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UNIVERSITY OF NEW ZEALAND

A bibliography of social research on the earthquake risk in Wellington, Aotearoa New Zealand: 1848 to 2019

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ABSTRACT

The Wellington region has a history of tectonic movement and damaging earthquakes. Social research on Wellington's earthquake risk is limited but has explored aspects of public education and issues around preparedness and resilience. As part of the Wellington "It's Our Fault" project, and QuakeCoRE (a New Zealand Tertiary Education Commission-funded Centre of Research Excellence), this document is a bibliography listing reports, papers, and other material on social research on earthquake risk in the Wellington region from 1848 to 2019.

KEYWORDS

Earthquake, social impacts, Wellington, bibliography.

1.0 INTRODUCTION

Wellington has a history of damaging earthquakes. The region is situated on and around active faults and is susceptible to earthquakes and the associated natural hazard events: tsunami and landslips and flooding initiated by tectonic movement. The first accounts of Wellingtonians' experience of earthquakes come from descriptions of the 1848 and 1855 earthquakes (Grapes, 2000; McSaveney, 2007) which impacted the early settlement of Wellington.

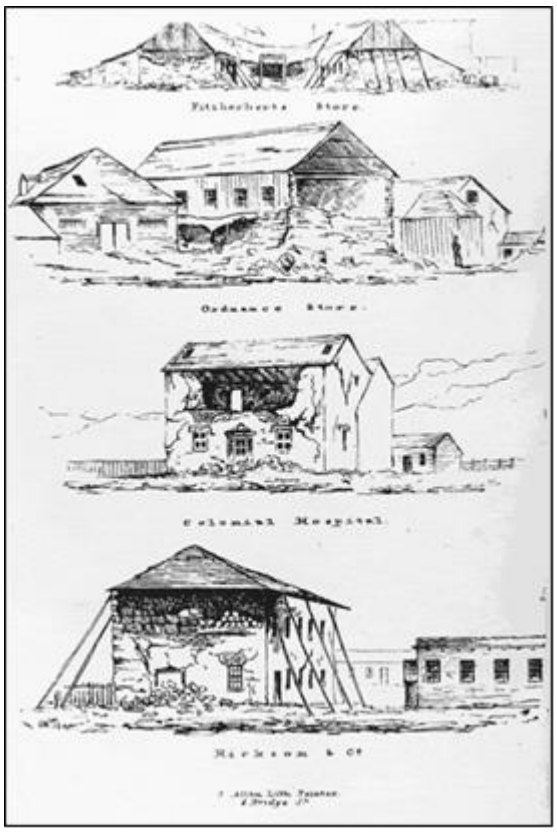

Figure Error! No text of specified style in document..**1** Sketches by Robert Park showing the damage to buildings sustained in the 1848 Wellington earthquake. Source: Alexander Turnbull Library.

The most recent significant earthquakes to affect Wellington were in 1942, with a magnitude 7.2 on 24 June, centred 80km to the north, followed by a magnitude 5.6 on 1 August and a magnitude 6.8 the next day. Although no loss of life occurred there was extensive damage, with the cumulative impacts of these events resulting in damage to over 5,000 houses and 10,000 chimneys (McSaveney, 2007).

The 2016 Kaikōura earthquake measuring magnitude 7.8 was centred near the town of Waiau and was felt over much of New Zealand. Kaikōura, Hurunui, Marlborough, and Wellington were the areas most damaged by this earthquake. The earthquake and surface rupture involved more than 20 different faults, lasted for nearly 2 minutes, and triggered a local source tsunami, coastal uplift, landslides, and landslide dams, as well as slow-slip "silent" earthquakes. The impacts were wide-ranging with damage to transportation networks, lifeline utilities, homes and businesses, and disruption to the agriculture and tourism industries.

Social research on the earthquake risk in Wellington has expanded in recent years since the Canterbury earthquakes in 2010 and 2011 and following the 2016 Kaikōura earthquake. Several studies by government agencies, councils, and other organisations have focused on

measuring the effectiveness of public education initiatives (MCDEM 2007-2018). Other researchers have explored general issues around preparedness and resilience, using Wellington as a case study (in part) for this work (e.g. Finnis, 2007; McClure, White & Sibley, 2009).

The individual works cited in Section 2.0, Table 2.1, look at the topics of preparedness, readiness, business continuity, socio-economic factors, school and public education programmes, readiness/preparedness message delivery, disaster warning systems, travel patterns, business disruption, debris disposal, public confidence levels, and the psychological effects of disasters on communities.

In this report we bring together a list of reports, papers, articles, and conference contributions on social science research for earthquakes in the Wellington region and the associated potential effects on communities within the Wellington region.

2.0 METHOD

To gather all known sources of social science research on earthquakes in the Wellington region, a literature search was carried out using the following databases:

- GNS Science Bibliographic Database – an index of New Zealand geoscience literature indexing journal articles, reports, books excerpts, conference papers or abstracts, and maps;
- New Zealand Science – index of New Zealand science and part of the Knowledge Basket;
- FindNZArticles – index of information about New Zealand containing 3 sections: culture including arts and humanities, newspapers, and science and technology;
- INNZ – index of New Zealand periodicals; and
- KRIS – Kiwi Research Information Service, a gateway to the open-access research documents produced at universities, polytechnics, and other research institutions throughout New Zealand.

All relevant publications have been included in Section 2.0, Table 2.1, with full references in Section 3.0. The draft of this document was distributed to key people in this field and any additional references identified have been added to Table 2.1.

3.0 ACKNOWLEDGEMENTS

This report builds on the earlier 2012 bibliography developed as part of the Wellington: It's Our Fault Project (Johnston et al. 2012). This updated version was partially supported by QuakeCoRE, a New Zealand Tertiary Education Commission-funded Centre. This is QuakeCoRE publication number 0588. This report was reviewed by Jennifer Lillo and Lucy Kaiser.

Updated version from: Johnston, D., Coomer, M., McClure, J., Becker, J., Wright, K., 2012, A bibliography of social research on the earthquake risk in Wellington, New Zealand: 1848 to 2010. GNS Science Report 2011/11: 29p

Table Error! No text of specified style in document..**1** Social research on earthquake risk in Wellington: 1848 to 2019

Year	Nature of Study	Key Findings	Reference
2019	Information needs, communication, and use during the Canterbury earthquake sequence	Used interviews and focus studies with participants from Christchurch and Wellington to identify and understand needs for information about aftershocks during the Canterbury earthquake sequence, both for the public and agencies. These needs depended on what the information would be used for, past experience and knowledge, timing in the impact/response/recovery process, personal situations, and demographic factors. How the information was interpreted influenced by a number of factors including relevance, ease of understanding, knowledge/experience, trust in source, and personalization. The authors make several recommendations for ways to improve risk communication and suggest creation of strategies before an event to reduce the ad hoc, reactive nature of communication during the Canterbury earthquake sequence.	Becker et al., 2019
2019	Wellington resilience workshop	Summarizes the process and outputs of a workshop held in Wellington to further knowledge objectives for cultural and community resilience. The workshop involved academics, practitioners, and members of relevant institutions and community groups. As well as reaching a shared definition of community and cultural resilience, several objectives for future work were identified such as appreciating the value of cultural activities during recovery and considering community-specific needs in disaster resilience programmes.	Brown, Campbell et al., 2019
2019	Modelling physical and social impacts of a Wellington Fault earthquake	Reports findings of a scenario narrative used to model impacts from a Wellington Fault earthquake. This modelling examines business impacts and identifies ways to improve the resilience of key infrastructure. Further, the model explores psychosocial impacts on individuals and communities including resulting behaviour changes and population displacement as an important acknowledgment that resilience concerns social systems, as well as economic and physical ones.	Brown, McDonald et al., 2019
2019	Disaster resilience within the hotel sector	Used quantitative survey methodology to test and understand disaster resilience of hotels in Hawke's Bay and Wellington. Participants included general managers and hotel employees. Overall, hotels demonstrated good levels of a range of capitals: economic, social, human, physical, natural, and cultural. Strengths included insurance and financial resources, team approaches, and compliant infrastructure. The authors make several suggestions to increase resilience within these hotels, including budgeting disaster management and creating systems that will allow for off-site data retrieval and power generation.	Brown, Rovins, Feldmann-Jensen, Orchiston, and Johnston, 2019

Year	Nature of Study	Key Findings	Reference
2019	Disaster resilience in Wellington's hotel sector	Summarizes a body of work exploring the resilience of hotels in New Zealand, focusing on those in Wellington and drawing some preliminary lessons from the 2016 Kaikōura earthquake. The studies reported use secondary data, survey data, and qualitative data from semi-structured interviews. Hotels demonstrated several strengths, such as good building standard compliance and strong social networks, while areas for improvement were identified, such as increasing the inclusion of staff in disaster management planning and shifting to a multi-hazard perspective.	Brown, Rovins, Orchiston, Feldmann-Jensen, and Johnston, 2019
2019	Wellington City's response to the 2016 Kaikōura earthquake	A former Civil Defence and Emergency Management Primary Local Controller presents their perspective on the emergency management response to the 2016 Kaikōura earthquake, including which tasks were prioritized, long-term impacts, and discussion of how future events might impact the city.	Fleisher, 2019
2019	Developing resilience indicators for Wellington	Reports the method and outcomes of a blended top-down and bottom-up process to identify and select key indicators of resilience to natural hazards for Wellington. This process was a collaboration of emergency managers, researchers, and other stakeholders to ensure that the indicators were both practical and theoretically informed.	Kay et al., 2019
2019	Social capital and neighbourhood disaster resilience	Used semi-structured focus groups in Wellington and San Francisco to identify key themes relating to social capital. Data demonstrated three themes: community demography (e.g., length of residence, rate of homeownership), cultural influences (e.g., norms and values), and neighbourhood governance (e.g., leadership, collective action). The authors incorporate these findings with previous literature to create a framework to measure neighbourhood disaster resilience. Several suggestions are made for increasing social capital, and thereby community resilience, such as aligning disaster risk reduction interventions with cultural values unique to the target community and increasing ability of residents to engage with planning processes.	Kwok, Becker, Paton, Doyle, and Johnston, 2019
2019	Risk judgments, social norms, and preparedness after the Kaikōura earthquake	Reports the findings of a survey of Wellington residents following the 2016 Kaikōura earthquake. Perception of earthquake risk was higher after the event, while judgments of earthquake likelihood and social norms in support of preparing were positively associated with preparation actions after the 2016 event, particularly for survival actions. The authors suggest that these findings around the role of social norms can be used to enhance risk communication and efforts to encourage preparation behaviour.	McClure, Ferrick, Henrich, and Johnston, 2019

Year	Nature of Study	Key Findings	Reference
2019	Impact of the Kaikōura earthquake on the effectiveness of social norm messages	Reports the findings of a natural experiment, comparing the effectiveness of social norm messages aimed to increase support for earthquake strengthening legislation before and after the 2016 Kaikōura earthquake. These messages demonstrated weaker but still significant effects after the earthquake, suggesting that social norm messages are fairly robust to major events. Further, participants showed higher concern about earthquakes generally and earthquake-prone buildings specifically after the earthquake but were less supportive of the strengthening legislation, although this support was still overall positive.	Vinnell, Milfont, and McClure, 2019
2019	Learning from past events to increase earthquake resilience	Summarizes a number of papers exploring impacts and outcomes of the 2016 Kaikōura earthquake, including effects on preparation and risk perception and lessons for organizations such as hotels, as well as papers covering the definitions and measurement of resilience.	Vinnell, Orchiston, Becker, and Johnston, 2019
2018	Impact of the Kaikōura earthquake on Wellington CBD apartment residents	Reports the findings of a survey of residents of CBD apartments in Wellington following the 2016 Kaikōura earthquake. While some participants evacuated because of the potential of a tsunami, many were not worried about the possibility and evacuated for other reasons such as wanting to stay close to others. The behaviour of other residents was used to confirm people's decision to evacuate. A large proportion of residents were concerned about further earthquakes and several reported psychosocial impacts such as a need for reassurance. Most residents stayed within the city or the wider region and increased some preparation actions such as storing survival items, although participants noted that space to store such items presents a challenge. The survey also found some differences between those who own and those who rent their apartments, with owners being surer of their decisions about evacuation than renters.	Becker et al., 2018
2018	Wellington preparedness survey	Reports the findings of a survey to assess the emergency preparedness of households in the Wellington region. Respondents had undertaken a range of actions covering: 1) planning, such as what their household would do in an emergency and how to get home without cars or public transport; 2) preparation, such as storing food and emergency supplies; and 3) risk reduction, such as learning if their home is in a tsunami zone. Other findings, such as use of information sources and community engagement, are also presented.	Blake, Tippler, Garden, Johnston, and Becker, 2018

Year	Nature of Study	Key Findings	Reference
2018	Ministry of Civil Defence & Emergency Management Campaign Monitoring Research 2018	Presents the findings from a large (*N* = 1,000) phone-based interview study to evaluate changes to the Ministry of Civil Deference and Emergency Management's disaster preparedness campaign in 2016. Findings include a decrease in knowledge of the action "drop, cover, and hold" but an increase in knowledge of when and how to evacuate in case of a tsunami and a decrease in preparedness following an increase after the 2016 Kaikōura earthquake. Statistics on other important factors, such as barriers to and triggers for preparing, are also presented.	Colmar Brunton for Ministry of Civil Defence & Emergency Management, 2018
2018	Motivations to prepare after the 2013 Cook Strait earthquake	Used quantitative surveys to examine natural hazard preparedness in Wellington. The results demonstrated a range of factors relating to preparedness, including gender, earthquake characteristics, problem-focused action coping, and beliefs in negative outcomes of natural hazard events. Evidence of increased concern and action following the first earthquake suggests that such events offer a limited window to run preparedness campaigns. The authors make some recommendations for tailoring information provided during such post-event windows, such as using unique aspects and impacts of the event.	Doyle et al., 2018
2018	Risk tolerance for earthquakes and the impact of risk characteristics on mitigation	Examined risk tolerance for earthquakes compared to that for other hazards. Wellington participants showed different levels of risk tolerance for different hazards and prefer different risk mitigation strategies for earthquakes (e.g., government funding) compared to other hazards. Level of controllability and how unknown the hazard is to those that are exposed were predictors of a desire for stronger legislation for earthquakes. Risk communication might therefore benefit from emphasising the controllable aspects of earthquake resilience (e.g., preparedness).	Henrich, McClure, and Doyle, 2018
2018	Developing a neighbourhood-based resilience measurement framework	Used an appreciative inquiry approach to create frameworks to measure neighbourhood-level disaster resilience by engaging with key stakeholders. This addresses a current lack of research and focus on developing and evaluating resilience at local levels, which is necessary to increase community preparedness for, and outcomes in, natural hazard events. This framework covers factors including infrastructure, economic, socio-cultural, and psychological which will assist practitioners engaging with communities. The authors recommend further research into inclusive community engagement.	Kwok, Paton, Becker, Hudson-Doyle, and Johnston, 2018
2018	Strengthening of commercial buildings and voluntary earthquake safety checks on houses, 2012-2016	Used data on commercial and public buildings removed from the Wellington City Council Earthquake-prone Buildings List, as well as rates of voluntary home earthquake assessments in Wellington from 2012-2016. Significant numbers of buildings were removed from the earthquake-prone building list during the observed timeframe with strengthening the most common mitigation action being	McRae, McClure, Henrich, Leah, and Charleson, 2018

Year	Nature of Study	Key Findings	Reference
		undertaken (compared with demolition, chimney removal etc.) While there is steady progress on buildings being strengthened, there was only a short-lived increase in self-initiated home earthquake checks following the 2013 Seddon/Cook Strait earthquakes. These results suggest that personal mitigation actions (e.g., checking house strength) might be more routinely undertaken if they became subject to the same legislative or incentivized motivations that apply to earthquake-prone buildings.	
2018	The inverse response law: Theory and relevance to the aftermath of disasters	The inverse response law proposes that those who are more vulnerable to disaster risks also tend to receive less support during the response and recovery phases of an event. The authors present a number of case studies demonstrating this concept, including the 2016 Kaikōura earthquake. Although rural areas of the South Island, such as the Hurunui, experienced more severe impacts, they received less support from government and less attention from media and science than Wellington, where impacts were not as severe. The authors argue that socio-economic status is directly and negatively related to access to assistance and recommend that public health and social theory should be used in creating structural approaches which reduce inequity.	Phibbs et al., 2018
2018	The changing price of urban disaster risk following an earthquake	Used a natural experiment design to compare house prices before and after the Canterbury earthquakes, as well as between Dunedin and Hutt City, between construction types, and between liquefaction risk zones. The data demonstrate that house prices did not differ after the earthquakes based on construction type in either city. However, houses in Hutt City that are within high liquefaction risk zones saw a significant decrease in sale price, suggesting peoples' perception of liquefaction risk changed following the vicarious experience of the damage in Canterbury. This discount lasted for approximately four years, suggesting that this effect of risk perception dissipated relatively quickly. The authors suggest changes to public policy, such as greater emphasis of liquefaction risk for new buyers, and restriction of construction in high liquefaction risk zones.	Timar, Grimes, and Fabling, 2018
2018	Learning from experience: emergency response in schools	Conducted interviews with stakeholders from three case studies (Wellington schools) to explore how schools respond in emergency events (e.g., earthquakes). The data was used to identify key factors that contribute to the success of an emergency response - before (i.e., preparation), during (i.e., communication), and after (i.e., evaluation) an emergency strikes. A six-stage model of a school-based emergency response is also proposed that can apply to different types of emergencies. The authors recommend that schools should consider each stage in their emergency planning.	Tipler, Tarrant, Tuffin, and Johnston, 2018

Year	Nature of Study	Key Findings	Reference
2018	Effect of social norms on support for earthquake strengthening legislation	Found that injunctive social norms (information about whether a social group approves of a behaviour) can be used to increase support for legislation requiring the strengthening of earthquake-prone buildings in Wellington. Descriptive norms (information about the prevalence of a behaviour within a social group) can be used to increase judgments that the strengthening work is possible to achieve in the given time frame. Social norms are therefore potential tools for organizations wanting to increase support for new policies or legislation.	Vinnell, Milfont, and McClure, 2018
2017	Preparedness materials and meeting needs for vulnerable groups	Reviews current motivations for preparation, in particular the detrimental economic cost reduction focus. Efforts to increase feelings of safety and security are important to limit psychological harm. To do this, individuals need the financial means, capability, and support in order to prepare. These needs of vulnerable groups are not being met equally and are often being ignored by government preparedness material. The authors suggest a challenge of the current socio-political context to improve the meeting of needs for disadvantaged groups.	Blake, Marlowe, and Johnston, 2017
2017	Different perspectives on the preservation of community and heritage buildings	Used survey, interview, and focus group data from the general public, church communities, heritage specialists, professional engineers, and local authorities. Several recommendations are made to assist decision-makers regarding what to do with earthquake-prone community and heritage buildings. These include standardization of structural assessment processes, public funding to upgrade buildings, signage to increase public awareness, and regular communication among stakeholders.	Goded et al., 2017
2017	Assessing research priorities and practices following the 2016 Kaikōura Earthquake	Reports findings from a workshop of emergency management practitioners and social science researchers following the 2016 Kaikōura Earthquake. As well as co-ordinating research, the workshop included discussion of best practice among the social science community in the post-disaster phase. The discussion suggests that to draw lessons from such events, including best recovery practice and engagement practice, data needs to be collected immediately. The workshop further identified the importance of improving the effectiveness of social science following a disaster. The authors conclude with suggestions for post-disaster research best practice.	Hatton, Kipp, Brown, and Seville, 2017
2017	Trends for strengthening and policy recommendations on earthquake-prone heritage buildings	Reviews the risks posed by earthquake-prone buildings and the problems associated with strengthening and/or demolishing heritage buildings that fall within this category. Using data from Wellington City Council, this study reports that many Category 1 heritage buildings in Wellington have already been strengthened or are being strengthened well ahead of the legislated deadline for	Henrich and McClure, 2017

Year	Nature of Study	Key Findings	Reference
		completion. Steady progress towards the strengthening of all categories of earthquake-prone heritage buildings in Wellington suggests an emerging norm for building strengthening. This marked progress, as well as the relative risk of these buildings when compared to other hazards, warns against hasty demolition of heritage buildings without careful consideration.	
2017	Impact of a museum-based hazard education programme with students	Primary school students participated in a hazard education programme and were given either nothing at all, a fill-in disaster plan, plastic putty, or a steel bracket to take home and secure objects with. The education programme had a positive impact on student, teacher, and parental knowledge about disaster preparedness. Providing students with objects and instructions on how to use objects at home prompted discussions at home and uptake of the desired preparedness actions. These results are encouraging in terms of the effectiveness of such a programme for increasing awareness, discussion, and behavioural uptake regarding disaster preparedness.	MacDonald, Johnson, Gillies, and Johnston, 2017
2017	Economic and social reconnaissance: Kaikōura earthquake 2016	Reviews social and psycho-social impacts of the 2016 Kaikōura earthquakes, including disruptions to social infrastructure in Wellington such as school closures and building evacuations which required a welfare centre to accommodate the evacuees. The authors suggest possible long-term psycho-social impacts on Wellington residents such as reduced confidence in buildings and, conversely, an increase in complacency due to the lack of damage to earthquake-prone buildings. Other impacts, such as the confusion experienced during wide-spread tsunami evacuations, are discussed. The authors conclude with key issues for recovery.	Stevenson et al., 2017
2017	Emergency preparedness in New Zealand schools	Surveyed 355 schools in New Zealand and identified inconsistencies in emergency preparedness. Although the majority of schools have prepared for emergencies in ways such as educating students about hazards, planning, and running drills, other measures such as providing grab bags and crisis training are uncommon. The inconsistency in the extent of this preparation suggests that schools need to do more. The authors suggest clarification of legislation, the use of benchmarks and standard operating procedures, and community and practitioner engagement as options to improve emergency preparedness of schools.	Tipler, Tarrant, Johnston, and Tuffin, 2017
2017	Emergency preparedness in New Zealand schools and practitioner expectations	Reviews current legislation around disaster preparedness in New Zealand schools, finding that there is a lack of clarity around expectations of steps that schools should take to reduce disaster risk. The study also reports semi-structured expert interviews with three practitioners including the Wellington Region Emergency Management Office (WREMO). The authors suggest introducing benchmarks for	Tipler, Tarrant, Tuffin, and Johnston, 2017

Year	Nature of Study	Key Findings	Reference
		preparedness in schools to address this lack of clarity, as well as the development of standard operating procedures for schools to use in the event of a disaster. Suggested actions to target in these procedures include evacuation, family reunification, and education continuity.	
2017	Designing an earthquake-resilient classroom table	In the seismically active region of New Zealand the threat of earthquakes is ever-present with potential implications for residents of all ages. As school children spend a large extent of their daily lives within the classroom, it is vital that they are provided with an effective means to protect and prepare themselves for natural disasters. Through the application of qualitative, ethnographic, and "research through design" methodological approaches, this research has informed the design of a classroom table that effectively promotes safety and resilience around seismic events.	Tucker, 2017
2017	Effect of framing messages on support for earthquake legislation	Using an experimental design, this study surveyed 262 Wellington residents to test whether two types of information framing, valence and numerical format, would affect judgments of earthquake strengthening legislation. People were less tolerant of the risk posed by earthquake-prone buildings when presented with the number of those buildings, compared to the number of buildings classified as not prone. Participants also saw the strengthening work as more feasible, and expressed more concern, when presented with a number of prone buildings, compared to a percentage. Implications for policy communication are discussed.	Vinnell, McClure, and Milfont, 2017
2016	Earthquake risk and risk communication	Conference presentation on gaps between theory and practice in risk communication.	Becker, Wein, Doyle, McBride, and Potter, 2016
2016	Tsunami response behaviour and judgements in coastal suburbs of Wellington	Questionnaires were distributed to residents of coastal suburbs in Wellington following 2013 earthquakes. Less than 10% of respondents evacuated out of concern that a tsunami would strike following these earthquakes despite the majority thinking there was a moderate likelihood of a tsunami occurring. Respondents reported an increase in concern about future tsunami following the earthquakes, but 80% also rated their likelihood of evacuating in future tsunami being between "not at all likely" and "medium likelihood". Being in a tsunami evacuation zone increased this likelihood of future evacuation. Previous education about tsunami had little impact on perceived tsunami impact, though respondents were accurate in their perceptions of safety in respect to the tsunami hazard zone. At-risk communities should be involved in risk management procedures and educated about how to respond to tsunami warnings.	Fraser et al., 2016

Year	Nature of Study	Key Findings	Reference
2016	Evaluation of tsunami drills and preparedness actions in at-risk schools in the Wellington region	Investigated and evaluated general tsunami preparedness actions undertaken by at-risk Wellington schools. All 17 schools that were surveyed reported undertaking some tsunami preparedness actions. However, not all schools were fully prepared despite being within the tsunami inundation zones and therefore creating a high life-safety risk for students. In conjunction with exercises such as the ShakeOut drill, the necessity of tsunami planning and preparedness activities in at-risk schools needs emphasizing.	Johnston et al., 2016
2016	Examining the behavioural response in the immediate aftermath of shaking	Examined behaviour in the first half hour following an earthquake. Common behaviours included information-seeking and contacting family members. Factors affecting the resumption of previous activities were explored. These include damage and disruption to infrastructure, emotional responses, perceptions of intensity of shaking, and perceived earthquake threat. Other important findings, such as the lack of correlation between actions during and after shaking, are presented and discussed in relation to existing literature and potential applications.	Jon et al., 2016
2016	What is 'social resilience'?	Used perspectives of disaster researchers, emergency management practitioners, and policymakers from the Wellington region to understand the essential attributes of social resilience. Two key dimensions emerged (cognitive and structural) and encompassed a range of key attributes including community gathering place, social support, knowledge of risks and consequences, collective efficacy, and sense of community. The authors suggest strategies and actions that can be undertaken by policymakers and programme developers to strengthen social resilience.	Kwok, Doyle, Becker, Johnston, and Paton, 2016
2016	Effect of earthquakes in different locations on risk judgment and preparation	Examined the combined effect of the 2011 Christchurch and 2013 Cook Strait earthquakes on risk judgments and preparation in Christchurch, Wellington, and Palmerston North. The study found that earthquake likelihood was not judged higher in Wellington after the Cook Strait event, although the plausibility and importance of the risk increased, as did preparation. Patterns in risk perception between the cities surveyed suggest that the increase in Christchurch's perceived risk following the 2011 event is dissipating, and that people in New Zealand are again perceiving Wellington as the most at-risk of earthquakes. Other relevant factors, such as causal attributions, are also discussed.	McClure, Henrich, Johnston, and Doyle, 2016
2016	Older adults' meanings of preparedness in Wellington	Interviewed older adults (aged between 65 and 90 years) about their views on disaster preparedness. Central to these views were the importance of managing physical health needs (e.g., medical health alarms) and having social resources (e.g., assistance from family and neighbours). The meaning of preparedness in the context of old age is therefore not always disaster-specific and extends to any	Tuohy and Stephens, 2016

Year	Nature of Study	Key Findings	Reference
		kind of preparedness that supports independence. Efforts to tackle emergency preparedness for older adults might therefore be better received if it is packaged within a wider perspective (e.g., health).	
2016	Examining the effects of message framing and social norms on judgments of earthquake legislation	Reports three surveys on Wellington residents' judgments of earthquake strengthening legislation, including predictors of support. Consistently, the belief that the strengthening work will reduce damage and injury in a future earthquake strongly and positively predicted support for the legislation. Implications for policy communication are discussed.	Vinnell, 2016
2015	A community resilience perspective on risk communication	Reviews community resilience literature, starting with a definition of resilience then summarizes relevant social and psychological factors such as outcome expectancy, place attachment, social norms, and previous disaster experience. The authors suggest that these factors should be considered in the development of a range of strategies to communicate risk.	Becker, Paton, and Johnston, 2015
2015	Knowledge transfer to improve community resilience	Presents the rationale, method, and outcomes of a workshop hosted by the International Centre of Excellence in Community Resilience, Wellington, NZ. During the workshop, participants identified the obstacles to sharing knowledge across sectors, such as communication, and potential solutions including more creative approaches to resourcing.	Doyle, Becker, Neely, Johnston, and Pepperell, 2015
2015	Effects of risk framing on earthquake risk perception	Using an experimental method, tested risk perception based on five different statements of potential earthquake fatalities in a hypothetical city. These statements varied frequencies versus probabilities of deaths, time frame, and sample frame. Wellington participants judged risk highest when the frequency of fatalities over a lifetime was presented. The authors discuss the implications of this finding for risk communication practice.	Henrich, McClure, and Crozier, 2015
2015	Judgments about earthquake probabilities across time windows	Provided participants with an expert estimate of earthquake risk, and then examined judgments of earthquake risk across a time window of 60 years. The perceived risk of an earthquake in Wellington increased throughout the time window. However, there was no change in likelihood of increasing preparedness. The findings that risk perception changed, despite no information suggesting this in the provided scientific estimates, leads the authors to suggest that individual beliefs about earthquake risk, such as perceived base rates, might influence the interpretation of expert risk estimates.	McClure, Doyle, and Velluppillai, 2015

Year	Nature of Study	Key Findings	Reference
2015	Risk judgements in Wellington after the Canterbury earthquakes	Examined earthquake preparedness and perceived earthquake risk in a Wellington sample following the 2010-2012 Canterbury earthquake sequence. Wellington residents reported greater preparedness and marginally higher judgements of earthquake risk following the earthquakes. Wellington residents recalled thinking that an earthquake was more likely to occur in Wellington than in Christchurch prior to the earthquakes, but that an earthquake was equally likely to occur in both cities following the Canterbury earthquakes. Those that personally knew someone in Christchurch judged local earthquake risk as higher than those that did not personally know someone. Disaster experience therefore can affect risk perceptions and preparedness even outside of the affected region.	McClure, Johnston, Henrich, Milfont, and Becker, 2015
2015	Examining attributions for preparedness and comparing frequency of mitigation actions with frequency of survival actions	Wellington businesses and households were questioned about their earthquake preparation and attributions for not having prepared. Mitigation actions (e.g., strengthening building foundations) were undertaken less frequently than survival actions (e.g., having water supplies). Expensive actions were undertaken less frequently than inexpensive actions but cost was not the top-ranked attribution for failing to prepare. Higher-ranked attributions included not having thought about it, the belief that the action would make no difference, and low priority of the action. Cost is therefore not the only relevant criterion when it comes to the decision to prepare and cannot fully explain why mitigation actions are under-performed.	McClure, Spittal, Fischer, and Charleson, 2015
2015	Public perceptions of building seismic safety in Wellington following the 2011 Canterbury earthquake	Analysed all relevant Twitter data in the days following the February 2011 Canterbury earthquake. Several keywords emerged in relation to tweets about “buildings”. Alongside “failed”, “old”, “codes”, and “heritage”, “Wellington” emerged as an important keyword in this data. These tweets sought out knowledge about earthquake-prone buildings in Wellington and considered a future earthquake scenario in Wellington where buildings might be jeopardized. This highlights that an earthquake in another part of New Zealand prompts information-seeking regarding building safety in Wellington.	Mora, Chang, Beatson, and Morahan, 2015
2014	Life safety vs. preservation of community and heritage buildings in the Wellington region	Balancing risk against the preservation of earthquake prone buildings is a continuing struggle in Wellington. This project gathered and compared the perspectives of the general public, church communities, heritage specialists, professional engineers, and local authorities to assist GNS Science in balancing the interests of these stakeholders. Recommendations include standardizing structural assessment processes and training, feasibility of additional public funding to upgrade buildings, new signage to increase public awareness of earthquake prone buildings, and regular communication among stakeholders to understand and resolve differences.	Beaupre et al., 2014

Year	Nature of Study	Key Findings	Reference
2014	Survey on reactions of Wellington residents to the Cook Strait earthquake sequence	Surveyed 204 residents of Wellington about their experiences during two recent earthquakes, Cook Strait and Lake Grassmere, including who they were with, how they reacted, and how they felt. Participants also demonstrated their understanding of communications about aftershocks, both real and hypothetical. The authors present tabulated results of the survey.	Coomer et al., 2014
2014	Relationships among quality of life, well-being, and disaster preparedness	Used a quantitative survey of Wellington adults to measure health protective behaviours and attitudes and examined their associations with preparedness to evacuate in a disaster. Several significant correlations were found between dimensions of well-being and evacuation preparedness, including emotional well-being and life satisfaction. Regression analyses demonstrated a small but significant proportion of variance in evacuation preparation explained; however, spiritual well-being was the only unique predictor. Further, the research explores intangible aspects of readiness such as perceived disaster risk and consequences, which, along with well-being, should be included in conceptualizations of preparedness.	Gowan, Kirk, and Sloan, 2014
2014	Factors predicting citizens' risk tolerance regarding earthquakes	People tolerate different levels of risk from different hazards in their day-to-day life. Perceptions of risks and the amount of risk mitigation people desire for different hazards vary. Previous research shows that the psychometric properties of different hazards predict the level of risk people tolerate for various hazards, but not for earthquakes. Risk tolerance is likely to also be affected by factors other than the psychometric properties of hazards. This research tested how earthquakes score on psychometric risk properties compared to five other hazards and aimed to replicate previous research on the risk factors predicting risk tolerance. Secondly, the research aimed to test if other factors, namely framing effects, risk perception and fatalistic thinking predict risk tolerance for earthquakes.	Henrich, 2014
2014	Disaster preparedness education in New Zealand primary schools	Uptake of a national disaster preparedness education scheme was analysed with a mixed method approach. Findings from focus groups and a nationally representative survey are presented. These include factors which increased uptake, such as school-wide use, and factors which deterred uptake, such as lack of awareness. The authors make several recommendations to increase the use of the resource, such as online teacher training.	Johnson, Ronan, Johnston, and Peace, 2014
2014	Land use planning policies and initiatives in San Francisco for earthquake: What can Wellington learn?	Presents the land use planning policies and initiatives for earthquake in San Francisco, California, with discussions on how these lessons can be incorporated into planning practice within the Wellington region.	Mieler, Beban, and Saunders, 2014

Year	Nature of Study	Key Findings	Reference
2014	Wellington schools and tsunami evacuation	Used a citizen science approach to test tsunami evacuation exercises at Wellington schools to develop communication resources.	Robinson, 2014
2014	Community resilience, latent resources and resource scarcity after an earthquake	Reports on the results of interviews conducted with Wellington residents to assess their beliefs about their ability to survive in place in an earthquake scenario. Nearly half of the participants would have run out of at least one necessity (e.g., food, water) after three days, with nearly all running out of at least one necessity after seven days. After a week without official aid, participants said they would be more likely to engage in undesirable behaviour such as stealing and would be less likely to offer help to others.	Thomas and Mora, 2014
2014	Exploring older adult's understanding of disaster preparedness	Reports two studies on specific issues around preparedness for older adults, including practical concerns such as stocking medication and storing water, and social concerns such as the importance of supportive social relationships.	Tuohy, 2014
2014	Evacuation planning in Wellington Region for tsunami	Many thousands of people in the Wellington Region could be displaced by large, local source tsunamigenic earthquakes. Modelling of a large subduction zone event earthquake in the Hikurangi Margin has been undertaken to determine evacuation rates due to building damage and self-evacuation for tsunami.	Wright and Cousins, 2014
2013	Water needs and availability in post-earthquake Wellington City, and the significance of social factors in determining community resilience	The Wellington Fault is expected to generate a magnitude 7.5 earthquake. The direct and indirect impacts of this event are expected to cause wide and extensive damage to buildings, infrastructure and lifelines and result in the loss of life and injury. The security of the water supply and the availability of alternatives is an important consideration as the bulk-supply pipelines cross the Wellington Fault in several places.	Beban, Doody, Wright, Cousins, and Becker, 2013
2013	Review of how earthquake hazards are recognised and addressed in council plans and policies for the Wellington Region	Earthquake hazards in New Zealand are addressed under a variety of pieces of legislation, including the Resource Management Act 1991, Building Act 2004, Earthquake Commission Act 1993, Civil Defence Emergency Management Act 2002, and the Local Government Act 2002. A number of these pieces of legislation require councils to produce plans and policies that identify how they are going to address the risks due to natural hazards in their respective jurisdiction. However, there is little research that examines how well natural hazards are identified and recognised in councils' plans and policies. This paper presents the findings from two projects completed under the Wellington "It's Our Fault" programme which explores this topic.	Becker and Beban, 2013

Year	Nature of Study	Key Findings	Reference
2013	Land use planning and policy for earthquakes in the Wellington region (2001-2011)	Used Wellington region land use planning documents to determine if earthquake hazards became better recognised and mitigated between 2001 and 2011. Policy statements and plans display a greater recognition of earthquake risk in more recent years compared to a decade earlier. Despite this, some identified areas for improvement include the addressing of all hazards associated with earthquakes (e.g., liquefaction, landslides), as well as continued evaluation of policy to ensure that earthquake risk is adequately recognised, addressed, and mitigated.	Becker, Beban, Saunders, Van Dissen, and King, 2013
2013	Tsunami awareness and preparedness in the Greater Wellington region	Used interview data with coastal inhabitants in the Wellington region to assess awareness of, and preparedness for, tsunami threat. Only half of respondents expected a tsunami in their lifetime, with less than 10% knowing the natural warning signs. Many of those interviewed indicated they would evacuate immediately, but would likely wait on an official order through radio or alarm, and planned to drive their cars to higher ground (with little recognition of the congestion that might result from mass evacuation). Several recommendations were made for GNS and WREMO regarding both improvement of survey/interview methodology and data and ways to improve awareness and preparedness for tsunami in Wellington. Some recommendations include continued implementation of blue-lines, stickers to indicate tsunami safe buildings, and increased emphasis on evacuation by foot or bicycle and the importance of taking personal responsibility for evacuation.	Currie, Enjamio, Girardo, and Hensel, 2013
2013	Community understanding of, and preparedness for, earthquake and tsunami risk in Wellington	The authors explain the Wellington hazard context, and the current tendency of public education campaigns to focus on providing risk information. Survey findings demonstrate that risk awareness is high, but preparedness levels are low. Based on these findings, the authors suggest that individual, psychological, and community factors contribute to the relationship between perception and preparedness, and that future campaigns should consider these factors.	Johnston et al., 2013
2013	Children's knowledge, cognitions, and emotions surrounding natural disasters	Conducted focus groups with Year 5 school students from Wellington to explore the children's knowledge, thoughts, and feelings about earthquakes and tsunamis. Knowledge about these hazards, including causes and consequences, was generally good. Children understood the unpredictability of such events, and expected a large earthquake in Wellington in the future, but held the belief that both their families and their schools were equipped to deal with a disaster. This belief, along with the belief that they and their families know how to keep safe in a disaster, helped them feel less afraid about disasters. The authors also discuss the importance of the finding that the children had discussed disaster preparation with friends and families following learning about it at school.	King and Tarrant, 2013

Year	Nature of Study	Key Findings	Reference
2013	Communicating earthquake risk and building resilience in Wellington New Zealand	Between August and November 2012, GNS Science, Wellington City Council, and WREMO ran 20 community meetings. Attendees completed quantitative (scale response) and qualitative (free response) items to determine the effectiveness of the meetings. Overall, participants found the meeting useful and reported feeling positive about living in Wellington and in the work being carried out. Other findings identify features which should be included or added in future similar activities such as limiting technical information, providing more information about preparedness in general and specific agency's work, using analogies, and giving localized information.	McBride et al., 2013
2013	The effects of news media reports on Wellingtonians' earthquake attributions and preventability judgements following the Canterbury earthquake	Compared the impact of fatalistic media reports (reporting widespread and indiscriminative damage irrespective of building type) with informed media reports (reporting varied damage according to building type) following the February 2011 Canterbury earthquake. Participants who read informed media messages were more likely to attribute earthquake damage to controllable causes and therefore judged damage as more preventable than those that read fatalistic media messages. Media reporting can therefore play an important role in shaping citizens judgements about earthquakes as well as in facilitating preparedness for earthquakes.	McClure and Velluppillai, 2013
2013	Biases in earthquake risk over time windows	Located on the edge of two tectonic plates, New Zealand has numerous fault lines and seismic risk across the whole country. The way this risk is communicated affects whether people prepare effectively or at all. Perceptions of risk are affected by slight changes in wording, and that probabilities commonly reported by experts and media are often interpreted subjectively based on context.	Velluppillai, 2013
2013	Planning for immediate evacuation in Wellington Region following major subduction zone earthquakes	Conference presentation in “Same risks, new realities: New Zealand Society for Earthquake Engineering Technical Conference and AGM”.	Wright, Cousins, and Leonard, 2013
2012	Assessing earthquake hazards: a review of council policies and plans within the Wellington region	Investigated how various council plans and policies within the Wellington region recognise earthquake hazards. Annual plans, long term plans, district plans, spatial plans and earthquake-prone building policies of the following councils were reviewed: Hutt city Council, Kapiti Coast District Council, Porirua City Council, Upper Hutt City Council, and Wellington City Council.	Beban, Coomer, and McBride, 2012

Year	Nature of Study	Key Findings	Reference
2012	School earthquake emergency response and evacuation case study	Reports findings from a case study observing and evaluating an earthquake drill in a Wellington primary school. This drill included practice of response to the emergency and evacuation. Overall, the school performed well, largely due to prior preparation and planning. Modifications to address weakness with the drill are discussed, including more communication and reassurance from teachers to keep children calm, involving children in the planning stage, and integration with other areas of the curriculum to increase learning benefits.	Coomer, Tarrant, Hughes, and Johnson, 2012
2012	The relationship between perceived susceptibility to earthquakes and tsunami and response in Wellington	Used questionnaire and interview data with Wellington citizens. There is close alignment between physical and perceived susceptibility to earthquakes in Wellington which produces a high response rate to these hazards (e.g., having a survival kit). This relationship is not linear, however, given that preparedness for tsunami is low despite awareness of susceptibility. It is suggested that other characteristics relating to place and person (e.g., fatalism or blasé effect) impact these relationships. The authors conclude that understanding the gap between perceived and physical susceptibility to hazards, and narrowing this gap, can lead to better hazard management in Wellington.	Khan, Crozier, and Kennedy, 2012
2012	Effect of authoritative information and message characteristics on evacuation and shadow evacuation in a simulated flood event	Looks at the influence of the presenter in a mock television evacuation order on people inside and outside the evacuation area. The presenter's level of authority and message did not affect the likelihood of evacuation. Participants indicated they would place the greatest level of trust in evacuation information from the highest role within Civil Defence, followed by local Police. Three quarters of shadow evacuation was due to participants incorrectly including themselves in the evacuation zone. The remaining quarter reported higher levels of concern about their safety and ability to travel.	Lamb, Walton, Mora, and Thomas, 2012
2012	Post-earthquake sheltering needs in Wellington	Wellington City has a population of approximately 200,000 people, concentrated in high-rise buildings in the Central Business District and mostly timber houses in surrounding hillside suburbs. The city is bisected by the Wellington-Hutt Valley segment of the Wellington Fault and a large surface rupture earthquake (M~7.5) on this section of fault will result in many dwellings within the city being damaged and unsafe for habitation, transportation routes and critical lifeline services will also be severely disrupted, and evacuation out of the city will not be possible immediately after the quake.	Wright et al., 2012

Year	Nature of Study	Key Findings	Reference
2012	Estimating post-earthquake welfare and sheltering needs following a Wellington earthquake.	A future earthquake in the city of Wellington will cause widespread building and infrastructure damage, particularly on soft soils. It is also anticipated that all major transport routes (air, sea, rail, and road) out of the region and many within the region will be affected. Such impacts create challenges for the provision of welfare and sheltering in the aftermath of an earthquake. A model framework for calculating evacuation numbers, welfare needs and sheltering requirements is proposed based on a variety of damage and non-damage related factors that contribute to evacuation decision-making.	Wright, Johnston, Cousins, and McBride, 2012
2011	Lessons from an evaluation of a Wellington school earthquake exercise	Observed and evaluated one Wellington primary school's annual earthquake response and evacuation exercise. Recommendations are made to modify the exercise, as well as some key lessons communicated as a result of observation. One conclusion that can be drawn is that frequent, well-learned emergency exercises are likely to increase the chances of schools, staff, and pupils responding to a real emergency in a safe, informed, and predictable manner. These lessons can inform the design and implementation of future emergency preparedness exercises conducted in New Zealand schools.	Johnston et al., 2011
2011	Framing effects on disaster preparation	Using an experimental survey, the authors tested positive and negative outcome frames. Those who were given negative outcome judged preparedness in general as more important than those who were given a positive outcome. The combination of a negative outcome and a negative action led to stronger intentions to undertake specific preparations. Implications for risk communication are discussed.	McClure and Sibley, 2011
2011	Earthquake risk judgements and preparedness before and after the Canterbury earthquake	Using questionnaires, this study found that Wellington citizens' thought an earthquake was likely to occur in Wellington prior to the 2010 earthquake, and this judgment of likelihood did not increase following the earthquake. They did, however, report increased likelihood for another earthquake to occur in Christchurch compared to their judgments of likelihood before, more-so for those that had friends, family, or close acquaintances in Christchurch. This study concludes that New Zealanders' may be incorrectly fixated on Wellington as the only earthquake-prone city. It also reviews three methods of preparedness for earthquakes: legislation; incentives; and personal readiness.	McClure, Wills, Johnston, and Recker, 2011a
2011	Earthquake risk perception inside and outside the affected region	Reports findings of surveys in three NZ cities, Christchurch, Wellington, and Palmerston North following the 2010 Darfield earthquake. People in Wellington had a higher expectancy of an earthquake in their own city than in the other two cities before the earthquake, and judgments of	McClure, Wills, Johnston, and Recker, 2011b

Year	Nature of Study	Key Findings	Reference
		likelihood did not increase following the 2010 event. In contrast, residents of both Palmerston North and Christchurch had higher expectations of an earthquake in their own cities after the earthquake. The authors suggest that prior expectancies and earthquake experience are important factors to consider when testing risk judgments.	
2010	Earthquake hazard: Wellington	Earthquake Hazards Fact Sheet. Wellington: Greater Wellington Regional Council (GWRC).	GWRC, 2010
2010	An earthquake emergency response and evacuation exercise in a New Zealand school: a case study report	Observation of an earthquake response and evacuation exercise in a Wellington primary school. Modifications and issues for best practice were identified and included. Key findings include: frequent, well learned emergency practices will help staff and pupils react well in an emergency and that having well practiced plans in place send a message to the community that their children are safe at the school.	Johnston et al., 2010
2010	Community understanding of hazard response, perception, preparedness and past experience	Theorises the concept of "HazardScape" and assesses its influences on local response of people and administration in Wellington Region. The research is interdisciplinary in nature and looks for both physical and social causes of hazards along with all responses in different forms of adjustments and adaptations for hazard mitigation, preparedness, real time response and recovery. It is based on the hypothesis that whereas integrated planning has aimed for uniform response, HazardScape introduces variations in local response.	Khan, 2010
2010	Are we prepared?	Preparedness level in Wellington. Wellington Region CDEM Group commissioned telephone surveys in 2010, 2007, 2006, 2005, and 2004 among a random cross-section of residents to gather information that helps quantify the region's level of preparedness for a major civil defence emergency. This report contains data from the 2010 survey.	Peter Glenn Research, 2010
2010	Preparedness to cope with hazards – schoolchildren	The study investigated the perceptions, knowledge, and preparedness needed to cope in a range of natural hazard scenarios, with particular attention given to earthquakes and tsunami. The school children had a realistic understanding of the likelihood of earthquakes and tsunami occurring in the Wellington region, and the large majority understood the causes of earthquake and tsunami, and knew best practice in the event of these two hazards. However, about 20% of the children were often fearful of earthquakes and tsunami. Only a minority of children discuss with their parents what they learn about hazards at school, and family preparedness rates were low for dealing with an emergency event. Results suggest that future hazards programmes in schools include emotional-coping	Tarrant and Johnston, 2010a

Year	Nature of Study	Key Findings	Reference
		components, and hazards related homework exercises to encourage the flow-on effect of school-learning to the home and wider community.	
2010	An investigation of the relationship between socio-economic status and hazards-preparedness in intermediate school children	The study used self-report questionnaires in five Wellington-region intermediate schools with a range of decile rankings, which reflects the socio-economic status (SES) of the community, to examine whether SES relates to knowledge of and preparedness for natural hazards. Overall, the authors found support for the hypothesis that students from lower decile schools, reflecting lower SES, have less knowledge of the causes of earthquakes and tsunamis and lower preparedness for such events. Similar patterns are reported for related cognitions, including fear (which decreased with higher SES) and realistic perceptions of risk (which increased with higher SES). The authors conclude that SES is associated with hazard knowledge and preparedness but suggest that future studies could examine a larger number of schools and consider other relevant factors, particularly ethnicity.	Tarrant and Johnston, 2010b
2010	Better defining earthquake risk in Wellington	The goal of the “It’s Our Fault” programme is to see Wellington positioned to become a more resilient city through a comprehensive study of the likelihood of large Wellington earthquakes, the effects of these earthquakes, and their impacts on humans and the built environment. Some key results to date include better definition and constraint on: 1) faulting in Cook Strait, 2) timing and size of past ruptures on the Wellington, Wairarapa, Wairau, and Ohariu faults, 3) state of locking of the subduction interface, 4) fault interactions throughout the region, in particular, rupture statistics of the Wellington-Wairarapa fault-pair, and 5) conditional probability of rupture of the Wellington Fault. Current investigations are focused on characterisation of earthquake ground shaking behaviour in Wellington City and the Hutt Valley.	Van Dissen et al., 2010
2010	Post-earthquake sheltering needs: How loss of structures and services affects decision making for evacuation	For a major Wellington earthquake event, decisions about evacuation will occur after event impact. A model framework for calculating evacuation numbers and sheltering requirements is proposed based on a variety of damage and noon-damage related factors that contribute to evacuation decision making. A household’s decision on whether to evacuate or shelter in place is based on a range of factors and the outputs from this model will assist those tasked with planning for readiness, response and recovery.	Wright and Johnston, 2010
2009	Ministry of Civil Defence & Emergency Management	MCDEM’s “Get thru” campaign showed continued effectiveness. New Zealanders who had taken steps to prepare in the previous 12 months were mainly prompted by advertisements they	Colmar Brunton for Ministry of Civil Defence

Year	Nature of Study	Key Findings	Reference
	Campaign Monitoring Research 2009	saw/heard/read (29%). Four out of five New Zealanders who had seen the ads (80%) had been prompted to think or take action to prepare for a disaster (up from 74% in 2008).	and Emergency Management, 2009
2009	Planning for tsunami evacuations: The case of the Marine education centre, Wellington, New Zealand	Reviews the application for the Marine Education Centre at Te Raekaihau Point and discussion around the Environment Courts decision on evaluation planning for coastal facilities. The Environment Court agreed that there needed to be specific planning for evacuation of staff and visitors to tsunami at-risk facilities. This is significant for future applicants seeking resource consents for the establishment and operation of public facilities in areas susceptible to natural hazards, in that an evacuation plan is a necessary consideration of public safety.	Garside, Johnston, Saunders, and Leonard, 2009
2009	Disposal of debris following urban earthquakes: Guiding the development of comprehensive pre-event plans	Guidelines and procedures in place to manage disaster debris assists in the timely and efficient removal of debris and assists with the appropriate recycling and/or disposal to appropriate locations. Inefficient or poorly planned responses can impose additional social, economic and environmental burden on an already impacted community.	Johnston et al., 2009
2009	Building community resilience through community-based education programmes	The design of hazard education programmes should be integrated with community development initiatives and will be more effective than stand alone, one-off programmes. School education programmes need to be one of the centrepieces of a sustained, community-based effort.	Johnston et al., 2009
2009	Travel behaviours following the 2007 Gisborne earthquake: Evidence for the use of simulation in earthquake research	Simulated post-earthquake travel behaviour for Wellington scenarios and examined likely vehicle abandonment during post-earthquake travel. The effects of social influence and trip distance were examined. A variety of factors motivate post-earthquake travel, not just to return home. Walking was the preferred means of travel up to 6.25kms and driving at greater distances. 32% of participants chose to drive as far as possible before abandoning their cars and participants who saw other people abandoning their vehicles were more likely to abandon theirs.	Lamb and Walton, 2009
2009	Framing effects on preparation intentions	Examined whether peoples' intentions to prepare for earthquakes were influenced more by positive or negative framing of the messages. The findings indicate that negatively framed messaging is more likely to influence people to prepare for an earthquake, and negative framing of outcomes is likely to increase preventive actions in relation to natural hazards. Intentions to undertake both general and specific preparation were higher with negatively framed outcomes than positive outcomes. With	McClure, White, and Sibley, 2009

Year	Nature of Study	Key Findings	Reference
		specific actions, negative outcomes led to higher intentions to prepare when the action frame was positive (i.e. being well prepared).	
2009	Framework for economic impact assessment of earthquakes disruption to Wellington metropolitan lifelines	This project developed a framework for measuring the business interruption losses from lifeline disruption after a rupture of the Wellington fault line.	Sanderson and Norman, 2009
2009	Returning to work after the big one: Predicting staff priorities in a dual role agency	Studied the return to work behaviour of 190 staff in a local government organisation after a hypothetical earthquake scenario. Attitudes and interdependencies between individuals and departments were examined using questionnaires, social network analysis, and multidimensional scaling. An individual's overall responsibility in the organization affected their attitudes to returning to work the most, while dependents had less effect on the decision to return than expected. Staff were more motivated to return for their colleagues and the community, rather than economic or organisational reasons.	Smith and Walton, 2009
2009	Experimental investigation of post-earthquake travel behaviours	Used an experimental design to examine behavioural responses to a simulated earthquake event with a specific focus on travel behaviours. Presented four earthquake simulation videos varying in severity (moderate and severe) and location (home or office) to examine their effect on intended travel movements in a 48-hour period and other related behaviours. The majority of participants who experienced the earthquake "at work" chose to travel home, with many "at home" also choosing to travel. Event severity had an impact on mode of transport chosen and motivation to travel. Travel responses in this study show a heavy reliance on the transport network in a post-earthquake setting which may cause heavy traffic to hinder emergency response.	Walton and Lamb, 2009
2009	Rational chaos: Human and traffic behaviour in earthquake events	Examined New Zealanders' needs for information and mobility after a natural hazard event, and how these can be met to promote recovery. It is generally conceded that panic behaviour after an emergency is unusual, with individual behaviour instead being rational and goal-directed. Despite this, there is evidence that the collective rationality of society is lost in the disaster scenarios. It is argued that we should not underestimate how dependent individuals are on various elements of modern society. Reliance on media, communications, and the ability to easily travel greater distances by modern personal transportation modes makes us less able to coordinate ourselves well as individuals	Walton, Lamb, and Smith, 2009

Year	Nature of Study	Key Findings	Reference
		and small groups after an emergency event. From the results of four research projects, some insights are shown into New Zealanders' likely reactions to a major earthquake or landslide.	
2009	Survival confidence of New Zealanders in outdoors and post-earthquake situations	Surveyed 233 New Zealanders and 130 people from overseas on their preparedness and confidence at performing tasks post-earthquake and in the bush. Participants compared their abilities to those of the average person from their own country: in the bush scenario, 67% of New Zealanders and 69% of those from overseas showed an optimism bias by rating themselves better than average in the earthquake scenario 72% of New Zealanders and only 33% of those from overseas showed this bias. The difference in confidence between scenarios can be explained by the likelihood of having experienced the scenario examined, and it is suggested that New Zealanders may be overconfident in their abilities in a scenario they have not experienced.	Walton and Smith, 2009
2008	Ministry of Civil Defence & Emergency Management Campaign Monitoring Research – June 2008	Awareness of the advertising remains high and the advertisements continue to be effective at getting people to either think about or take action to be more prepared.	Colmar Brunton for Ministry of Civil Defence & Emergency Management, 2008
2008	Emergency management in schools	Looked at current emergency management teaching, resources and exercises within schools, and how they are used for Emergency Management education and preparedness. The majority of schools in the study area have some awareness of preparedness issues. The level of awareness depends on the individual school, which ranges from some that are fully prepared for a disaster scenario to some that just have fire drills.	Coomer, Johnston, Edmonson, Monks, Pedersen, and Rodger, 2008
2008	Earthquake and tsunami losses from major earthquakes effecting the Wellington Region	The results showed that the Wellington Fault earthquake still represents a reasonable benchmark for risk assessment purposes, with the combined earthquake and tsunami losses generated for four key earthquake scenarios either adding little to the Wellington event itself or accumulating to significantly less than that earthquake on a stand-alone basis.	Cousins, Power, Destegul, and King, 2008
2008	Travel behaviours following the 2007 Gisborne earthquake: Evidence for the use of simulation in earthquake research	Travel behaviours were examined following the December 20, 2007, magnitude 6.8 earthquake in Gisborne. People away from their homes were five times more likely to travel than those at home. Official warning not to travel, long trip distances, dangerous conditions, and the possibility of traffic jams did not decrease the likelihood of travel. People stayed at home only if they had no reason to travel.	Lamb and Walton, 2008

Year	Nature of Study	Key Findings	Reference
2008	Developing an effective tsunami warning system: lessons from the 1960 Chile earthquake tsunami for New Zealand coastal communities	Since 2004, the renewed focus on tsunami has built on a range of improvements in emergency management policies and practices, and the lessons identified from the event paved the way for a number of new initiatives to get underway to enhance New Zealand's tsunami warning capacity and capability.	Johnston et al., 2008
2008	Predictors of two types of earthquake preparation: Survival activities and mitigation activities	When demographic factors were taken into account, risk-taking tendency predicted earthquake preparation in general and survival actions in particular, but not mitigation actions. In contrast, locus of control predicted mitigation actions. These findings extend existing theories and show the value of measuring mitigation actions as well as survival actions.	Spittal, McClure, Siegert, and Walkey, 2008
2007	Ministry of Civil Defence & Emergency Management Campaign Monitoring Research – June 2007	Public awareness of the Civil Defence advertising remains high (66%). Ads continue to be effective at getting people to think or take action. Only 24% have done nothing after seeing the ads.	Colmar Brunton for Ministry of Civil Defence and Emergency Management, 2007
2007	Community-based public education initiatives	A review of community-based public education programmes identified key factors for successful community-based public education programmes.	Finnis, 2007
2007	School and community-based hazards education and links to disaster-resilient communities	Children are especially vulnerable to the effects of disasters. Schools are communities in themselves, and are key groups within geographic communities through which hazard education initiatives can be carried out.	Finnis, Johnston, Becker, Ronan, and Paton, 2007
2007	Using action plans to increase voluntary actions that reduce earthquake damage	For both immediate and long-term consequences, companies reported thinking more about life and adoption of survival actions than mitigation actions. The findings show that use of action plans doesn't enhance hazard preparedness.	McClure, Fischer, Hunt, and Charleston, 2007
2007	Listening to reporters or engineers? How instance-based messages about building design affect earthquake fatalism	Looked at the role of earthquake information in influencing people's judgements about future damage. Presenting citizens with detailed information about why poorly constructed building are damaged in earthquakes versus more typical "news" items can increase their belief that damage can be prevented by appropriate mitigation actions.	McClure, Sutton, and Sibley, 2007
2007	How information about building design influences causal	Findings show that mechanism (design) information does influence judgments about damage in earthquakes and, by implication, other hazards. Participants attributed damage to building design	McClure, Sutton, and Wilson, 2007

Year	Nature of Study	Key Findings	Reference
	attributions for earthquake damage	more strongly and rated the damage as being more preventable when scenarios referred to the poor building design.	
2007	Where two plates meet: Earthquakes	Review of impacts of the c. 15th century, 1848, 1855, and 1942 earthquakes in Wellington. Provides an account of the social and environmental impacts of the earthquakes. The 1942 Wellington earthquakes caused extensive damage to over 5,000 houses and 10,000 chimneys.	McSaveney, 2007
2007	Final Report on Exercise Capital Quake 06	Key exercise observations include: while strategic short-term solutions for access into the Wellington region were developed during the exercise, specific planning needs to be undertaken. MCDEM in conjunction with the Domestic and External Security Group and CDEM groups needs to establish pre-programme response actions.	Ministry of Civil Defence and Emergency Management, 2007
2007	Risk perceptions, preparedness, and hazards education participation of Porirua school children	Master's thesis to assess schoolchildren's perceived risks, awareness levels, and home-based preparedness measures from natural hazards and the influence of hazard education programmes.	Tipler, 2007
2007	An experimental investigation of the influence of media type on individual perceptions of the severity of earthquake events	While radio was the most preferred media source prior to viewing, television was found to cause the largest increase in perceptions of severity. Viewing all media sources significantly increased perceptions of severity compared with only viewing the initial earthquake simulation video. Relative damage estimates indicated that participants believed the earthquake was centred on their home.	Walton, Lamb, and Dravitzki, 2007
2006	Ministry of Civil Defence and Emergency Management Campaign Monitoring Research – June 2006	This was the benchmark survey used to measure the attitudes and behaviours of New Zealanders around civil emergencies. New Zealanders have incomplete knowledge of disasters and their effects and incomplete levels of preparedness for disasters. While New Zealanders' may have some knowledge of what to do, they have not fully thought through the impact.	Colmar Brunton for Ministry of Civil Defence and Emergency Management, 2006
2006	Wellington Area Earthquake Casualty Estimation – 2006 Update.	Estimates arising from a 7.5 magnitude earthquake at two different times: 11am on a workday and 2am. At 11am the mean number of deaths is estimated at 600, and at 2am the number is estimated to be 200.	Cousins, Spence, and So, 2006
2006	The Earthquake Readiness Scale: The development of a valid and reliable unifactorial	Studies of Wellington residents showed that 23 items measuring different aspects of earthquake preparation could be combined into a reliable, valid, unifactorial scale. This scale should have use in multivariate studies of earthquake preparation.	Spittal, Walkey, McClure, Siegert, and Ballantyne, 2006

Year	Nature of Study	Key Findings	Reference
	measure of earthquake readiness		
2005	Understanding the vulnerability of organisations	Businesses, or more generically organisations, play key roles within our society. They have the responsibility for managing, maintaining, and operating our infrastructure, creating our economy, and providing employment and essential goods and services for our communities. The ability of key organisations to continue to function in the face of sudden crises, such as that presented by earthquakes, will have a large influence on the length of time that essential services are unavailable, and on the suffering and duration of recovery for the community as a whole.	Dalziell, 2005
2005	Societal impact and response to the 1855 earthquake	The 1855 earthquake of January 23rd with its numerous and protracted aftershocks occurred at a time of important social and political tensions in New Zealand, and particularly in Wellington where the greatest damage was sustained. Evidence from most contemporary accounts shows that many people, particularly politicians, were acutely aware of the negative effect that a second large earthquake in seven years would have on prospective immigrants and on Wellington's aspirations of becoming the seat of Government. The damaging effects of the earthquake had to be downplayed. The future of the settlement depended on it.	Grapes and Campbell, 2005
2005	Individuals' response to natural hazard events	Some preparedness for natural disasters takes the form of building regulations and other legislation, but regulations need to be complemented by individuals' own preparation. Despite the risk of huge losses from earthquakes, many individuals and businesses do not prepare. It is useful to clarify psychological and social factors that contribute to a failure to prepare for earthquakes, and to show how we can overcome these obstacles.	McClure, Johnston, and Paton, 2005
2005	Plate Tectonics	Preliminary thoughts on the need to plan for the "great Wellington earthquake", the direction of city planning today, current earthquake hazard mitigation measures in place, and some of the factors that might be taken into account in the post-disaster planning of the city. New Zealand local and regional councils should consider hazard mitigation and risk avoidance in our urban planning and design.	McKay, 2005
2005	Optimistic bias in relation to preparedness for earthquakes	Examined unrealistic optimism bias: individuals thinking that they are better prepared for earthquakes than others. Wellington citizens have the unrealistic optimism bias of thinking that they are better prepared for earthquakes than others.	Spittal, McClure, Siegert, and Walkey, 2005

Year	Nature of Study	Key Findings	Reference
2005	Review of tsunami preparedness in New Zealand, including specific measure for Wellington	There are varying levels of knowledge and levels on tsunami preparedness in the public and Emergency Management agencies.	Webb, 2005
2003	Earthquake preparedness in Wellington homes	Presents the methodology and findings of two earthquake preparedness pilot surveys conducted in parallel and compares their results with those from previous surveys. The first survey, a door-to-door audit of 100 homes in Wellington City, ascertained the extent to which householders had seismically restrained tall furniture and other chattels. In the second and parallel survey, 50 homes located in the same suburbs as the door-to door audit were telephoned. An adult occupant was questioned about what mitigation actions had been taken.	Charleson, Cook, and Bowering, 2003
2003	Tabulated results of the 2003 national coastal community survey	There are varying levels of knowledge and levels of tsunami preparedness in the public in the Wellington Region.	Johnston et al., 2003
2003	Demographic and psychological factors and preparation for earthquakes	Examined the relationships between different dimensions of personality and earthquake preparation in a large sample of Wellington residents using psychometrically-sound measures. Measures of locus of control, risk, and earthquake preparation were first evaluated in a series of studies using both university students and Wellington residents. The results showed that locus of control, risk precaution, home ownership, and length of residence were significant predictors of earthquake preparation. Moreover, people exhibited evidence of unrealistic optimism.	Spittal, 2003
2002	What a difference a year makes: How immediate and anniversary media reports influence judgements about earthquakes	Examines the influence of immediate and anniversary media reports on judgements about earthquakes. Research suggests that the content of newspaper and television reports about natural disasters, such as earthquakes, affects people's fatalistic judgments about these disasters. These study findings have clear implications for the way the media and civic education programs present information on earthquakes and other disasters.	Cowan, McClure, and Wilson, 2002
2002	A night of terror: Wairarapa's 1942 earthquake	An account of the 1942 Wairarapa earthquake using eye-witness accounts and extensive oral histories. The earthquakes are recreated in an account of the impacts of the 1942 Wairarapa earthquake on Wellington.	McLaren, 2002

Year	Nature of Study	Key Findings	Reference
2002	Project Phoenix: Preparing to respond to a major earthquake in Wellington	The exercises simulated the gathering, transport, and distribution of supplies and personnel in the critical period after the event. The exercise programme was also being linked to USAR and health initiatives to establish and test coordination systems. Phoenix was also providing a catalyst for revisiting the existing guidelines for exercise development. The exercise highlighted critical issues such as roading access, emergency water, communications, reconnaissance, public information and air support.	O'Kane, 2002
2002	The Spheres of Control scale: The identification of a clear replicable three-factor structure	Compares the factor structure of the original Spheres of Control scale with that of a revised version of the scale. A satisfactory level of stability between studies and a satisfactory level of internal consistency within the scales was found.	Spittal, Siegert, McClure, and Walkey, 2002
2001	Countering fatalism: Causal information in news reports affects judgments about earthquake damage	Examined the effect of different patterns of earthquake damage on participants' judgments of the cause of the damage. Participants attributed generalised damage to the earthquake but attributed distinctive damage more to the building design.	McClure, Allen, and Walkey, 2001
2000	Integrated and interactive risk assessment platform for Wellington, New Zealand	The Integrated Risk Assessment Program is designed to use Geographic Information Systems to illustrate various aspects of hazard impacts, with the twin goals of enhanced communication of risk and greater precision in the formulation of policy options. This project provides a more holistic view of the consequence of various approaches to hazards. The Integrated Risk Assessment is a powerful tool to support the building of resilient communities. However, it must be oriented around real needs of those who are trying to bring about change.	Cousins, Heron, Jensen, Kozuch, and Savage, 2000
2000	Hazards & society	Planning for an earthquake crisis in New Zealand: field trip to the Wellington Fault.	GNS Science, 2000
2000	Magnitude Eight Plus: New Zealand's Biggest Earthquake. An account of the 1855 Wairarapa earthquake	Provides an account of the impacts of the 1855 Wairarapa earthquake on Wellington which includes personal accounts from different sources as well as illustrations to show how Wellington's landscape was transformed. Also included are newspaper reports from the time and a report investigating the level of damage.	Grapes, 2000
1999	Perception of earthquake risk and the preparation for earthquakes in New Zealand	Recommendations from the research include providing people with preparation information that gives them some sense of control but is easy to carry out. However, different groups of people are likely to respond to messages in different, and sometimes opposing, ways. Scientists need to consider ways	Dew, 1999

Year	Nature of Study	Key Findings	Reference
		of having some control over the presentation of their research in the media, as the sensational treatment of research may be undermining the credibility of scientists.	
1999	When earthquake damage is seen as preventable: Attributions, locus of control and attitudes to risk	Clarified the relation between different cognitive and personality factors and preparation. No relationship was found between judgements of the likelihood of a major earthquake and precautionary measures adopted.	McClure, Walkey and Allen, 1999
1997	The effect of increased earthquake knowledge on perceived preventability of earthquake damage	There is support for the hypothesis that changes in perceived preventability occur when specific targeted information is introduced. Prior earthquake knowledge correlated with earthquake preparation, but perceived preventability did not relate to prior knowledge or preparation for earthquakes.	Hurnen and McClure, 1997
1995	Earthquake Risk Assessment Study	Rebuilding after an earthquake – earthquake hazard analysis.	Davey and Shephard, 1995
1995	Atlas of isoseismal maps of New Zealand earthquakes	Atlas of isoseismal maps, including those that have affected Wellington.	Downes,1995
1995	Wellington after the ‘quake: The challenge of rebuilding cities	The publication contains the proceedings of an international workshop held in Wellington in March 1995. It outlines the basis for planning recovery by identifying the problems sure to be faced and by indicating possible solutions based on world and New Zealand experience.	Gregory, 1995a
1995	Disaster recovery needs	Discusses needs highlighted by the “Wellington after the Quake” conference. These are based on long-term recovery including recovery of communities and restoration of facilities, organisations, and amenities of their normal surroundings.	Gregory, 1995b
1994	Reducing community vulnerability to earthquakes: the value of lifelines studies	Lifelines studies take natural hazard information and through various processes identify mitigation and preparedness measures that can be undertaken by utility operators. The overall objective is to reduce both damage levels and the time taken by lifelines organisations to restore their usual level of service following a major earthquake. This saving in time translates directly into a saving for the community as a result of reduced disruption to homes, offices, and industry.	Brunsdon, 1994

Year	Nature of Study	Key Findings	Reference
1993	Lifelines in Earthquakes: Wellington Case Study	This project identified a series of possible mitigation measures that operators of lifelines could undertake to reduce the risk from a major earthquake. The concepts of interdependence and critical areas were also identified: interdependence relates to the effect of the outage of one utility service (e.g. power) on the time taken by another to recover (e.g. water supply requiring power for pumping). Of greater significance however beyond the technical content was the heightened awareness of this work created by this project amongst utility services providers both in Wellington and elsewhere in New Zealand.	Hopkins, Lumsden, and Norton, 1993
1991	Exercise: Our Fault	Describes “Our Fault” Civil Defence exercise, in which a major earthquake was simulated in Wellington.	Lipski, 1991
1991	Civil Defence survey of Schools	Preparedness survey.	Upper Hutt City Council (unpublished report located at the Ministry of Civil Defence), 1991
1990	How Civil Defence can improve the preparedness of Wellington citizens for a major earthquake: A marketing plan	A study on marketing the delivery of earthquake readiness programmes in Wellington. It suggests that the responsibility for operational disaster coordination and marketing earthquake preparedness be separated.	Fraser and Hansen, 1990
1989	The 1942 Wairarapa earthquakes	Paper discusses the 1942 Wairarapa earthquakes seismology.	Webb, 1989
1988	Planning for geological hazards in Wellington	Legislation and planning issues around the Wellington fault.	Fellows, 1988
1983	Earthquake occurrence, experience and appraisal in Wellington, New Zealand	A study of Newlands residents’ understanding of earthquake risk. Residents denied or were uncertain of future earthquake occurrences and tended to minimize or feel personal exclusion from possible future damage.	Simpson-Housley and Curtis, 1983
1978	Personality and the perception of earthquake hazard	A study of Newlands residents’ understanding of earthquake risk and the role of personality variables in determining perceptions of natural hazards. The study clearly indicated the importance of personality variables in determining perceptions of earthquake risk.	Simpson-Housley and Bradshaw, 1978

Year	Nature of Study	Key Findings	Reference
1976	The influence of locus of control and repression-sensitization on perception of natural hazards	A PhD study on the role of personality variables in determining perceptions of natural hazards. Personality variables are important in determining perceptions of earthquake risk.	Simpson-Housley, 1976
1945	Damage to buildings in the City of Wellington by earthquake, 1942	Structural damage to Wellington buildings was extensive and there was more damage to Wellington buildings than Wairarapa buildings.	Aked, 1945

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