. The national hazardscape report was published in 2007 by the Ministry of Civil Defence and Emergency Management. This was aimed at informing policy makers and hazard managers in carrying out risk and hazard management. We recommend updating this report as the evidence is now a decade old and may well have changed. Furthermore it is important to inform policy makers that this resource is available and summarises the current evidence which should guide their decision making. Allocating resources based on the actual risk will ensure that our limited resources are being channelled to the right area and utilised wisely.

2. Create supportive environments

The overarching goal of health protection is to develop a safe environment for society. In order for society to achieve this, it is important to focus our attention on the hazards that are actually most likely to cause harm. When people are distracted by sensationalised hazards, societies attentions and efforts are often wasted on causes that do not provide the most return for our investment. Hence we recommend that the government advocates for more responsible reporting by the media. The media often informs public opinions and whilst they tend to publish headlines that garner the most attention, it often misleads people into thinking that these are the most important hazards. This approach belittles the important role that media has in informing our society and the responsibility it has acquired in doing so. If we portrayed what the science was showing then we would give more attention to hazards that pose the greatest risk and spend less time reporting on the sensationalised attention-grabbing hazards. A well informed public would have a knock on effect to politicians who would be more likely to focus resources where they should be if they had public support.

3. Strengthen community action

An educated community is in the best position to set priorities, make decisions, plan and implement strategies that address the issues they face. If we want to empower communities to take control and ownership of their health then it requires us to provide an accurate

understanding of what these issues are and how they will be affected by them. As stated above, currently the public is unaware of the seriousness of several hazards and has an overinflated idea about the risk of others. Our key informants all agreed that the public didn't have a realistic understanding of the hazards and would benefit from a shift in focus. We recommend ongoing education into these communities to help them understand the current situation. We propose educating the youth by incorporating an understanding of basic epidemiology into high school curriculums. As stated above, a more responsible media would also target older demographics who have already completed their formal education.

4. Develop personal skills

To stress this point further, accurate portrayal and education around the hazardscape of New Zealand is a crucial first step in supporting personal and social development. By educating individuals and providing an accurate understanding it increases the options available to people to exercise more control over their preparation and responses if they ever were to encounter one of these hazards. Education has also been shown to improve resilience, preparedness and the response to government management. Furthermore many individuals are unaware that being prepared for one hazard also covers them for many of the other potential hazards. Educating them about what can be done for each hazard and the overlap in being prepared would likely increase the uptake of people willing to prepare themselves.

5. Reorient health services

The government plays a key role in allocating resources to adequately manage the potential hazards we face as a society. The government's involvement in health protection is divided among many different sectors of government. Reorienting services to where they would have the biggest impact is a logical step but one that is made difficult by intervening politics. However unpopular it may be, it is important to not let public opinion divert resources into causes where they are not required. It is the responsibility of the government to listen to the experts and subsequently inform the public about what they have found as well as use this information to guide their own decision making. Hence we recommend that the government updates the national hazardscape report and develops a working group to investigate how to best inform the public of the evidence. Investing money into research the largest potential burdens for our society helps guide money to where it needs to be and will save us money and suffering in the future. We have seen an example of this with the government's response to meth contamination in state houses where vast quantities of money has been spent on an issue that debatably does not warrant such an intervention. A concern raised during some interviews with our key informants were that often people who were already well off were the ones who were making the most noise about issues. Areas of society that are less fortunate are already suffering from bearing a larger portion of the burden. However as the saying goes "the squeaky wheel gets the oil" and these concerns about growing inequality were raised during several of our key informant interviews. Therefore when allocating resources, it is important to consider inequalities and whether the way we distribute our resources contributes to or addresses these disparities.

Recommendations for Future Study

This study highlighted the mismatch between what the burden is of various hazards and public perception. Analysis of surveys and key informant interviews produced various themes which warrant further detailed research. The vast nature of the topic additionally endears itself to huge range of areas which could be further looked into.

Media Hazardscape

This appears to be the key missing link between the public's perception of hazards and what the actual risk the hazard poses to populations and individuals. The public receives information about a hazards importance and modifiability mainly through this medium. How much media exposure a population receives about certain hazards and how they are framed is crucial to how they form their opinions. This would extend to social media and its increasing influence on people's lives.

Further research is needed to evaluate and quantify the media influence on the public perception of hazards. If there was a strong association, a certain hazards media attention and would garner a subsequent change in public perception and worry. Conversely if certain hazards are shown to be important through literature and surveillance data but not through the media, the public and government may be left unprepared when disaster strikes.

Updating the NZ Hazardscape Report

This was first published in 2007 and there hasn't been an update since. In 10 years it is safe to assume that the hazardscape has changed greatly in some areas and not others. To empower policymakers to make informed decisions to which hazards they can focus on with limited resources they need up to date information, local information. Currently public perception is driving a lot of the government's focus on hazards, for instance with meth contaminated homes. The local media and global influences on this public perception can be detrimental, leaving us unprepared for important, modifiable hazards. Without this update, important emerging hazards mentioned by our key informants like antibiotic resistance and climate change may catch us unprepared.

Expanding the Scope and Coverage

This study covered 10 hazards and interviews with 7 key informants from different relevant government departments and research organisations. A comprehensive study in the area should have a wide coverage of hazards from all areas that pose a significant threat to New Zealanders. It should cover expertise from all government departments involved and all relevant scientific organisations. The nature of hazard management is that each department will only have expertise in a small coverage of hazards. By interviewing more of these, researchers would feel confident the scope of every hazard would've been covered by experts in the field of each of them.

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APPENDIX

Appendix 1: *General Public Means*

	Physical Assault	International Terrorism	Seasonal Flu	Flu pandemic	Antibiotic Resistance	Damp housing	Meth contaminated housing	Lead paint contaminated housing	Earth-quakes	Extreme weather events
Exposure	3.14	2.34	4.14	2.72	3.34	3.94	2.66	2.53	4.24	3.59
Severity	3.18	4.02	2.58	3.52	3.82	3.30	3.06	2.97	3.42	3.65
Personal LOC	2.60	1.51	2.68	2.30	2.18	2.77	2.16	2.32	1.57	1.72
Government LOC	2.73	2.99	2.42	2.93	2.79	3.46	2.95	3.18	2.06	2.42
Worried	2.18	2.27	1.64	1.83	2.79	2.82	1.86	1.54	2.64	1.98

Appendix 2: *Key Informant Means*

	Physical Assault	International Terrorism	Seasonal Flu	Flu pandemic	Antibiotic Resistance	Damp housing	Meth contaminated housing	Lead paint contaminated housing	Earth-quakes	Extreme weather events
Exposure	2.71	1.14	3.43	2.14	2.57	3.57	1.86	2.71	3.43	3.86
Severity	3.14	3.00	2.43	3.86	3.86	3.43	1.86	2.57	3.29	3.43
Personal LOC	3.00	1.86	3.00	2.14	1.86	2.86	2.29	3.14	1.86	2.14
Government LOC	2.86	2.86	2.71	2.86	3.00	3.43	2.86	3.14	2.43	3.14
Worried	1.29	1.14	1.43	1.71	2.71	3.29	1.43	1.29	2.71	1.71

Appendix 3: Confidence Intervals (General Public)

	Physical assault	International terrorism	Seasonal flu	Flu Pandemic	Antibiotic Resistance	Damp housing	Meth contaminated housing	Lead paint contaminated housing	Earth-quakes	Extreme weather events
Exposure	0.139	0.169	0.123	0.143	0.157	0.142	0.150	0.131	0.127	0.143
Severity	0.116	0.139	0.115	0.130	0.130	0.115	0.142	0.145	0.171	0.117
Personal LOC	0.124	0.125	0.135	0.141	0.152	0.144	0.180	0.168	0.122	0.131
Government LOC	0.131	0.166	0.122	0.136	0.166	0.146	0.159	0.153	0.159	0.152
Worried	0.158	0.188	0.133	0.154	0.189	0.178	0.166	0.136	0.168	0.158

Appendix 4: Confidence Intervals (Key Informants)

	Physical assault	International terrorism	Seasonal flu	Flu pandemic	Antibiotic Resistance	Damp housing	Meth contaminated housing	Lead paint contaminated housing	Earth-quakes	Extreme weather events
Exposure	0.56	0.28	0.58	0.67	0.72	0.72	0.79	0.56	0.94	0.79
Severity	0.28	0.6	0.4	0.67	0.51	0.4	0.79	0.58	0.93	0.4
Personal LOC	0.6	0.79	0.86	0.51	0.51	0.79	1.02	1.08	0.51	0.79
Government LOC	0.51	0.67	0.56	0.51	0.43	0.58	0.28	0.67	0.58	0.51
Worried	0.36	0.28	0.4	0.56	0.36	0.36	0.58	0.36	0.93	0.56

Appendix 5: *P-Values*

	Physical assault	International terrorism	Seasonal flu	Flu pandemic	Antibiotic Resistance	Damp housing	Meth contaminated housing	Lead paint contaminated housing	Earth-quakes	Extreme weather events
Exposure	0.211	0.004	0.021	0.105	0.047	0.299	0.031	0.564	0.012	0.447
Severity	0.893	0.003	0.594	0.294	0.902	0.656	0.001	0.265	0.752	0.449
Personal LOC	0.189	0.262	0.349	0.640	0.390	0.816	0.780	0.050	0.343	0.195
Government LOC	0.689	0.736	0.324	0.828	0.595	0.920	0.813	0.917	0.349	0.052
Worried	0.018	0.025	0.516	0.754	0.943	0.284	0.289	0.434	0.863	0.489

Appendix 6: *Rationale for choice of hazards*

<u>Hazard</u>	<u>Burden, include s risk and consequences</u>	<u>Percept ion of risk by public (estima ted)</u>	<u>Predict ability/ stabilit y of risk</u>	<u>Inequal ity of burden</u>	<u>LOC</u>	<u>Manage ment by Governm ent</u>	<u>Government agencies involved in managing risk including response & prevention (*=lead policy agencies, if known)</u>
	* = Low burden	* = Low perceiv ed risk	* = Predicta ble	* = Small disparit y	* = High level of control	* = High level of Governm ent risk managem ent	Useful to distinguish lead agency for national policy, national response, regional/local preparation and response
Violence							
Assault	***	**	**	***	**	*	Ministry of Justice*, Police*, Ministry for Vulnerable Children
Terrorism	*	*	*	*	*	*	Police*, Defence forces
Infectious diseases							
Pandemic Flu	*	**	*	*	***	**	Ministry of Health*, DHBs

Seasonal flu	***	*	***	***	**	*	Ministry of Health*, DHBs
Antibiotic resistance	**	*	**	**	***	***	Ministry of Health*, MPI, DHBs
Housing							
Lead paint contaminated housing	**	*	*	***	**	***	Ministry of Health, MBIE, Worksafe, Local authorities (City/District Councils)
Meth contaminated housing	*	**	**	***	***	*	Ministry of Health, MBIE, Local authorities (City/District Councils)
Damp housing	***	**	***	***	**	**	Ministry of Health, MBIE, Local authorities (City/District Councils)
'Natural' disasters							
Earthquakes	*	***	*	*	***	*	MBIE*, Ministry of Civil Defence & Emergency Management,* Local authorities (City/District Councils), DPMC, EQC
Climate induced extreme weather	*	*	**	*	***	**	Ministry for the Environment,* Ministry of Civil Defence & Emergency Management*, Regional councils, Local authorities (City/District Councils)

Rationale for choice of hazards:

- Choosing a range of hazard types, including physical, biological, chemical and disasters.
- Choosing some that have relatively high burden but probably low perceived risk eg seasonal flu, injury at work
- Choosing others that have relatively low burden but probably perceived high risk eg terrorism, genetically modified organisms, meth contaminated housing

- Choosing some where we expect the public to consider the risk to be very uncertain/unpredictable eg antibiotic resistance, earthquakes
- Choosing some where many people may feel they have considerable ability to protect themselves (ie high LOC) eg seasonal influenza (via vaccination), contaminated housing in many cases (owning their own home), injury at work
- Choosing some where many people may feel they have very little control over their exposure eg assault, terrorism, pandemic influenza, GMOs, air pollution, extreme weather, earthquakes
- Choosing hazards managed by a range of Government agencies.

Appendix 7 and 8 (Quantitative and Qualitative Questions) attached separately.