

Seismic Preparedness of Hospitals in Victoria, British Columbia, Canada

by

Harpreet Kaur Jaswal
BSc, University of Victoria, 2006

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of the Requirements for the Degree of

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Abstract

This research explored the extent to which two hospitals in the City of Victoria are prepared for a future earthquake event. The goal is to examine the level of emergency preparedness of two tertiary care hospitals in Victoria for dealing with the potential damage caused by an earthquake in the region. The research objectives are aimed at highlighting current strengths regarding health sector emergency preparedness, reducing the vulnerability of the health sector by identifying key areas of improvement, and ultimately, increasing the capacity of the health sector to respond to the damages sustained by earthquakes. A small-scale mixed-methods approach was taken to assess hospital preparedness. A structured survey was administered to 26 key informants who were selected specifically based on their prior knowledge, experience and current roles and responsibilities pertaining to Disaster and Emergency Management in the province. A concerted effort was made to include a sample of participants from each of five target populations at the Provincial, Health Authority, and Local Health Authority levels. Data analysis included quantitative and qualitative techniques to generate simple statistics and thematic coding of the interview transcripts to identify main themes and patterns. Both quantitative and qualitative insights were used to provide a clearer picture of hospital preparedness and to foster credibility and dependability of key results. The findings and results confirm that there are excellent levels of engagement and integration between the Local Government, BC Ambulance Service and Fire Departments. There is room for improvement in regards to engaging and integrating NGOs with Hospital planning. Robust plans and protocols were found to be in place for Communication Systems, Emergency Operations Centres and Public Information and Media Relations. Hospital level respondents reported having less Emergency Management education and Training and had participated in fewer disaster exercises compared to Provincial and Local Emergency Managers. Although 76% of respondents had participated in a disaster exercise, only 5 % had responded to an earthquake. Only 23% of respondents had activated their planning in response to an earthquake. The results emphasize the immediate need for increased engagement and integration of earthquake response planning between health system stakeholders, communities and all levels of government. At the hospital level, increased attention needs to be directed to the following operational areas: Mass Casualty Planning, Resource Stockpiling, Department Level Contingency Plans, Evacuation and Relocation Protocols and Procedures, Volunteer Coordination Protocols, and Internal and External Traffic flow. Lastly, the results highlight the need for increased disaster education and training for front line acute care employees, hospital administrators and management staff. In addition to training and education, multi-jurisdictional and multi-agency exercises should be undertaken to engage all key community stakeholders and to promote a more integrated and optimal response in the event of an earthquake.

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“If you know neither the enemy nor yourself, you will succumb in every battle”
~ Sun Tzu, axiom 18 (490 BC)

Chapter 1: Introduction

Background

Hospitals are an important part of the infrastructure in dealing with emergencies of any kind. With the complexity of recent events such as the March 2011 M9.0 Tohoku Earthquake and Tsunami in Japan, we recognize the magnitude of damage and disruption that can occur after a powerful earthquake. This heightened awareness reinforces the need for increased hospital preparedness in many ways. First, damaged physical infrastructure and the loss of civil services (water, power and waste management systems) combined with a surge of casualties in need of medical attention, are some of the challenges hospitals face post-disaster. Secondly, such events highlight existing issues within the acute care settings in terms of hospital disaster preparedness. Poor planning and integration with stakeholders, and the lack of disaster and emergency response training and education have both been identified as the two most common problem areas within hospital environments (Desforges & Waeckerle, 1991). Lastly, these events also highlight how staff shortages, overcrowded emergency rooms, decreased medical and financial resources, and poor surge capacity magnify the problems of an already compromised health care systems (Ginter, Duncan, & Abdolrasulnia, 2007). Such problems have reinforced the need to improve hospital disaster preparedness efforts within areas where disasters are likely (Manley et al., 2006).

As an essential part of the community emergency response operations, hospitals need to be well prepared to respond in disaster situations, due largely to the critical nature of the services they provide (Ginter et al., 2007). Experience suggests that the first 24 hours after an earthquake are the most critical, and therefore, any loss of hospital functionality is a major

concern (O'Hanley, 1993). The role of hospitals immediately following a disaster is four-fold: to save lives, to reduce morbidity, and to deal with the surge of casualties, all while maintaining care for existing patients (Paturas, Smith, Smith, & Albanese, 2010). Heightened awareness arising from recent earthquakes that have occurred in Japan, New Zealand, and Chile, have raised concerns about public safety and hospital disaster preparedness.

The need for a standardized validated method to assess disaster preparedness has never been greater (Ginter et al., 2007; Jenkins, Kelen, Sauer, Fredericksen, & McCarthy, 2009). It is well understood that to lessen the impact of earthquakes, hospitals must have well established plans and protocols in place to provide care for the greatest number of people (Desforges & Waeckerle, 1991). The benefits of conducting an assessment of preparedness are two-fold: (1) to ensure disaster plans and protocols are effective and efficient, and (2) to highlight areas that need to be strengthened and improved. Without an assessment of preparedness, the general public and external stakeholders are unaware of the health system's ability to respond to a disaster (Elliot, 2010). For the above reasons, an assessment of preparedness is of critical importance in geographic areas where disasters are likely to occur.

Scope of Current Research

Situated along the southwest coast of British Columbia, Victoria is located on the southern tip of Vancouver Island. Found within Canada's most seismically active region, the likelihood of a damaging earthquake in this region is high (Clague, 2002). The significant threat of an earthquake disaster in this area makes it imperative that hospitals in this region are prepared. This study examines current levels of earthquake preparedness at two Victoria hospitals: The Royal Jubilee Hospital (RJH) and The Victoria General Hospital (VGH). These hospitals were chosen because they are not only located in the seismically active region, but

they also serve as primary, secondary and tertiary care facilities for all 750,000 people living in rural and urban communities throughout Vancouver Island.

Approach and Rationale for Current Research

This research study is grounded in the disaster planning literature. There are several conceptual approaches to disaster management. This thesis emphasizes the established relationship conveyed by the equation $R = H \times V$; which states that the risk (R) of a disaster is a function of the nature of the hazard (H) multiplied by the vulnerability (V) of the population (Wisner, Blaikie, Cannon, & Davis, 2004). This pseudo-equation takes into account the synergistic relationship that exists between risk, hazard and vulnerability. From a disaster management perspective understanding more about the nature of these relationships is fundamental to reducing the risk of disasters caused by hazards. Other conceptual approaches used to guide the research were based on the Canadian Standards Association (2008) standards for emergency management and business continuity document Z1600 and the British Columbia Emergency Management System (BCERMS; Emergency Management British Columbia, 2008, 2011). Both frameworks outline best practices for emergency management which focus on the four pillars of emergency management. These four pillars are recognized in disaster planning and emergency management: preparedness, response, recovery and mitigation (Mileti, 1999). These relationships between risk and the disaster management cycle provide the conceptual foundation for this thesis to understand hospital preparedness in the City of Victoria.

The rationale for undertaking this research is three-fold. First, the literature suggests hospitals are “high risk/ high response” organizations, meaning they are at a high risk of experiencing the adverse impacts of disasters, and also have a primary role in the response to

a disaster (Ginter et al., 2007). Hospital buildings, equipment, staff and systems must be able to function immediately following a damaging earthquake. An assessment of hospital preparedness is needed to ensure that the hospitals have the necessary plans and protocols in place to effectively respond to an earthquake disaster. Secondly, three common assumptions made by the public regarding a hospital's ability to respond to and recover from a disaster are: all hospitals have the capacity and resources to stay functional during a disaster; hospital coordination includes input from multi-level emergency management agencies and interdepartmental planning committees; and hospital-wide training and drill exercises are conducted regularly to test effectiveness and execution of the plan itself (Lusby & Leonard, 2006). This assessment of hospital preparedness levels within Victoria hospitals will test such assumptions. Lastly and perhaps most importantly, to our knowledge, no previous assessment of hospital preparedness has been done in this region.

Primary Research Goals and Objectives

This research seeks to examine the degree of emergency preparedness of 2 tertiary care hospitals in the City of Victoria for dealing with the potential damage caused by a future earthquake in the region.

The objectives used to guide the research are:

1. Review existing literature and research to understand key elements of emergency preparedness within the hospital environment, in addition to understanding lessons learned from past disasters.
2. To highlight current strengths regarding health sector emergency preparedness.
3. To reduce the vulnerability of the health sector, by identifying key areas of improvement

4. To increase the capacity of the health sector to respond to and recover from the damages sustained by future earthquakes in this region.

Thesis Structure

The thesis is structured in the following manner. Chapter 2 presents a literature review which will include: a brief overview of the seismic risk and vulnerability of Vancouver Island, key elements of earthquake preparedness in acute hospital environments, and lessons learned from past events. Chapter 3 summarizes the methodological framework used to conduct the research. Chapter 4 presents the quantitative results, and Chapter 5 presents the qualitative results of the research. Chapter 6 includes a discussion and analysis of the research findings, in addition to presenting the study limitations. Lastly, Chapter 7 highlights the final conclusions and offers recommendations.

Chapter 2: Literature Review

Global disaster trends stress how the damage caused by natural disasters, as measured by financial loss, has increased in recent times. Based on data from the Centre for Research on the Epidemiology of Disasters (CRED; Vos, Rodríguez, Below, & Guha-Sapir, 2010), in 2009 there were 335 recorded disasters, which affected 119 million people, and caused \$41.3 billion dollars in damage; this is compared to 2011 in which there were 305 recorded disasters, which affected 206 million people, and caused an astonishing \$366 billion dollars in damage (Ferris & Petz, 2011). In addition to becoming more damaging and long-lasting, CRED data also suggests the number of reported disasters caused by natural hazards are on the rise (see Figure 1).

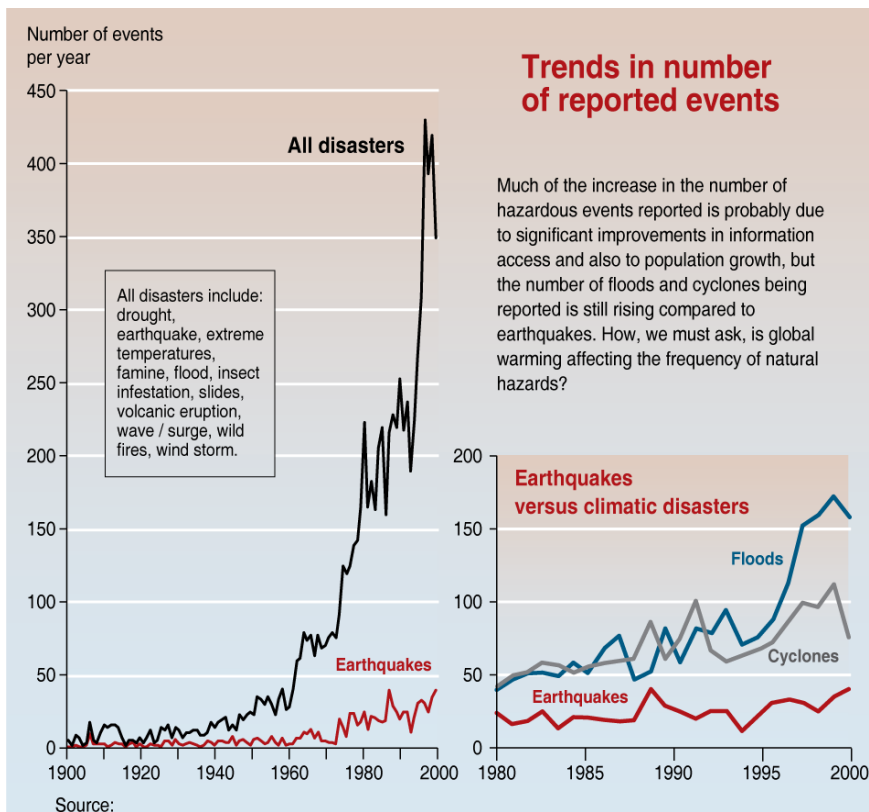


Figure 1. Trends in number of disasters reported (1900–2010).

From *Annual Disaster Statistical Review 2009: The Numbers and the Trends* by F. Vos, J. Rodríguez, R. Below, & D. Guha-Sapir, 2010. Copyright 2008 by CRED.

Earthquakes, especially since the 1976 Tangshan earthquake, have been one of the most damaging natural hazard (Manley et al., 2006). For example, preliminary estimations from The World Bank suggests the economic cost of the 2011 M9.0 Tohoku earthquake and tsunami in Japan could be as high as USD \$235 billion (Xinhua English News, 2012). This in contrast to the USD \$11.1 billion damage that was caused by the 2011 M6.3 Lyttelton earthquake near Christchurch, New Zealand (Kissane, 2011). Most, if not all of the damage caused by earthquakes derive from combinations of increases in population, expansion of built-up areas, growth of high cost infrastructure, inattention to social dimensions and vulnerabilities, and the lack of disaster preparedness. In this chapter, based on a review of research and other literature, seismic hazard, vulnerabilities and preparedness are described with particular reference to hospitals and the health system.

Vancouver Island Earthquake Hazard Tectonic Environment and Historical Seismicity

Tectonic environment and historical seismicity. Southwestern British Columbia is one of Canada's most seismically active areas, with more than 200 earthquakes occurring annually (Clague, 2002). Over the past 130 years, there have been ten M6-7 subcrustal earthquakes within 250 km of Vancouver and Victoria (Clague, 2002). Figure 2 shows the distribution and magnitude of significant earthquakes that have occurred in southern British Columbia between 1700 and 2006.

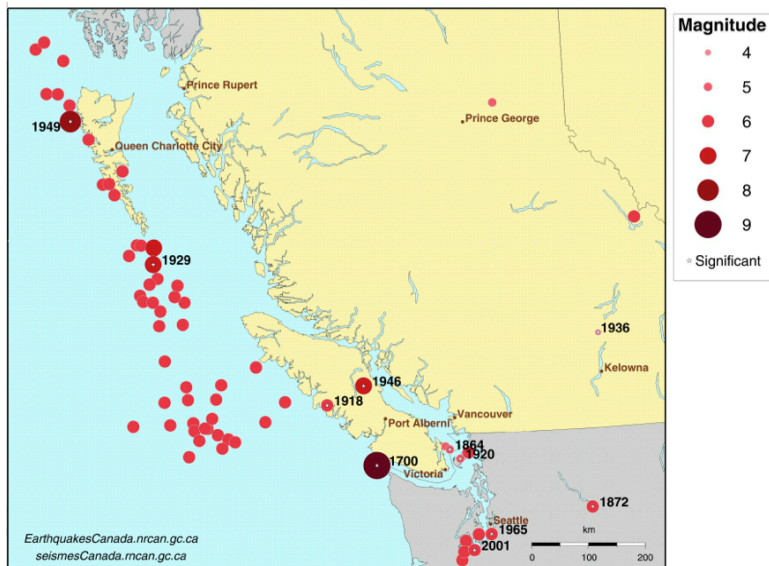


Figure 2. Significant earthquakes in southwestern British Columbia, 1700–2006.

From *Significant Canadian Earthquakes: 1600–2006*, by M. S. LaMontagne, J. F. Halchuk, G. Cassidy, & C. G. Rogers, 2007. Copyright 2007 by Natural Resources Canada.

Situated along the Pacific Ring of Fire, Vancouver Island, British Columbia is located on the Cascadia Subduction Zone (CSZ), an area that extends from Central Vancouver Island to Northern California. More specifically, the tectonic environment of Vancouver Island is unique; the oceanic Juan de Fuca plate is subducting at a rate of approximately 4 cm per year beneath the continental North American plate (Heaton & Hartzell, 1987; McCaffrey, 2007). Three types of earthquakes that can occur in this region are: deep subcrustal earthquakes in the subducting Juan de Fuca plate, shallow crustal earthquakes in the North American plate, and great interplate earthquakes (Clague, 2002; see Figure 3).

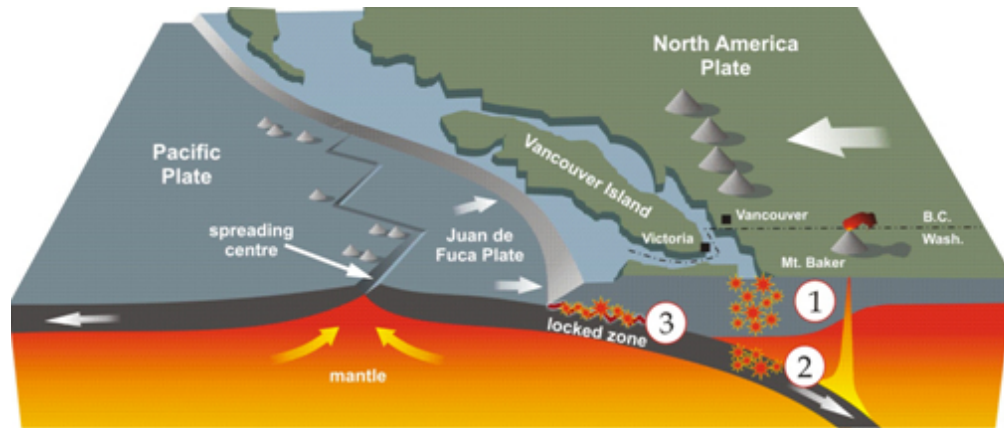


Figure 3. Tectonic Environment of southwestern British Columbia.

The figure illustrates the location of each earthquake type (1) shallow earthquakes, (2) subcrustal earthquakes, and (3) interplate earthquakes (Natural Resources Canada, 2011).

An earthquake occurs with an abrupt release of slowly accumulated strain when the mineral makeup of a plate is altered due to changes in temperature, pressure, and density (Walsh, Gerstel, Pringle & Palmer, 2012). Each type of earthquake can be associated with particular characteristics. Subcrustal earthquakes occur in the subducting Juan de Fuca plate, and often occur at depths of 40-60 km below the surface (Natural Resources Canada, 2011). Shallow crustal earthquakes occur within the North American plate, and usually cause the most amount of damage because the epicenter is usually close to the earth's surface (Natural Resources Canada, 2011). Interplate earthquakes (also known as "Megathrust" earthquakes), occur at the interface between the Juan de Fuca and North American Plates and are the most powerful type of earthquake (Clague, 2002).

The most powerful and damaging earthquake on Vancouver Island within the historical period occurred on June 23, 1946, at 10:13 am. As illustrated by Figure 4, closest to the epicenter, Modified Mercalli Intensities (MMI) ranged from VII-VIII, and damage was excessive close to the epicenter (Clague, 2002). Shaking resulting from the M7.3 earthquake

was felt over a wide geographic region, including as far south as the state of Oregon.

Secondary effects triggered by the earthquake included liquefaction induced ground failures, land subsidence of up to 9ft in some areas, and hundreds of landslides that occurred all across Vancouver Island (Clague, 2002).

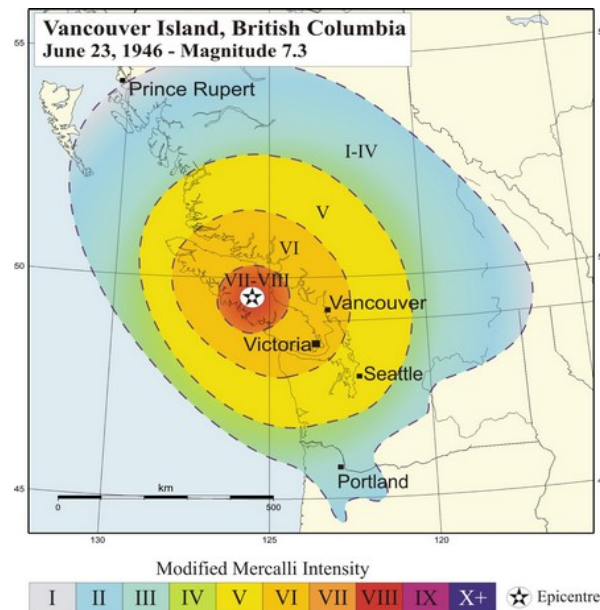


Figure 4. Modified Mercalli Intensities—1946 M7.3 Vancouver Island earthquake. (Natural Resources Canada, 2011)

Given that this region has experienced large earthquakes in the past, thermal deformation studies have revealed the subduction interface between the North American and Juan de Fuca Plate is presently locked for a distance of approximately 60 km (Nedimović, Hyndman, Ramachandran, & Spence, 2003). Current research indicates significant strain and pressure is accumulating within this locked portion (see Figure 3) of the CSZ, especially since the last major subduction event occurred on January 26, 1700. The next event could potentially exceed M9.0, causing a rupture along 1000 km of subduction zone, significantly damaging the Pacific Northwest (Clague, 2002).

Earthquake hazard in the Victoria Region

Ground conditions. The timing, location and magnitude of earthquakes cannot be predicted, but geological and geotechnical data can be used to better understand the level of hazard the Victoria region faces against an earthquake (Ministry of Energy and Mines, 2000). A special initiative taken by the BC Ministry of Energy and Mines focused on mapping the surficial geology of the region. In doing so, the work not only helped to quantify varying levels of risk across the region, but also identified high risk areas that are susceptible to ground shaking and liquefaction.

A map showing the Relative Amplification Hazard for the Greater Victoria Region based on surficial materials is included in Appendix A. Figure 5 shows the Relative Amplification Hazard for the two specific study sites specifically.

Although much of the damage experienced during an earthquake depends on the duration, and magnitude of shaking, geologic and soil characteristics also are important. The ground motions and intensity of shaking experienced during an earthquake are greatly influenced by site-specific properties such as bedrock type, soil moisture, texture, density and thickness (Department of Regional Development and Environment Executive Secretariat for Economic and Social Affairs Organization of American States, 1991). Ground motions are strongly amplified by thick deposits of sands, silts, and clay, compared to bedrock (Levson, Matysek, Monahan, & Watts, n.d.).

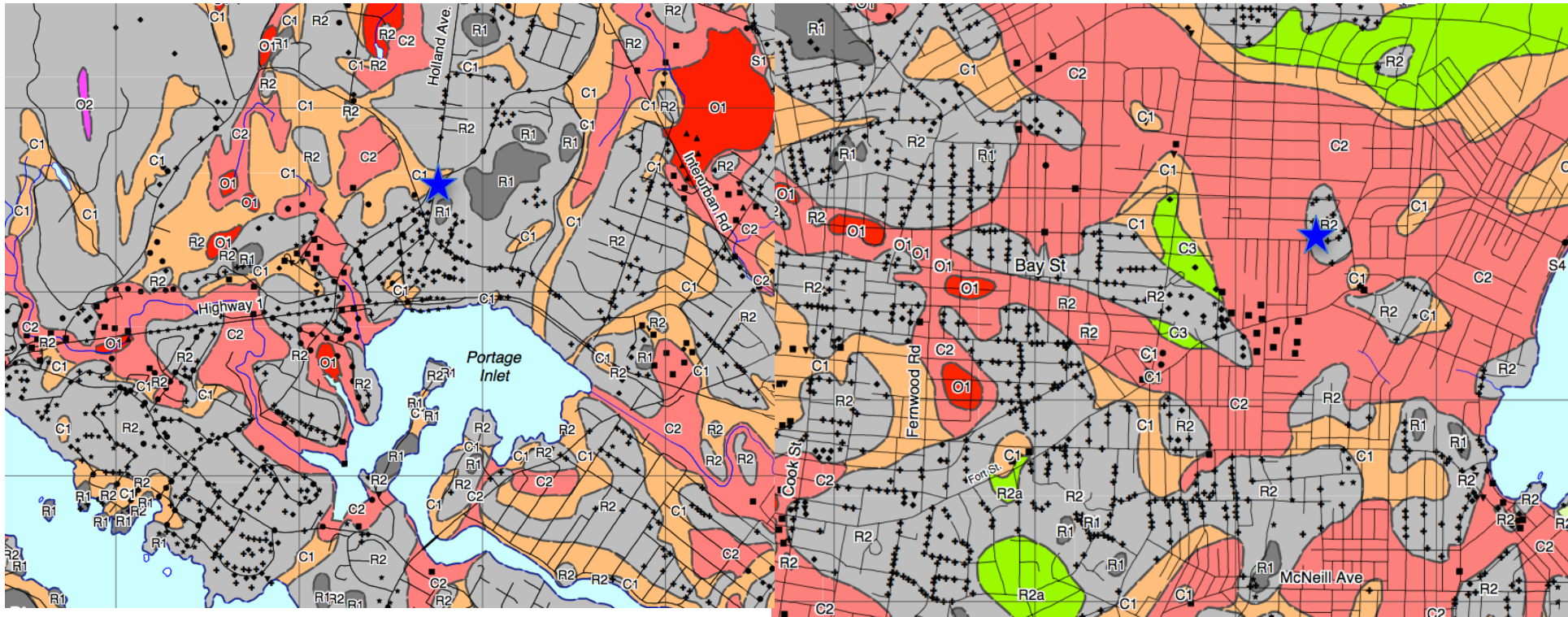


Figure 5. Study Site Ground Amplification Hazard Maps.

Left: Victoria General Hospital Region; Right: Royal Jubilee Hospital Region. Hospital study sites are indicated by the blue star (Ministry of Energy and Mines, British Columbia, 2000).

Hazard Ratings

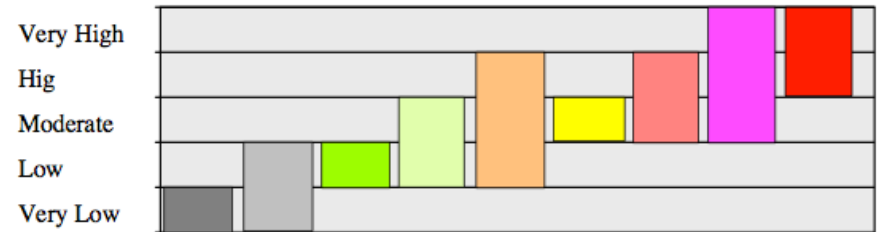


Figure 5 clearly shows that shaking from even a moderate earthquake would be experienced differently at each site, due to the difference in site-specific soil properties underlying each facility. Based on the legend provided, the brighter colors reflect a higher hazard rating, and in contrast, the duller colors represent a lower hazard rating. The map on the left shows the region surrounding Victoria General Hospital. This area is expected to experience a relatively low ground amplification hazard, mainly due to the underlying bedrock. However, there are some areas surrounding the facility underlain by soft clays that have moderate to very high ground amplification hazard ratings. Any damage to the transportation networks leading to the hospital would have serious implications for first responding vehicles.

Similarly, a majority of the region surrounding the Royal Jubilee Hospital is given a moderate to very high ground amplification hazard rating. This is mainly due to the older, softer Pleistocene deposits. The high ground amplification hazard presents serious risks to hospital infrastructure and to the transportation networks to and from both facilities. With an understanding of how the underlying geology will behave during an earthquake, specific structural and non-structural mitigation strategies can be set in place to reduce the impact of shaking.

Although less severe, there also is a risk of experiencing soil liquefaction in this region. Soil liquefaction occurs when water saturated soils behave as a liquid in response to intense shaking (Levson et al., n.d.). The soil may be saturated before the event, or become saturated during the shaking due to a high water table. Often seen to occur in low density and unconsolidated soils, liquefaction caused extensive damage in the most recent earthquake in Lyttelton, New Zealand.

With the risk of ground shaking and liquefaction, combined with the unreinforced masonry architecture of old Victoria, the potential damage resulting from a moderate earthquake is significant, likely causing millions of dollars in damage and having a lasting major economic impact (Clague, 2002).

The area is also at a high risk to secondary hazards associated with earthquakes such as tsunamis, land subsidence, and landslides. If a Cascadia earthquake generated a tsunami, Figure 6 shows which areas would be inundated by water. It is important to note that the increased run-up potential along the west coast of Vancouver Island is due to the high risk of land subsidence in these regions.

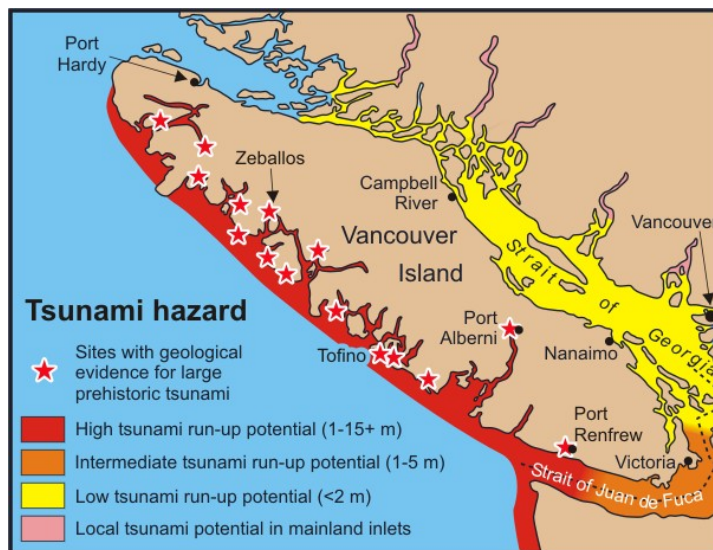


Figure 6. Tsunami hazard map for Vancouver Island.

(Government of Canada, 2008)

Earthquake hazard probabilities. The last megathrust earthquake along the west coast of British Columbia was an estimated M9.0 on January 26, 1700 (Clague, 2002; Seemann, Onur, & Cloutier-Fisher, 2011). Historical records suggest the reoccurrence interval for such large subduction earthquakes is approximately once every 500-600 years

(Geological Survey of Canada, 2005), and the probability of the next one occurring within the next 50 years is estimated to be 12% (Seemann et al., 2011).

Specific ground shaking probabilities have been calculated for Victoria using the Modified Mercalli Intensity scale (MMI V - widely felt; MMI VI - threshold for non-structural damage; and, MMI VII - threshold of structural damage). Estimated crustal/sub-crustal exceedence probabilities of “structurally-damaging” ground shaking (MMI VII) for Victoria within the next 50 years is 21%, and “non-structurally” (MMI VI) damaging ground shaking probabilities are estimated to be 56% (Seemann et al., 2011). These ground-shaking probabilities for Victoria are high enough to demand comprehensive earthquake preparedness, response and recovery planning (Seemann et al., 2011). As highlighted by the estimated ground shaking probabilities, the risk of a damaging event happening in this region is significant. A large earthquake in southwestern British Columbia would cause tens of billions of dollars in damage, seriously impacting the economies of the rest of Canada and the United States (Clague, 2002). For these reasons alone, more effort must be focused on reducing the risks and vulnerabilities to earthquakes.

Vulnerabilities to earthquake impact. Vancouver Island presents unique physical, social, economic, and environmental vulnerabilities in the context of earthquakes. From a social perspective, there are many vulnerable populations groups in the Victoria: senior citizens, the homeless, and rural populations to name a few. Extending beyond Victoria, there is a significant number of First Nations communities that are located along the west coast of Vancouver Island. These communities would be greatly impacted, especially if a tsunami was generated. Economically, transportation networks such as ferry terminals, ports and highways are extremely vulnerable, and if damaged, would raise concerns about food

security for the 750,000 residents living on Vancouver Island since a significant portion of the food supply is imported. Any damage to the Trans-Canada Highway, in particular the southern most portion, would disconnect the southern part of the Vancouver Island from surrounding areas, creating serious issues for the transportation of patients, and for getting access to additional resources (human, equipment or supplies). The Greater Victoria area is linked via three major transportation routes: Highway 14, Highway 17 and Highway 1. Blockages on any of these routes would severely compromise the ability of aid and support to reach those in need.

A large earthquake in Cascadia would cause tens of billions of dollars in damage, seriously impacting the economies of the rest of Canada and the United States (Clague, 2002). Given that a great subduction earthquake may occur sometime in the near future, it is critical to understand the present risks as well as the potential complications associated with earthquakes in this area. The following section will present a discussion on hospitals in the context of disaster preparedness and Emergency Management. There will be a brief overview of existing vulnerabilities within the health system, followed by an in-depth discussion of the key elements of hospital preparedness. This will be followed by lessons learned from past events.

Hospital Disaster Preparedness

Experience has shown it is not uncommon for hospitals to be the main providers of immediate medical care during a disaster, and for this reason, hospital preparedness planning is essential (Schultz, Koenig, & Lewis, 2003). In preparing for disasters, hospitals must anticipate all possible disruptions and ensure plans and contingencies are in place to remain fully functioning so they can continue to provide medical care to those in need (Ginter et al.,

2007). The following section identifies typical hospital vulnerabilities by reviewing the literature on how hospitals in other jurisdictions have been affected by past seismic events. It also summarizes and introduces established key components of hospital preparedness. Lastly, a brief overview of lessons learned from past disasters will be presented.

Historic hospital vulnerabilities. During a disaster, the ability of a hospital to respond can be severely compromised. Earthquake disasters that have occurred over the past decade have caused considerable damage, and severely comprised health system response and recovery efforts. A recent article by Kirsch et al. (2010) summarized how post-disaster response capabilities can be compromised as a result of earthquake disasters:

1. During the 1994 M6.7 earthquake in Northridge, California, 8 of 91 acute care hospitals were evacuated within 72 hours of the event, due to water damage and loss of electrical power, and four hospitals were permanently closed (Schultz et al., 2003; Schultz, Koenig, & Noji, 1996).
2. Following the 1995 M6.8 Great Hanshin earthquake in Japan, reports indicated that at least four hospitals were immediately closed, twelve were severely damaged, and other facilities lost operating rooms, sterilization and medical imaging functionality.
3. The 2005 M7.6 earthquake in Pakistan closed 68% of health care facilities in the region; and in 2003, a M6.6 earthquake in Bam, Iran, eliminated almost 50% of the local health care staff.
4. The 2010 M8.0 Haitian earthquake injured over 300,000 people and severely damaged 22% of hospitals in the affected region.

5. The M8.8 earthquake that occurred off the coast of Chile on February 27, 2010, greatly impacted local hospitals, with approximately 23% of hospitals losing some degree of operability as a direct result of earthquake damage.

The vulnerability of hospital facilities to potential hazards involves four major areas: (1) loss of basic lifelines such as electrical power, communications, water, sanitation and waste management, (2) structural damage to hospital infrastructure, (3) damage to medical equipment, and (4) loss of human resources and medical personnel (Conchesno-Garcia, 2003). Even if hospital systems themselves don't fail, they may be vulnerable to other failures. In order to reduce costs, present day hospitals are increasingly relying on external vendors for items such as food and blood supplies. Such dependencies may prove to be detrimental after a damaging earthquake.

Key components of hospital preparedness. Recent earthquakes in Japan, New Zealand, and Chile have reinforced the need for proactive, integrated approaches to enhancing disaster preparedness. In addition to building design, and increased retrofitting and structural and non-structural mitigation, disaster preparedness is the most effective means of reducing earthquake casualties, damage and disruption. The definition of preparedness will vary, as will the key elements. For the sake of this research project, key components of hospital preparedness parallel important themes as identified by the Canadian National Standards Association and by Pan-American and World Health Organization reports and publications. Such standards have been designed to provide a systematic proactive approach to guide departments and agencies at all levels of government and the private sector to work together to prepare and respond to disasters (Jenkins et al., 2009). These themes include: risk assessment, a disaster plan, effective communication systems, community linkages, resource

stockpiles, disaster training /education, disaster exercises, surge capacity and business continuity and contingency planning.

Risk assessment. Risk assessments tie back to the approach taken in this research and is grounded in the disaster management literature. Because risk assessments are fundamental to disaster preparedness, identifying and understanding the nature of the hazard and the risk in terms of probability of occurrence is important (Top, Gider, & Tas, 2010). When conducting a risk assessment, it is necessary to reflect on the unique characteristics of the area. It is important to understand existing vulnerabilities in terms of social, economic and environmental systems. The risk assessment should list such vulnerabilities and explain how they would be adversely impacted in a disaster. It is also important to understand how secondary hazards may arise and increase the level of damage and disruption. For example, although a M9.0 megathrust earthquake caused the initial disruption in Japan, as a result of the earthquake, the region subsequently was struck by a tsunami, and faced a possible nuclear crisis. Once all the risks have been identified, then specific initiatives can be set in place to help mitigate the risk.

Disaster plan. A disaster plan forms the basis of an organization's response to a disaster, outlining roles and highlighting procedures, policies, and protocol for a coordinated disaster response (Rebmann, Carrico, & English, 2008). Experience has shown a greatest demand for patient care occurs during the first 24 to 48 hours after an earthquake. The plan should include specific protocols and procedures which address the following areas: command and authority channels, mass casualty response, triage response, public information and media, evacuation and relocation, pandemic control, resource management, external and internal traffic control. It is important the disaster plan is not written in isolation,

but in conjunction with the larger community response plan. An effective disaster plan outlines specific plans and protocols to (1) ensure efficient delivery of medical care to the newly injured, and (2) allow for the resumption of medical services as quickly as possible (Howard & Wiseman, 2001; Schultz et al., 1996; Top et al., 2010).

Communication systems. Communication in the context of hospital disaster preparedness should be looked at from many different perspectives. First, it is crucial for each health care facility to have an alternative mean of communication, in the event that existing hospital communication systems fail or become overloaded. Alternative systems include satellite phones, cell phones, and two-way radios. Secondly, strong lines of communication and robust fail proof systems need to be established internally at the hospital level, to ensure the proper command and authority channels are being used. Such systems must function across all departments and all staff must receive the appropriate training and education of communication plans, protocols and equipment. Thirdly, following an earthquake, communication with external support agencies is crucial. External support agencies include: first responders, surrounding health care facilities, and regional and local government agencies. For this reason, interagency communication systems and protocols should be established, in order to allow for an integrated response. Lastly, the hospital must ensure a consistent message and alert system is in place to ensure that the public, hospital staff and visitors and patients stay informed (Rebmann et al., 2008).

Community linkages. Hospitals have often been criticized for being isolated islands in their disaster planning activities, and external stakeholders often refer to them as possibly the weakest link in a community emergency response (Braun et al., 2006). It is important for hospitals to form and maintain a functioning partnership with community agencies and

organizations (Kaji & Lewis, 2006). There are many benefits to forming such partnerships. First, research has proven that hospitals in a network with other hospitals and organizations function better following an earthquake, mainly due to the sharing resources such as personnel, medical supplies and equipment (Thorne, Levitin, Oliver, Losch-Skidmore, & Neiley, 2006). Secondly, it is important for hospitals to form and maintain close relationships with external stakeholders such as fire safety, law enforcement, local government, and other health care facilities during the planning process (Kaji, Langford, & Lewis, 2008). Engaging all stakeholders in the planning process of disaster response plans will allow all players involved to fully understand each other's response capabilities and capacities.

The health care framework in British Columbia is structured in such a way that emergency management roles and responsibilities fall at various levels of authority and include: the individual hospital level, inter-hospital level, department level, in addition to the regional, provincial and national levels. For this reason, interagency partnerships are crucial for increasing hospital level preparedness. Networking and building of such partnerships allows for the appropriate leadership, knowledge, skills, technical abilities and resources to be utilized efficiently and in a coordinated fashion within the community (Paturas et al., 2010). Disasters typically require an immediate, coordinated, and effective response by multiple private and public stakeholders to meet the medical and logistical needs of the affected population (Ginter et al., 2007). One way to enhance community linkages networks and ultimately strengthen community preparedness is to conduct multi-agency and multi-jurisdictional disaster exercises and drills (Braun et al., 2006).

Resource stockpiles. It is important for hospitals to have a complete up-to-date inventory of all supplies and equipment. The inventory should also include provisions

outlining how additional resources will be acquired if needed, both at the local and regional levels. Mutual aid agreements with external stakeholders should also be developed which state how and when resources will be provided following an earthquake. Within the health community in particular, the development of health care coalitions that facilitate a community wide inventory of medical assets and supplies is one way to determine the response capacity for each community (Braun et al., 2006).

Disaster training and education. Training and education are an essential part of preparedness (Chapman & Arbon, 2008). Disaster education and training should focus on three areas: roles and responsibilities, emergency plans and protocols, and personal preparedness (Agency for Healthcare Research and Quality, 2010). First, during a disaster, roles and responsibilities of health care staff often change. For instance, staff may be required to take on additional responsibilities and tasks that extend beyond their current role and skill set. For this reason, it is crucial that staff be educated as to how their role could possibly change during a disaster. Secondly, all hospital employees must be well acquainted with disaster plans and protocols, not only for their specific department but for the hospital facility in general. It is important for all employees to understand how to ensure patient care and to maintain functioning of their department in less than ideal conditions. It is also crucial staff are well versed in evacuation and relocation protocols to ensure the safety of patients. Third, it is important that health care providers be educated on how to be personally prepared for a disaster so they can come to work during a disaster (Rebmann et al., 2008). By maintaining continuing education and training programs, hospitals can help to ensure that proper action is taken promptly during a disaster event (Counts, 2001). Management can implement mandatory disaster training for all employees as a way to increasing disaster preparedness.

Education materials and disaster preparedness workshops should take a multi-disciplinary approach, and have been proven to be very effective in increasing disaster preparedness both at work and at home.

Disaster exercises and drills. The best way of testing disaster preparedness plans is by conducting unannounced, simulated, or “table top” exercises and real time drills (Chapman & Arbon, 2008). There are four main advantages of conducting disaster exercises. First, disaster exercises allow hospital staff to become familiar with the hospital disaster plan. It provides them with an opportunity to practice emergency response protocols and procedures, in addition to allowing them become familiar with their roles and responsibilities during a disaster. Second, disaster exercises allow for the opportunity to integrate community and local stakeholders. Multi-agency and multi-jurisdictional exercises allow for a better understanding of organizational response capacities, increase communication regarding roles and responsibilities, and as a result, better preparing the community as a whole (Rebmann et al., 2008). Thirdly, by conducting disaster exercises, hospital administration can ensure all response protocols and procedures are in compliance with national emergency management standards. Lastly, disaster exercises provide a realistic practice scenario and help identify potential problems and gaps with the plan itself (Counts, 2001). For this reason, it is important that after each disaster exercise, lessons learned and areas of improvement are identified.

Surge capacity. In addition to maintaining everyday operations and services post disaster, hospitals are tasked with the responsibility of dealing with a surge in the number of casualties (Yi, George, Paul, & Lin, 2010). For this reason, it is important for hospitals to have a firm understanding of their surge capacity. Surge capacity is defined as the ability to

obtain adequate staff, supplies and equipment, structures and systems to provide sufficient care to meet the immediate needs of an influx of victims following a large-scale incident or disaster (Adams, 2009). In order to deal with patient surge during a disaster, hospitals may need to adjust existing patient care capacity, and relocate nurses and hospital support staff in order to meet the needs of the surge (Paturas et al., 2010). There are many components of a surge plan. The first and perhaps most important factor of a surge plan is identifying what current resources are in place. Once that has been established, it is important to know if additional resources are needed, and if so, to address where they would come from.

Essential components of surge capacity which have increased the level and quality of patient care include: staff (both medical and nonmedical), equipment (pharmaceuticals and medical supplies), and structure (both physical structure and a management infrastructure) (Kaji & Lewis, 2006; Kaji et al., 2008). Following a disaster, a hospital emergency room (ER) can expect a sudden surge of injured patients (up to three to five times the normal patient volume); this can easily overwhelm hospital resources (Yi, George, Paul & Lin, 2009). Research has also shown surge capacity is eroded by: the overcrowding of emergency rooms, boarding of admitted patients in hallways, frequent episodes of ambulance diversion, and the declining numbers of sub-specialists, nurses, physicians and hospital support staff (Peleg & Kellermann, 2009). For these reasons, hospital disaster preparedness planning must include surge capacity planning. Specific plans and protocols must be pre-identified to care for the larger numbers of affected individuals (Ginter et al., 2007).

Operational contingency planning. From a health care perspective, the primary function of a hospital following an earthquake is to continue to provide services and ensure the continuity of medical care, despite being adversely impacted by external events. To be

able to do so, hospitals must address operational contingency planning. At the departmental level, plans must outline how physicians and support staff will ensure the continuation of medical care to existing patients, while simultaneously providing medical care to the surge of newly injured. Also, specific contingences must be pre-identified for outpatient services. Dialysis for nephrology patients and blood transfusions for haematology patients are just a few examples of outpatient services that must continue after a disaster. Therefore it is crucial that hospital administrations develop department level specific strategies to ensure the full functioning of such critical services during a disaster. Experience has shown an effective response is based on a pre-designated contingency plan which maps various activities that will be put into play post-disaster (Adini et al., 2006).

Challenges and lessons learned. Disasters caused by natural hazards elsewhere have highlighted existing gaps in current hospital disaster preparedness that include: (1) insufficient coordination between hospitals and civil response agencies and external stakeholders, (2) insufficient on-site critical care capability and portability of acute care processes, and (3) inadequate disaster medical training for hospital personnel and support staff (Farmer & Carlton, 2006). The literature has also identified confusion over roles and responsibilities and the lack of hospital integration into community disaster planning as problem areas (Waeckerle, 1991). A disaster preparedness assessment of 45 hospitals in the Los Angeles area concluded the failure to fully integrate interagency disaster training and planning, the lack of mutual aid agreements, and a severely limited surge capacity all limited disaster preparedness (Kaji et al., 2008). Similarly, a study by Rebmann et al. (2008) identified disaster training and education for public and health care personnel, infection prevention/control during mass casualty incidents, internal and external hospital

communication and building partnerships with community agencies as major gaps in public health preparedness.

During the Red River Flood in Manitoba in 1997, the site-specific disaster planning was very effective and quickly engaged community agencies and external stakeholders in assisting with the diversion of patients to adjacent facilities, relocating staff, and obtaining equipment and supplies from alternative sites (Cloutier, Greenwood, Malawski, & Tremblay, n.d.). The above example highlights the importance of establishing community support networks and planning. During Hurricane Katrina in 2005, hospitals quickly realized they were not prepared to deal with the surge of casualties arriving simultaneously, nor were they prepared for individuals seeking temporary shelter and food, and still others looking for displaced family members (Rodríguez & Aguirre, 2006). Evacuation problems also emerged as a critical issue for many hospitals during Hurricane Katrina, reinforcing the need to develop robust evacuation planning strategies and protocols.

Despite various shortcomings in their disaster preparedness, hospitals still play a critical role in effective medical response and are an important part of a community's resilience. The capacity of hospitals to deal with emergencies has revealed significant gaps in the ability to meet the demands of a public health emergency (Kaji et al., 2008). Lessons learned from past disasters are important; gaps in preparedness that are identified can still be addressed in future disaster plans, thus improving hospital disaster preparedness (Rebmann et al., 2008).

Conclusion

Based on the unique tectonic environment, historic seismicity, calculated earthquake probabilities, and underlying geology of the study area, there is great potential for a seismic

disaster to occur sometime in the near future. Given the potential threat, it is important for hospitals in the region to plan and prepare for such an event. Past events have highlighted the need for increased hospital disaster preparedness, specifically in the following areas: planning and integration with community stakeholders, disaster preparedness training and exercises, and surge capacity planning. Hospitals must address key components of preparedness to ensure an effective health system response. Key components include: a risk assessment, a disaster plan, communication systems, resource stockpiles, community linkages, disaster training, education and exercises. There are many advantages to increasing hospital disaster preparedness planning, including: (1) ensuring the continuity of essential medical services post-disaster; (2) having well-coordinated hospital disaster plans and protocols; (3) ensuring efficient and effective internal and external communications; (4) increasing the ability of the health system to respond to a surge of patients requiring medical attention, and finally, (5) ensuring effective allocation of hospital resources (World Health Organization, 2009). All of these components must come together in unison to increase the preparedness of the health system, and ultimately of the community.

Chapter 3: Methodology

Research Design and Methods

Multiple methods were used to assess the seismic preparedness levels of two hospitals in Victoria, British Columbia. To begin, an extensive review of existing literature was conducted to help understand how hospitals have been adversely impacted by disasters in the past, and to highlight the lessons learned as a result of such events. Once the literature review was complete, the information collected was used to develop the survey instruments for five stakeholder groups: Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department Managers, and Local Emergency Managers. Surveys were conducted in each of the two Victoria hospitals, as well as in the supporting Emergency Management Offices. Finally, survey results were summarized and data analyses were conducted to identify trends both within and between groups. The following sections will provide a brief overview of the study area and subject hospitals, introduce the subject sample groups, provide an overview of the survey design and implementation process, and lastly, data analysis strategies.

Study area. The Vancouver Island Health Authority (VIHA) is the regional health authority responsible for delivering health services to the Greater Victoria region, the rest of Vancouver Island, the Gulf Islands, and to part of the Lower Mainland. Broken up into three geographic regions—North Island, Central Island, and South Island—the health authority serves approximately 750,000 people, operates over 150 facilities, and is responsible for approximately 1,500 acute care beds and 6,200 residential care/assisted living units (VIHA, 2009).



Figure 7. Map of the Vancouver Island Health Authority (VIHA).

VIHA spans approximately 56,000 km². From *VIHA Five-Year Strategic Plan (2008–2013)*, by the Vancouver Island Health Authority, 2009, p. 5 Copyright 2009 by Vancouver Island Health Authority.

Figure 7 shows the geographic regions of VIHA. With a combined population of over 350,000 residents, the South Island region is made up of four Local Health Areas: 61 Greater Victoria, 62 Sooke, 63 Saanich, and the 64 Gulf Islands. For practical, as well as research related reasons, the current research focuses on the Greater Victoria Local Health Area (see Figure 8).

According to the Local Health Area profile series (Vancouver Island Health Authority, Planning and Community Engagement, 2011) there are many characteristics that

make this Local Health Area unique. First, as of 2010, the Greater Victoria Local Health Area represented 29.4% of the total VIHA population with approximately 223,233 residents. Secondly, there are high rates of chronic conditions; the Greater Victoria Local Health Area not only has the highest rates of Dementia, but also has the second highest rates of chronic kidney disease and depression compared to the rest of the health authority. Third, the Greater Victoria Local Health Area has a growing senior citizens population, age 75+, that is expected to increase by 70.7% to almost 35,600 by 2030. The reasons stated above make the Greater Victoria Local Health Area particularly vulnerable to the adverse impacts caused by a damaging earthquake (Vancouver Island Health Authority, Planning and Community Engagement, 2011).



Figure 8. A map of the Greater Victoria Local Health Area.

The red star shows the location of the Victoria General Hospital, and the blue star shows the location of the Royal Jubilee Hospital. (Source: Vancouver Island Health Authority, Planning and Community Engagement, 2011)

The Greater Victoria Local Health Area is served by three main hospitals: The Victoria General Hospital (VGH), the Royal Jubilee Hospital (RJH) and the Saanich Peninsula Hospital. All three health care facilities fall under the administrative control of the Vancouver Island Health Authority (VIHA).

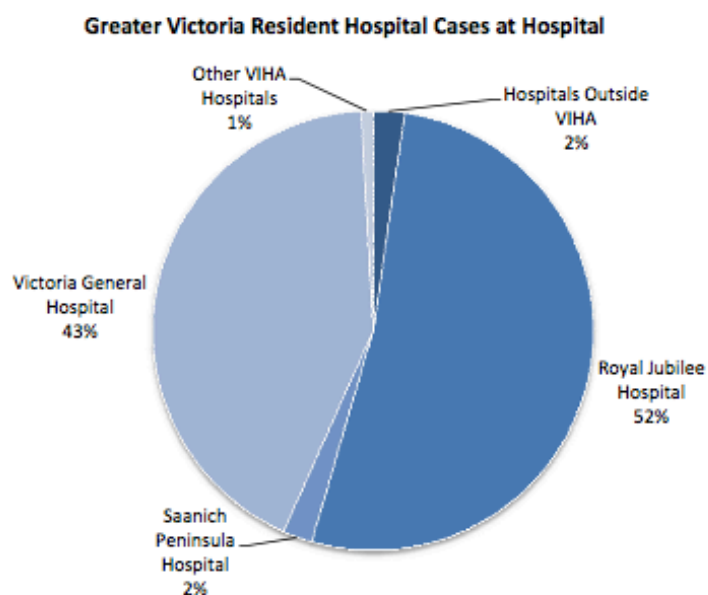


Figure 9. Where do Greater Victoria Residents go for medical care?

(Source: Vancouver Island Health Authority, Planning and Community Engagement, 2011)

The Victoria General Hospital (VGH) and The Royal Jubilee Hospital (RJH) will be the focus of this study, and these hospitals were chosen for two reasons: first, both hospitals are the main health care facilities serving Greater Victoria area residents. As illustrated by Figure 9, 95% percent of residents living in the Greater Victoria Local Health Area go to either Victoria General Hospital or the Royal Jubilee Hospital to seek medical attention. Secondly, both facilities act as primary, secondary and tertiary care facilities to all 750, 000 residents on Vancouver Island.

The first site, Victoria General Hospital (VGH), is a 344 bed acute care facility serving a catchment population of 196,635 (Vancouver Island Health Authority (VIHA) Five- Year Strategic Plan (2008-2013). Catchment populations are based on proportions of patients within each Local Health Area. Located in the municipality of View Royal, the VGH specializes in Neurosurgery, Maternity and Paediatric Care, Emergency and Trauma Care.

The second site, the Royal Jubilee Hospital (RJH), is a 400 bed acute care facility serving a catchment population of 192,578 (Vancouver Island Health Authority (VIHA) Five- Year Strategic Plan (2008-2013). Located in the municipality of Victoria and closely bordering the municipalities of Oak Bay and Saanich, RJH offers specialty services such as critical-care, surgery, diagnostics, emergency facilities, cardiac care, cancer care and other patient programs.

Participants. Purposive sampling techniques were used to develop the range of participants for this research project. All participants were selected specifically based on their knowledge, experience and current roles and responsibilities pertaining to Disaster and Emergency Management in the province. Given that the responsibility for Emergency Management in British Columbia falls on the shoulders of individuals at all levels, a concerted effort was made to include a sample of participants from each target population: at the Provincial, Health Authority, and Local Authority levels.

The participants can be broken down into five target groups: Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department Managers, and Local Emergency Managers (see Table 1). The Provincial Emergency Managers target group included a sample of five Provincial Emergency Managers belonging to The Emergency Management Unit of The Ministry of

Health, and Emergency Management British Columbia (EMBC). At the hospital level the focus was on Hospital Administration, Program Directors and Department Managers. Among the Hospital Administration staff there were only two individuals who could be invited to participate in this study and both of them agreed to be interviewed. Thus, at this level they represent the entire population of participants rather than a sample. All other participants represented a subgroup from the larger population e.g., Health Authority Program Directors and Hospital Department Managers. A range of Health Authority Program Directors were targeted to represent more vulnerable medical disciplines such as the Intensive Care Unit (ICU), Emergency Room (ER), Surgery, Renal, Medical Imaging, Child and Youth Health, and Facilities and Maintenance. Five Department Managers were interviewed from this group. Each of the Health Authority Emergency Managers, Program Directors and Department Managers are responsible for programs which span the entire health authority. Lastly, even though 13 municipalities serve the Greater Victoria Local Health Area, the research targeted a sample of Local Emergency Managers responsible for the municipalities in the immediate vicinity of the hospitals. These municipalities included the Capital Regional District, City of Victoria, Oak Bay, Saanich, Esquimalt, and View Royal.

Table 1

Research Participants and Sample Size

Research participants	Sample size ($N = 26$)
Provincial Emergency Managers	5
Health Authority Emergency Managers	2
Health Authority Program Directors	8
Hospital Department Managers	5
Local Emergency Managers	6

Survey Design and Implementation

The University of Victoria/Vancouver Island Health Authority Joint Research Sub-Committee gave ethical approval for the research on May 16, 2011, and data collection began shortly after. Each participant signed an informed consent form (see Appendix B). The primary data was collected through in-person interviews using a structured survey instrument (see Appendices C to D for survey instruments). While separate survey instruments were developed for each target group, the surveys shared many common questions, and contained a combination of open and close-ended questions. Additionally, the instruments were modified through input from subject level experts in both the health and emergency management fields. The questions addressed key elements of emergency preparedness as identified by the Canadian Standards Association (2008), the World Health Organization (2008, 2009) and Pan American Health Organization (2000, 2003, 2010). Other literature sources included peer-reviewed journal articles, reports, grey literature, and websites (Association for Professionals in Infection Control and Epidemiology, n.d.; California Emergency Medical Services Authority, 2006; Canadian Standards Association, 2008; Federal Emergency Management Agency, 2006; Healthcare Association of Hawaii, 2001; Kaji & Lewis, 2006; United Nations, 2008; United Nations Development Programme, 1994). Figure 10 summarizes the areas addressed by the survey instruments according to themes from the CSA-Z1600 document.



Figure 10. Themes from the Canadian Standards Association (CSA-Z1600) instrument.

Data collection began in May 2011, and was completed in September, 2011. Participants were initially invited to participate by email, and once consent was given, the interviewees were then contacted by telephone to arrange meeting times and locations. [Of the 30 respondents initially contacted to participate in the study, 26 agreed to participate, creating a 86% success rate. The interviews were tape recorded with the participants' consent, and ranged in length from 10 minutes to 2 hours. With the exception of 2 interviews, all interviews were conducted face-to face in Victoria; one interview was conducted in Nanaimo, and another interview was conducted over the telephone.

There were some challenges encountered during the recruitment phase, especially at the hospital level. Some respondents were contacted three to four times to set up interview times and places. It is also important to mention, of the four individuals who did not respond to the participation request, three were hospital level program directors, and one was a provincial emergency manager. The inability to participate may be due to a number of reasons: lack of time, interest, and competing priorities to name a few.

Data Analysis

Before the data could be analyzed, two databases had to be created: one for the numerical or quantitative data, and the other for the textual, qualitative data. The following sections explain: (1) how each database was created, (2) how the data was organized within each database and lastly (3) how the data was then analyzed.

Quantitative data. Before the quantitative database could be created, the data needed to be coded and organized. All quantitative survey questions were given binary codes, meaning that answers were coded as follows: yes was coded as 1, no as 2, and don't know as 3. In order to maintain anonymity, each participant was given a numerical identification tag which was used for the remainder of the study. This information was then entered into an excel spreadsheet, which was organized with headings compatible with the CSA-Z1600 document: Program Management, Planning, Implementation, and Evaluations, Exercises and Corrective Actions. For the sake of this research, Education and Emergency Management Background and Future Directions were also added as themes. After the database was created in excel, the spreadsheets were then imported into SPSS, and frequencies for each variable were then generated using the Crosstabs function. These frequencies were then analyzed for trends and patterns from two perspectives: first, across the whole sample, and secondly by target group. Due to the small sample size ($n = 26$), these data are not amenable to more sophisticated statistical or multivariate analyses.

Qualitative data. The qualitative database was not as complex as the quantitative database to develop, but these data were more numerous and more time consuming to explore. First, all 26 participant interviews were transcribed verbatim into Microsoft Word. Dictation software called Dragon Dictate version 2.5.1 was used to assist in this process. The

data was then organized into six separate Microsoft Word transcripts: (1) Education and Background, (2) Program Management, (3) Planning, (4) Implementation, (5) Exercises, Evaluations and Corrective Actions and (6) Future Directions and Priority Areas. These themes are consistent with the CSA-Z1600 categories already identified for the quantitative database. Each transcript was annotated, analyzed and coded for key themes and patterns within these broad headings. The themes were selected based upon their reoccurrence rates, and also based on their meaningfulness and uniqueness. The thematic analysis provided immense insight into the experience and views of subject matter experts; it was also effective in highlighting key limitations, challenges and disconnects regarding regional and organizational earthquake preparedness (Luborsky, 1994).

Credibility and validation of the thematic analysis was ensured through the use of purposeful sampling and triangulation techniques (Baxter & Eyles, 1997). All respondents were selected based on their potential role in the emergency response for a regional disaster, be it from a health system, municipal or provincial emergency response perspective. The use of purposive sampling enhanced credibility, by enabling a more in depth analysis and presentation of issues central to disaster preparedness in our area. Some sections of the survey had a very small sample size, however these results are still very meaningful. Given the role of these individuals in emergency management for their organization, and their engagement with these activities on a daily basis, their expertise and views regarding disaster preparedness are invaluable. Source and method triangulation enhanced the credibility of results (Baxter & Eyles, 1997). The key themes and trends identified in the quantitative data and the qualitative data complemented and reinforced each other. The use of interview quotations highlighted commonalities and discrepancies between the two data sources,

ultimately enhancing the credibility of the results. The use of qualitative insights gained from the interviews with a broad range of participants' added depth and enabled a greater understanding of key themes and issues. The interview data highlights were also compared to secondary literature and existing research to ensure transferability of findings. Dependability of the key themes identified e was strengthened through the use of audio recordings and through triangulation of qualitative and quantitative data and by comparing insights gained from the various target groups (Baxter & Eyles, 1997).

Chapter 4: Quantitative Results

The results presented in this chapter are organized into three main sections. The first section presents results pertaining to current respondent Emergency Management/Response Education and Experience. The second section presents the results from the Assessment of Preparedness. This section is further broken down into four sub-sections that parallel the main themes in the CSA-Z1600, the National Standards for Emergency Management and Business Continuity: 4.2.1) Program Management, 4.2.2) Planning, 4.2.3) Implementation and 4.2.4) Exercises, Evaluations and Corrective Actions. And lastly, section 4.3 will present Priority Areas, more specifically, the current barriers and future directions in enhancing institutional seismic preparedness.

The results are presented first as a part of the whole interviewed sample. This is followed by a breakdown of results by target group: Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department Managers, and Local Emergency Managers.

Emergency Management/Response Education and Experience

Survey questions relating to Emergency Management/Response Education and Experience were asked to the majority of the sample population (n = 25). Due to time constraints, one Health Authority Program Director was not asked questions pertaining to this section.

Emergency management/preparedness education or training. More than fifty percent (52%; n = 13) of the 25 interviewed respondents reported having some form of education or training, through the Justice Institute of British Columbia (JIBC) or other external agencies. Of these, half had either completed, or were in the process of completing

the Emergency Management Certificate Program offered through the Justice Institute. The remaining respondents (48%; n = 12) reported having no previous Emergency Management/Preparedness education or training.

Those with training (52%; n = 13) were comprised of Provincial Emergency Managers (38.5%; n = 5), Local Emergency Managers (38.5%; n = 5), Health Authority Emergency Managers (15.4%; n = 2) and Health Authority Program Directors (7.7%; n = 1). Those without training included Health Authority Program Directors (50%; n = 6), Hospital Department Managers (41.7%; n = 5), and Local Emergency Managers (8.3%; n = 1).

Based on the above results, a vast majority of Health Authority Program Directors (85.7%; n = 6) and Hospital Department Managers (100%; n = 5) had no previous Emergency Management/Preparedness education or training. In contrast, all of the Provincial Emergency Managers (100%; n = 5) and a majority of Local Emergency Managers (83.3%; n = 5) reported having training.

Participated in a disaster response. The majority of respondents (76%; n = 19) have participated in some form of response to a disaster situation. However of these respondents, all but one (94.7%; n = 18) reported the event to be something other than an earthquake (see Figure 11).

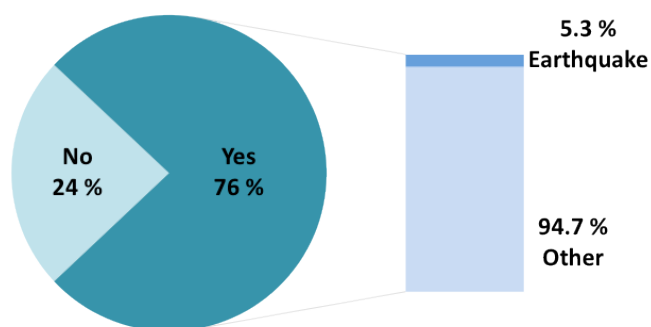


Figure 11. Participation in a disaster response.

As illustrated by Figure 12, respondents who had participated in a disaster response were comprised of Local Emergency Managers (31.6%; n = 6), Provincial Emergency Managers (26.3%; n = 5), Hospital Department Managers (21.1%; n = 4) and the remainder were evenly split between Health Authority Emergency Managers (10.5%; n = 2), and Health Authority Program Directors (10.5%; n = 2). Respondents who reported never having participated in a disaster response were comprised of Health Authority Program Directors (83.3%; n = 5) and Hospital Department Managers (16.7%; n = 1). Almost three quarters of Health Authority Program Director (71.4%; n = 5) had never participated in a disaster response.

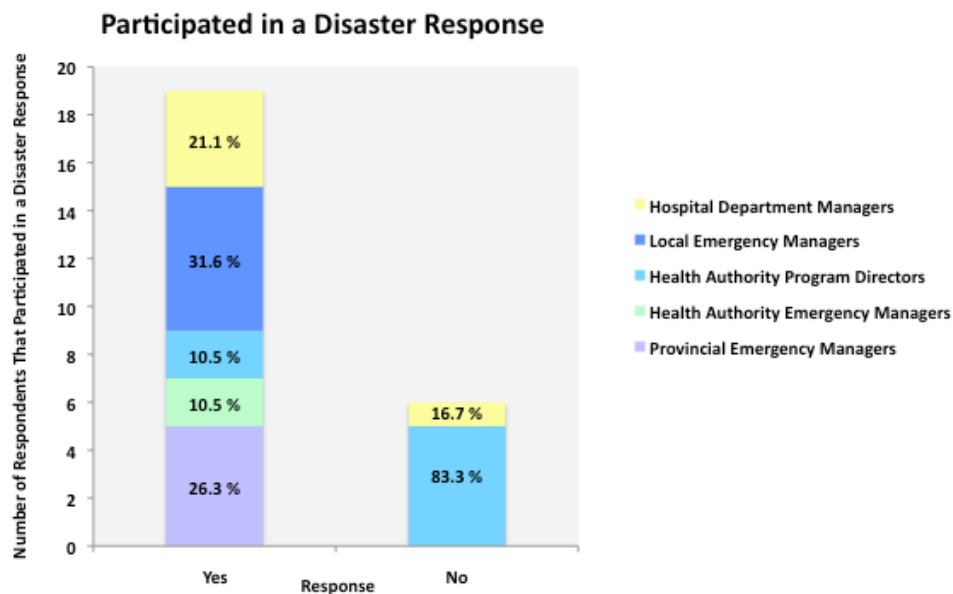


Figure 12. Participated in a disaster response.

Disaster exercises. Respondents were asked to indicate how many times they had participated in the following types of disaster exercises: Full Scale Exercises, Table Top Exercises, and Drills. For the sake of this discussion, Full Scale Exercises were defined as multi-agency, multi-jurisdictional exercises that included a full activation of the Emergency Operations Centre. A Table Top Exercise was defined as a round table discussion involving all key personnel involved in the emergency response. A Drill was defined as an exercise designed to test one specific component of an emergency response plan or protocol. Figure13

shows the distribution of disaster exercises as organized by target group.

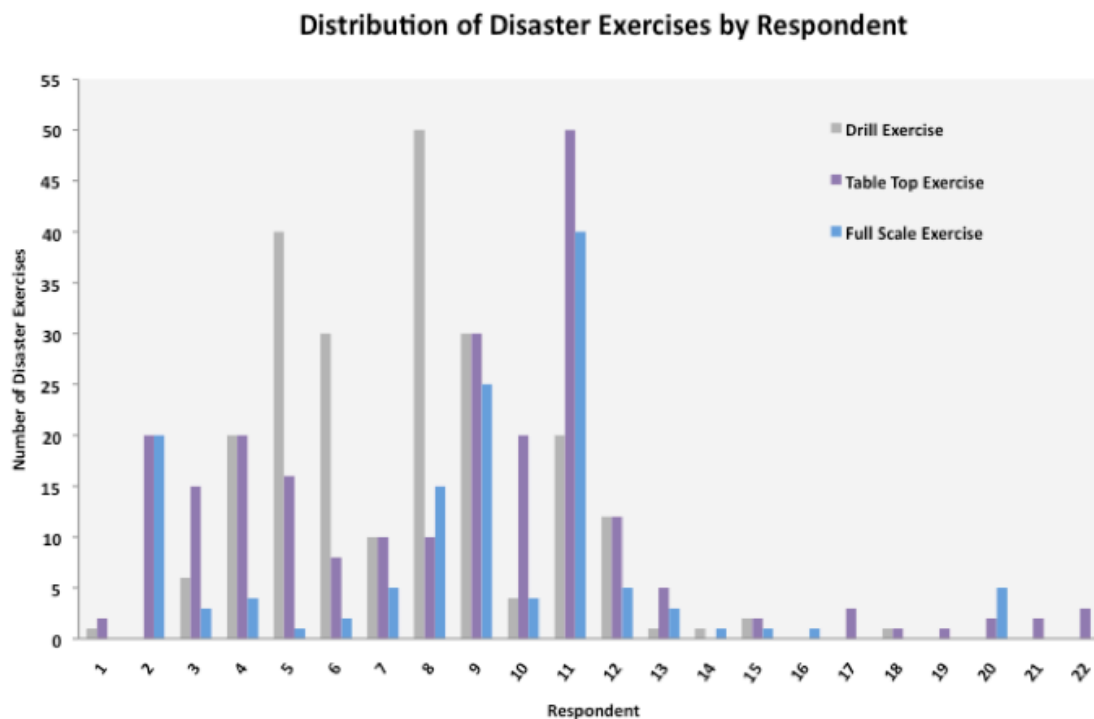


Figure 13. Distribution of disaster exercises by respondent.

Three important trends emerged from these data. First, based on the numbers reported, Provincial and Local Emergency Managers participated in significantly more exercises compared to all Hospital level participants. Reasons for these discrepancies are discussed in the following chapter. Second, three of the 26 respondents who reported having never participated in any type of disaster exercise were either Health Authority Program Directors or Hospital Department Managers. Lastly, the data shows that overall the respondents participated in more drills and tabletops exercises, and fewer full scale exercises.

Assessment of Preparedness

Program management. Under the heading of Program Management, respondents were asked questions regarding their Emergency Management Program. Questions

specifically addressed existing policies, program objectives and funding, and program reviews. Questions in this section were asked to three of the five target groups (n = 13), including: Provincial Emergency Managers, Health Authority Emergency Managers, and Local Emergency Managers. Due to time constraints, Health Authority Program Directors and Hospital Department Managers were not included as a part of the sample.

Disaster preparedness policy. The vast majority of participants (92.3%; n = 12) reported having a disaster preparedness policy in place.

Multi-stakeholder advisory committee. Participants were asked whether a Multi-stakeholder advisory committee had been developed to support the planning, implementation, evaluation and revision of the Emergency Management Program. A majority of participants (92.3%; n = 12) said a Multi-stakeholder advisory committee was in place.

Emergency management program goals and objectives. More than three quarters of respondents (77%; n = 10) said their Emergency Management Program had formal written goals and objectives. Those reporting having formal written goals and objectives were equally balanced between Provincial Emergency Managers (50%; n = 5), and Local Emergency Managers (50%; n = 5). Respondents who reported having no formal written goals and objectives included Health Authority Emergency Managers (66.7%; n = 2), and Local Emergency Managers (33.3%; n = 1).

Percentage of emergency management program goals and objectives funded. In terms of budget allocations, respondents were asked to identify what percentage of program performance goals and objectives had received funding. Funding could be in the form of grants, donations or subsidies. As shown in Table 2, nearly half of respondents (46.2%; n = 6) said between 75 to 100% of specified goals and objectives had allotted funds. These

results were equally balanced between Provincial and Local Emergency Managers. In contrast, of the two Health Authority Emergency Managers interviewed, one said fewer than 50% of goals and objectives were funded, while the other did not know what percentage of goals and objectives had funding support.

Table 2

Percentage of Emergency Management Program Goals and Objectives Funded

Target group	> 50%	51–75%	75–100%	Don't know	Total
Provincial Emergency Managers	0	1	3	1	5
Health Authority Emergency Managers	1	0	0	1	2
Local Emergency Managers	1	0	3	2	6
Total	2	1	6	4	13

More than one quarter of respondents (30.8%; n = 4) did not know what percentage of goals and objectives had received funding support.

Evaluation of the emergency management program. When asked how often an evaluation of the Emergency Management Program was conducted, just over one third of respondents (38.5%; n = 5) reported that their Emergency Management Program underwent a review annually. Almost a quarter of respondents reported the review process was conducted on a quarterly basis (23.1%; n = 3), and the same number of respondents said no review process was in place. The remaining respondents (15.4%; n = 2) said the review of the Emergency Management Program was conducted bi-annually. These results are summarized in Table 3.

Table 3

Evaluation of Emergency Management Program

Target group	Quarterly	Annually	Bi-annually	No Review	Total
Provincial Emergency Managers	0	3	2	0	5
Health Authority Emergency Managers	1	1	0	0	2
Local Emergency Managers	2	1	0	3	6
Total	3	5	2	3	13

As reflected in Table 3, there are two emerging trends based on these data. First, Provincial Emergency Managers are more likely conduct annual or bi-annual evaluations of their Emergency Management Program. In contrast, half of the Local Emergency Managers (50%; n = 3) reported having no review process in place.

Planning. Questions under this section focused on Earthquake Hazard Awareness, and were asked to all five target groups (n = 26): Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department Managers and Local Emergency Managers. Questions pertaining to Community Partnerships were asked to three target groups (n = 12): Health Authority Emergency Managers, Provincial Emergency Managers and Local Emergency Managers. Sample size for Earthquake Response Planning varied. Due to time constraints and lack of familiarity around emergency response planning specifics, some respondents were not asked these survey questions. These respondents included all Health Authority Program Directors and Hospital Department Managers, and one Provincial Emergency Manager.

Earthquake hazard awareness. All 26 participants were asked to list the top three hazards in Southwest British Columbia (see Figure 14).

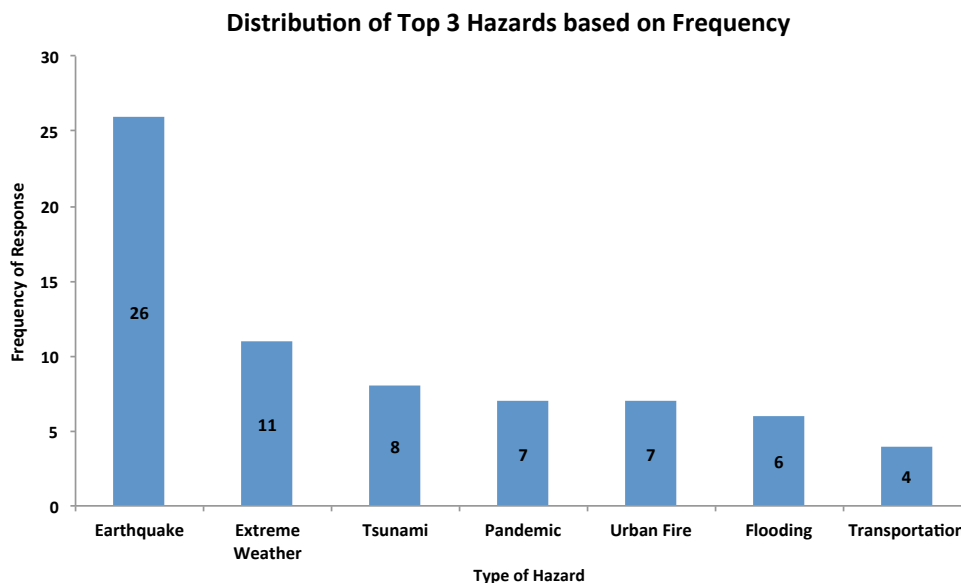


Figure 14. Distribution of top three hazards based on frequency.

In terms of frequency of response, earthquakes were clearly identified as the top hazard our region is exposed and susceptible to. The second most common answer was Extreme Weather Events with 11 responses, followed by 8 respondents reporting Tsunamis. Other hazards that were identified are presented in Figure 14. Based on the results there is a very high awareness of earthquake hazards among the respondents.

Earthquake risk perception. Participants were asked to use a Likert scale of 1–10 (1 = low and 10 = high) to rate the level of risk our region faced to a damaging earthquake. All of the respondents rated the risk of a damaging earthquake to be at least four. Six respondents rated the risk to be a 10 (23.1%), another six rated the risk to be 8 (23.1%) and another six rated the risk to be 7 (23.1%). Four respondents rated the risk to be 9 (15.4%), and 3 respondents rated the risk to be 5 (11.5%), and the remaining respondent rated the risk as 4 (3.9%).

All two respondents (100%; n = 2) from the Health Authority Emergency Managers perceived earthquake risk to be 10. A majority of respondents from the Provincial Emergency Managers (80%; n = 4), and Local Emergency Managers (83.3%; n = 5) perceived levels of earthquake risk to be greater than seven. Based on these results, the respondents perceive the risk of an earthquake to be significant in our region.

Perception of hospital earthquake preparedness. Participants were also asked to use a Likert scale of 1–10 (1 = low and 10 = high), to rate their perception of how prepared Royal Jubilee Hospital and the Victoria General Hospitals are to deal with a damaging earthquake. None of the 26 respondents rated the level of preparedness to be above eight.

The most common response about perceived levels of preparedness was 6 (27%; n = 7). These respondents came from included Health Authority Program Directors (42.9%; n = 3), Provincial Emergency Managers (28.6%; n = 2), and the remaining respondents were either Hospital Department Managers (14.3%; n = 1), or Local Emergency Managers (14.3%; n = 1). One Health Authority Emergency Manager perceived preparedness levels to be 2, while the other said 5.

The results also revealed that Provincial Emergency Managers, perceived hospitals to be more prepared to deal with a damaging earthquake, when compared to Health Authority Emergency Managers and Program Directors. It must be emphasized, that although Hospital Department Managers and Health Authority Program Directors perceive the risk for an earthquake to be high, they still perceive hospital preparedness levels to be low.

Community partnerships. Participants interviewed (n = 12) were asked to identify which of the following groups: local government, British Columbia Ambulance Service (BCAS), Nongovernmental organizations (NGOs), hospitals, and fire departments were

engaged in the planning process for earthquake response plans. The second component of the question asked participants to identify which of the stakeholder groups had integrated and coordinated their earthquake response plans with those of the respondents' organization.

Local government. When asked whether Local Government was engaged in the planning process for earthquake response plans, the majority of the respondents (75%; n = 9) answered yes. These respondents included Local Emergency Managers (55.6%; n = 5), Provincial Emergency Managers (22.2%; n = 2), and Health Authority Emergency Managers (22.2%; n = 2). Respondents who said Local Governments had not been engaged in the planning process were Provincial Emergency Managers (66.7%; n = 2), and Local Emergency Manager (33.3%; n = 1). These results are summarized in Table 4.

Table 4

Local Government—Engaged in Planning

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	2	0	2
Local Emergency Managers	5	1	6
Total	9	3	12

As summarized in Table 5, more than half of respondents (66.7%; n = 8) reported that Local Government had integrated their earthquake response plans with those of the respondent's organization. These respondents were comprised of Local Emergency Managers (62.5%; n = 5), Provincial Emergency Managers (25%; n = 2), and the remaining respondent was a Health Authority Emergency Manager (12.5%; n = 1). Respondents who said Local Government had not integrated their earthquake response plans with those of the

respondent's organization included Provincial Emergency Managers (50%; n = 2), a Health Authority Emergency Manager (25%; n = 1), and a Local Emergency Manager (25%; n = 1).

Table 5

Local Government—Integrated Plans

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	1	1	2
Local Emergency Managers	5	1	6
Total	8	4	12

British Columbia Ambulance Service (BCAS). Three quarters of respondents (75%; n = 9) said BCAS had been engaged in the planning process for their earthquake response plan. These respondents included Local Emergency Managers (44.4%; n = 4), Provincial Emergency Managers (33.3%; n = 3), and Health Authority Emergency Managers (22.2%; n = 2). The three respondents, who said that BCAS had not been engaged were either Local Emergency Managers (66.7%; n = 2) or Provincial Emergency Managers (33.3%; n = 1).

These results are summarized in Table 6.

Table 6

BCAS—Engaged in Planning

Target group	Yes	No	Total
Provincial Emergency Managers	3	1	4
Health Authority Emergency Managers	2	0	2
Local Emergency Managers	4	2	6
Total	9	3	12

As summarized in Table 6, three quarters of respondents (75%; n = 9) said BCAS had integrated their earthquake response plans with those of the respondent's organization. These

respondents were comprised of Provincial Emergency Managers (44.4%; n = 4), Health Authority Emergency Managers (22.2%; n = 2), and the remaining respondents were Local Emergency Managers (33.3%; n = 3). Both of the respondents who said BCAS had not integrated their earthquake response plan were Local Emergency Managers (100%; n = 2). The remaining respondent who did not know if BCAS had integrated their earthquake response plans was a Local Emergency Manager (8.3%; n = 1).

NGOs. As shown in Table 7, a little over half of respondents (58.3%; n = 7) said NGOs had been engaged in the planning process for their earthquake response plan. These respondents included Local Emergency Managers (57.1%; n = 4), Provincial Emergency Managers (28.6%; n = 2), and a Health Authority Emergency Manager (14.3%; n = 1). Those who said NGOs had not been engaged were reasonably distributed among Provincial Emergency Managers (40%; n = 2), Local Emergency Managers (40%; n = 2), and a Health Authority Emergency Manager (20%; n = 1).

Table 7

NGOs—Integrated Plans

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	4	0	0	4
Health Authority Emergency Managers	2	0	0	2
Local Emergency Managers	3	2	1	6
Total	9	2	1	12

As shown in Table 8, more than half of the respondents interviewed (58.3%; n = 7), said that NGOs had integrated their earthquake response plans with those of the respondent's organization. These respondents consisted of Local Emergency Managers (57.1%; n = 4),

Provincial Emergency Managers (28.6%; n = 2) and a Health Authority Emergency Manager (14.3%; n = 1).

Table 8

NGOs—Engaged in Planning

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	1	1	2
Local Emergency Managers	4	2	6
Total	7	5	12

As presented in Table 9, the respondents who said NGOs had not integrated their plans were distributed between: Provincial Emergency Managers (40%; n = 2), Local Emergency Managers (40%; n = 2) and a Health Authority Emergency Manager (20%; n = 1).

Table 9

NGOs—Integrated Plans

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	1	1	2
Local Emergency Managers	4	2	6
Total	7	5	12

Hospitals. As shown in Table 10, less than half of the respondents (40%; n = 4) said hospitals had been engaged in the planning process for their earthquake response plans. These respondents included Local Emergency Managers (66.7%; n = 2), and Provincial Emergency Managers (33.3%; n = 2).

Table 10

Hospitals—Engaged in Planning

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Local Emergency Managers	2	4	6
Total	4	6	10

In contrast, a vast majority of respondents (60%; n = 6) said hospitals had integrated their earthquake response plans with those of the respondent's organization (see Table 11). These respondents were comprised of Local Emergency Managers (66.7%; n = 4) and Provincial Emergency Managers (33.3%; n = 2). Respondents who said hospitals had not integrated or coordinated earthquake response plans were evenly distributed between Provincial Emergency Managers (50%; n = 2), and Local Emergency Managers (50%; n = 2).

Table 11

Hospitals—Integrated Plans

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Local Emergency Managers	4	2	6
Total	6	4	10

Fire department. A majority of respondents (83.3%; n = 10) said the fire department had been engaged in the planning process for their earthquake response plan. Of these respondents, most were Local Emergency Managers (60%; n = 6), and the remainder were Provincial Emergency Managers (20%; n = 2) and Health Authority Emergency Managers (20%; n = 2). These results are summarized in Table 12.

Table 12

Fire Department—Engaged in Planning

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	2	0	2
Local Emergency Managers	6	0	6
Total	10	2	12

Similarly, as shown in Table 13, of the twelve respondents interviewed, the majority of respondents (83.3%; n = 10) said their fire department had integrated their earthquake response plans with the earthquake response plans of the respondent's organization. These respondents were comprised mainly of Local Emergency Managers (60%; n = 6), Provincial Emergency Managers (20%; n = 2) and Health Authority Emergency Managers (20%; n = 2).

Table 13

Fire Department—Integrated Plans

Target group	Yes	No	Total
Provincial Emergency Managers	2	2	4
Health Authority Emergency Managers	2	0	2
Local Emergency Managers	6	0	6
Total	10	2	12

Pre-identified roles and responsibilities. Questions regarding roles and responsibilities were asked of three target groups (n = 13): Health Authority Emergency Managers, Provincial Emergency Managers and Local Emergency Managers. Due to time constraints, Health Authority Program Directors and Hospital Department Managers were not included as a part of this sample. As shown in Figure 15, more than half of respondents (69.2%; n = 9) said the roles and responsibilities of external stakeholders had been identified in the earthquake emergency response plan. These respondents were comprised a majority of

Local Emergency Managers (55.6%; n = 5), Provincial Emergency Managers (22.2%; n = 2), and Health Authority Emergency Managers (22.2%; n = 2).



Figure 15. Pre-identified roles and responsibilities of external stakeholders.

The remainder of respondents said both roles and responsibilities had not been identified (15.4%; n = 2), or they were unsure (15.4%; n = 2) whether the roles and responsibilities had been identified. Respondents who said roles and responsibilities of external stakeholders had not been identified were Provincial Emergency Managers (50%; n = 2), and Local Emergency Managers (50%; n = 2). Respondents who reported not knowing whether the roles and responsibilities were identified in their earthquake response plan were Provincial Emergency Managers (100%; n = 2).

Communicated roles and responsibilities. Respondents were then asked if the identified roles and responsibilities had been communicated. Of the thirteen participants interviewed, a majority of respondents (77%; n = 10) said the roles and responsibilities had been communicated to external organizations. These respondents were comprised of Local

Emergency Managers (50%; n = 5), Provincial Emergency Managers (30%; n = 3), and Health Authority Emergency Managers (20%; n = 2). These results are highlighted in Figure 16.

Communicated Roles and Responsibilities

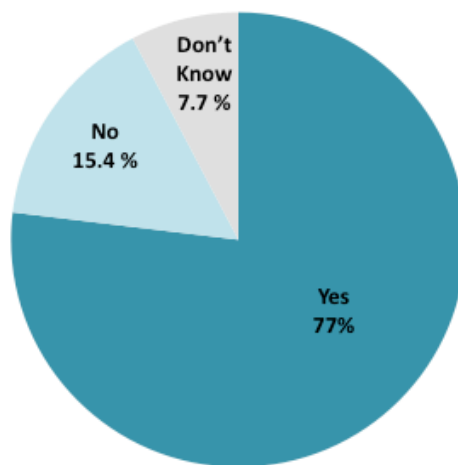


Figure 16. Communicated roles and responsibilities.

Respondents who said roles and responsibilities of external stakeholders had not been communicated, were equally distributed between Provincial Emergency Managers (50%; n = 1) and Local Emergency Managers (50%; n = 1). The one respondent who was unsure (7.7%; n = 1) was a Provincial Emergency Manager.

Earthquake response planning. Questions regarding earthquake response plans were asked of all target groups (n = 24), excluding one Provincial Emergency Manager, and one Health Authority Program Director. The respondents interviewed were asked to identify which of the following areas were addressed by their earthquake response plan: Command

and Authority Channels, Mass Casualty Response Protocols, Public Information and Media Relation Protocols, and Training and Exercising. These results are summarized in Table 14.

Table 14

Areas Addressed by Earthquake Response Plans

Target group	Command & authority channels	Mass casualty response	Public information & media relation	Training & exercises
Provincial Emergency Managers	4	3	4	3
Health Authority Emergency Managers	2	2	2	2
Health Authority Program Directors	5	4	3	7
Hospital Department Managers	4	3	4	0
Local Emergency Managers	6	4	5	5
Total	21	16	18	17

Note. Provincial Emergency Managers ($n = 4$), Health Authority Emergency Managers ($n = 2$), Health Authority Emergency Managers ($n = 7$), Hospital Department Managers ($n = 5$), Local Emergency Managers ($n = 6$).

Command and authority channels. Respondents were asked if Command and Authority Channels had been addressed, meaning the appropriate avenues and personnel for decision-making have been predefined and stated in the earthquake response plan. A majority of respondents (87.5%; $n = 21$) said Command and Authority Channels had been addressed. Respondents who said Command and Authority Channels had not been addressed were either Health Authority Program Directors (66.7%; $n = 2$), or Hospital Department Managers (33.3%; $n = 1$).

Mass casualty response protocols. Mass Casualty Response Protocols outline logistics in terms of supplies, medical resources and operational capacities and assess how

the medical system will cope with the surge of patients generated by a Mass Casualty event. More than half of respondents (66.7%; n = 16) said Mass Casualty Response Protocols had been addressed by their earthquake response plan. A majority of respondents who said Mass Casualty Response Protocols had not been addressed were Health Authority Program Directors (37.5%; n = 3), the remaining respondents were Local Emergency Managers (25%; n = 2), Hospital Department Managers (25%; n = 2) and Provincial Emergency Managers (12.5%; n = 1).

Public information and media relations protocols. A majority of respondents (75%; n = 18) said Public Information & Media Relations Protocols had been addressed by their earthquake response plans. Three quarters of respondents who said their earthquake response plans had not addressed Public Information and Media Relation Protocols were Health Authority Program Directors (75%; n = 3). Respondents who did not know whether their earthquake response plans addressed Public Information and Media Relations Protocols were either Health Authority Program Directors (50%; n = 1), or Hospital Department Managers (50%; n = 1).

Training and exercise protocols. Almost three quarters of respondents (70.9%; n = 17) said Training & Exercise Protocols had been addressed by their earthquake response plan, and the remaining respondents said they had not been addressed (29.2%; n = 7). A majority of respondents who said their earthquake response plans had not addressed Training & Exercise Protocols were Hospital Department Managers (71%; n = 5). The remainder were either Local Emergency Managers (14.2%; n = 1) or Provincial Emergency Managers (14.2%; n = 1).

Activated planning in response to an earthquake. More than three quarters of respondents interviewed (76%; n = 19) said they had never activated their planning in response to an earthquake, while the remainder of respondents (24%; n = 6) reported having activated their planning in response to an earthquake. Respondents who had never activated their planning in response to an earthquake were comprised of Health Authority Program Directors (31.6%; n = 6), Hospital Department Managers (26.3%; n = 5), Local Emergency Managers (22.1%; n = 4), and the remaining were equally Provincial Emergency Managers (10.5%; n = 2) and Health Authority Emergency Managers (10.5%; n = 2). Respondents who had activated their planning in response to an earthquake included Provincial Emergency Managers (50%; n = 3), Health Authority Program Directors (33.3%; n = 2), and Local Emergency Managers (16.7%; n = 1). Figure 17 summarizes the above results.

Activated Earthquake Response Planning

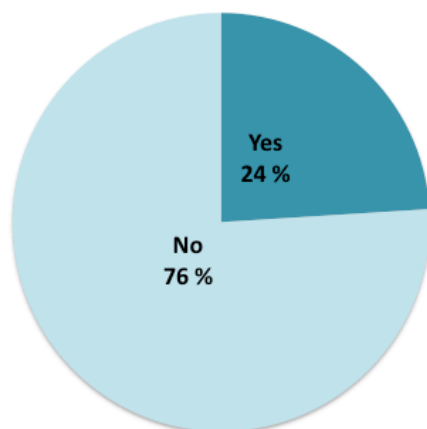


Figure 17. Activated response planning for earthquakes.

Earthquake response plans readily accessible. All respondents were asked if their earthquake response plans were readily accessible, meaning plans could be easily located within all departments or units. The majority of respondents (60%; n = 15) said plans were

readily accessible, and the remaining respondents (36%; n = 9) said earthquake response plans were not readily accessible. One respondent (4%; n = 1) did not know if plans were accessible.

Respondents who said earthquake response plans were not readily accessible were evenly distributed between Provincial Emergency Managers (22.2%; n = 2), Health Authority Emergency Managers (22.2%; n = 2), Local Emergency Managers (22.2%; n = 2), Health Authority Program Directors (22.2%; n = 2) and Hospital Department Managers (11.1%; n = 1). Figure 18 summarizes these results.

Readily Accessible Earthquake Response Plans

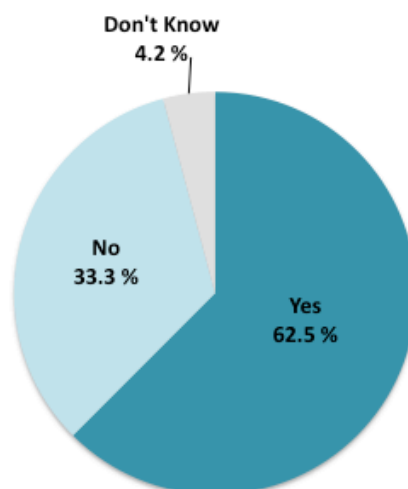


Figure 18. Readily accessible earthquake response plans.

Both respondents in the Health Authority Emergency Management group said earthquake response plans were not readily accessible. Despite this, results were fairly evenly distributed among all target groups.

Implementation. This section of the survey was broken down into two sub- sections. First, questions about the operational components of earthquake response planning for the

hospital site were asked only to Health Authority Emergency Managers (n = 2). Second, questions relating to department and program level preparedness were asked to all hospital level participants (n = 14): Health Authority Emergency Managers, Health Authority Program Directors, and Hospital Department Managers. Due to time constraints, one Health Authority Program Director was excluded from this sample.

Operational components of preparedness—hospital specific. Operational components of earthquake response planning included resource management, communication systems, emergency operations facilities, departmental contingency plans, and evacuation and relocation. Table 15 summarizes the results of the hospital level assessment.

Table 15

Assessment of Operational Components

Component	Yes	No	Don't know	Total
Resource management				
Stockpiles: Generators and fuel	1	1		2
Blood	2			2
Pharmaceuticals	2			2
Water	1	1		2
24-hour vendor contact information	1	1		2
Staff recall policy	1	1		2
Mutual aid assistance	1	1		2
Additional resources	2			2
				Continued

Table 15 (continued)

Component	Yes	No	Don't know	Total
Communication systems				
Alternative systems	2			2
Interagency communication system	2			2
Information dissemination	2			2
Emergency operations centre				
Alternative locations identified	2			2

Access to power, telecommunications	2		2
Contain up-to-date contact information	2		2
Departmental contingency plans			
Nephrology	1	1	2
Cancer treatments	1	1	2
Maternity	1	1	2
Surgery	1	1	2
Intensive care	2		2
Evacuation and relocation			
Evacuation plans	2		2
Evacuation routes	2		2
Evacuation sites identified		1	1

Resource management. Regarding all of the following resources: generators (including fuel), blood, pharmaceuticals and water, respondents were asked if emergency stockpiles existed. For generators (including fuel) and water, one respondent said stockpiles existed, and the second respondent said no stockpiles existed. Both respondents said stockpiles of blood supplies, and pharmaceuticals existed. Overall the respondents disagreed about the presence and nature of resource stockpiles.

Respondents were also asked whether provisions had been made regarding how resources (personnel and equipment) would be managed. Respondents disagreed when asked whether their earthquake response plan included 24-hour contact information for vendors of medical supplies, food etc., whether Mutual Aid Agreements with these suppliers existed and outlined how services would be delivered post event, and whether there was a Staff Recall Policy in place.

Both respondents agreed that if the organization required additional resources (personnel, equipment or medical supplies) certain external support avenues had been pre-established, both locally, and regionally.

Communication systems. There were no discrepancies in the answers provided by respondents with regards to communication systems. Both respondents confirmed alternate communication systems (e.g. mobile phones, 2 way radios and satellite phones) were in place, and that an interagency communication system for communicating with external response agencies existed. They also confirmed that specific protocols and procedures were in place for disseminating information to the following groups: public, hospital visitors, patients, and hospital employees.

Emergency operations facilities. Both respondents confirmed that primary and secondary locations had been pre- arranged for the hospital Emergency Operations Centre (EOC). Also, both respondents said these pre-arranged EOC locations had access to auxiliary power connections, telecommunication equipment, and contained current contact information for people who had roles and responsibilities in the EOC.

Department contingency plans. The results suggest more work is needed pertaining to the awareness of and development of departmental contingency plans. When asked whether departmental contingency plans had been developed to reflect how specific departments would continue to provide critical medical services after an earthquake, the respondents frequently reported conflicting answers. When asked whether contingency plans had been developed for Nephrology, Maternity, and Cancer Clinics, one respondent consistently answered yes, while the other consistently reported not knowing. Again, when asked whether departmental contingency plans had been developed for the Surgery department, one respondent answered no, and the other respondent answered yes. Both respondents said that departmental contingency plans existed for the Intensive Care Unit (ICU). These results

reflect some discrepancies either in communication and/or perception of existing plans and protocols.

Evacuation and relocation. Both respondents said evacuation plans and routes existed, however when asked if relocation sites had been pre-identified in the event the hospital had to be evacuated, one respondent said yes, while the other respondent said no.

Operational components of preparedness—department and program specific.

Questions relating to department and program level preparedness were asked to all hospital level participants (n = 14): Health Authority Emergency Managers, Health Authority Program Directors, and Hospital Department Managers. Due to time constraints, one Health Authority Program Director was excluded from this sample. All respondents interviewed were asked to identify which of the following areas had been addressed by their Earthquake Response Plans: Triage Response Protocols, Volunteer Coordination, Evacuation and Relocation Protocols, Department Level Contingency Protocols, Internal and External Traffic Flow Protocols, and Resource Stockpiles.

Triage response protocols. Of the interviewed respondents, the majority (85.7%; n = 12) said Triage Response Protocols were addressed by their earthquake response plan. These respondents were comprised of Health Authority Program Directors (50%; n = 6), Hospital Department Managers (33.3%; n = 4), and Health Authority Emergency Managers (16.7%; n = 2). One Health Authority Program Director said Triage Response Protocols had not been addressed by earthquake response plans, and one Hospital Department Manager did not know whether they had been addressed. These results are summarized in Table 16.

Table 16

Triage Response Protocols

Target group	Yes	No	Don't know	Total
Health Authority Emergency Managers	2	0	0	2
Health Authority Program Directors	6	1	0	7
Hospital Department Managers	4	0	1	5
Total	12	1	1	14

Volunteer coordination. In the event of a disaster, people with medical skills and previous disaster response experience are necessary to help deal with the surge of patients. There needs to be plans and protocols in place for the coordination and management of such volunteers. Less than half of the respondents (42.9%; n = 6) said Earthquake Response Plans addressed logistics about how volunteers would be coordinated and managed. The remaining respondents said that either it was not addressed (35.7%; n = 5), or that they did not know whether Volunteer Coordination was addressed by their Earthquake Response Plans (21.4%; n = 3). These results are summarized in Table 17.

Table 17

Volunteer Coordination

Target group	Yes	No	Don't know	Total
Health Authority Emergency Managers	2	0	0	2
Health Authority Program Directors	2	4	1	7
Hospital Department Managers	2	1	2	5
Total	6	5	3	14

As illustrated in Table 17, the respondents who said volunteer coordination had been addressed, were evenly split between all target groups: Health Authority Emergency Managers (33.3%; n = 2), Health Authority Program Directors (33.3%; n = 2) and Hospital Department Managers (33.3%; n = 2). A majority of respondents who said earthquake response plans did not address Volunteer Coordination were Hospital Program Directors (80%; n = 4), and the remaining respondent was a Hospital Department Manager (20%; n =

1). Respondents who did not know whether Volunteer Coordination had been addressed included Hospital Department Managers (66.7%; n = 2) and Health Authority Program Directors (33.3%; n = 1).

Evacuation and relocation protocols. As illustrated in Table 18, of the 14 respondents interviewed, half (50%; n = 7) said earthquake response plans addressed Evacuation and Relocation Protocols, and half said they did not (50%; n = 7).

Table 18

Evacuation and Relocation Protocols

Target group	Yes	No	Total
Health Authority Emergency Managers	1	1	2
Health Authority Program Directors	6	1	7
Hospital Department Managers	0	5	5
Total	7	7	14

A majority of respondents who said earthquake response plans addressed Evacuation and Relocation Protocols were Health Authority Program Directors (85.7%; n = 6). In contrast, a majority of respondents who said Earthquake Response Plans did not address Evacuation and Relocation Protocols were Hospital Department Managers (71.4%; n = 5).

Department level contingency protocols. A little more than half of the respondents (57.1%; n = 8) said earthquake response plans included Department Level Contingency Protocols which outlined how each department would continue to provide critical medical services after an earthquake, while five respondents said earthquake response plans did not (35.7%). The remaining respondents (7.1%; n = 1) did not know if Department Level Contingency Protocols had been included. These results are summarized in Table 19.

Table 19

Department Contingency Plans

Target group	Yes	No	Don't know	Total
Health Authority Emergency Managers	2	0	0	2
Health Authority Program Directors	5	2	0	7
Hospital Department Managers	1	3	1	5
Total	8	5	1	14

As illustrated by Table 19, a majority of respondents who said Department Level Contingency Protocols had been addressed were Health Authority Program Directors (62.5%; n = 5), the remaining respondents included Health Authority Emergency Managers (25%; n = 2), and Hospital Department Managers (12.5%; n = 1). In contrast, respondents who said they had not been included in earthquake response plans were comprised of Hospital Department Managers (60%; n = 3) and Health Authority Program Directors (40%; n = 2). The one respondent who was unsure if Department Level Contingency Protocols had been included was a Hospital Department Manager (7.1%; n = 1).

Internal traffic flow protocols. Internal traffic flow refers to the movement of patients and equipment inside the hospital. More than half of the interviewed respondents (64.3%; n = 9) said earthquake response plans addressed Internal Traffic Flow Protocols. The remaining respondents said earthquake response plans did not address Internal Traffic Flow Protocols (28.6%; n = 4), or did not know whether Internal Traffic Flow Protocols had been addressed (7.1%; n = 1). These results are summarized in Table 20.

Table 20

Internal Traffic Flow Protocols

Target group	Yes	No	Don't know	Total
Health Authority Emergency Managers	2	0	0	2
Health Authority Program Directors	3	3	1	7
Hospital Department Managers	4	1	0	5

Total	9	4	1	14
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Respondents who said internal traffic flow protocols were addressed consisted of Hospital Department Managers (44.4%; n = 4), Health Authority Program Directors (33.3%; n = 3), and Health Authority Emergency Managers (22.2%; n = 2). A majority of respondents who said internal traffic flow protocols were not addressed in earthquake response plans were Health Authority Program Directors (75%; n = 3). Based on the results, it appears Hospital Department Managers are more aware of internal traffic protocols compared to Health Authority Program Directors.

External traffic flow protocols. External traffic flow pertains to the movement of traffic outside of the hospital; these plans look at how the surge of patients and visitors to the hospital will be managed from a traffic perspective. Just over half of respondents interviewed (57.1%; n = 8) said earthquake response plans addressed external traffic flow protocols. More than one quarter of respondents (28.6%; n = 4) said earthquake response plans had not addressed external traffic flow protocols, and the remaining respondents did not know whether external traffic flow protocols were addressed (14.3%; n = 2). Table 21 shows that the respondents who said earthquake response plans addressed external traffic flow protocols were comprised of Health Authority Program Directors (37.5%; n = 3), Hospital Department Managers (37.5%; n = 3) and Health Authority Emergency Managers (25%; n = 2). The respondents who said earthquake response plans did not address external traffic flow protocols were evenly split between Health Authority Directors (50%; n = 2), and Hospital Department Managers (50%; n = 2).

Table 21

External Traffic Flow Protocols

Target group	Yes	No	Don't know	Total
Health Authority Emergency Managers	2	0	0	2
Health Authority Program Directors	3	2	2	7
Hospital Department Managers	3	2	0	5
Total	8	4	2	14

Resource stockpiles. A majority of the interviewed respondents (71.4%; n = 10) said earthquake response plans included an inventory of Resource Stockpiles, however more than a quarter of the respondents (28.6%; n = 4) said they were not. These results are summarized in Table 22.

Table 22

Resource Stockpiles

Target group	Yes	No	Total
Health Authority Emergency Managers	2	0	2
Health Authority Program Directors	4	3	7
Hospital Department Managers	4	1	5
Total	10	4	14

Respondents who said an inventory of resource stockpiles were included were comprised of Health Authority Program Directors (40%; n = 4), Hospital Department Managers (40%; n = 4) and Health Authority Emergency Managers (20%; n = 2). Three quarters of respondents (75%; n = 3) who said earthquake response plans did not include an inventory of resource stockpiles were Health Authority Program Directors.

Disaster training and education. Questions pertaining to disaster training and education were asked to all target groups (n = 25): Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department

Managers and Local Emergency Managers. One Health Authority Program Director was excluded due to time constraints.

Seismic preparedness education. A little more than half of respondents (52%; n = 13) said seismic preparedness training and education were provided, while the remaining respondents reported either no training or education were provided (28%; n = 7). The remaining respondents (20%; n = 5) did not know. As summarized in Table 23, respondents who said seismic preparedness training and education were provided were comprised of Provincial Emergency Managers (30.8%; n = 4), Health Authority Program Directors (30.8%; n = 4), Local Emergency Managers (30.8%; n = 4) and a Health Authority Emergency Manager (7.7%; n = 1). Respondents who indicated seismic preparedness training and education were provided included Health Authority Program Directors (28.6%; n = 2), Local Emergency Managers (28.6%; n = 2), Hospital Department Managers (28.6%; n = 2) and Provincial Emergency Manager (14.3%; n = 1). A majority of respondents who did not know whether seismic preparedness training and education were provided were Hospital Department Managers (60%; n = 3). The remaining respondents included a Health Authority Emergency Manager (20%; n = 1), and a Hospital Program Director (20%; n = 1).

Table 23

Seismic Preparedness Education

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	4	1	0	5
Health Authority Emergency Managers	1	0	1	2
Health Authority Program Directors	4	2	1	7
Hospital Department Managers	0	2	3	5
Local Emergency Managers	4	2	0	6
Total	13	7	5	25

Mandatory seismic preparedness training programs. Only one-third of the respondents (32%; n = 8) said it was mandatory to participate in regular seismic preparedness training programs, while the remaining respondents (60%; n = 15) said it was not mandatory, and two respondents did not know (8%). As shown in Table 24, respondents who said it was mandatory to participate in regular seismic preparedness training programs included Health Authority Program Directors (37.5%; n = 3), Provincial Emergency Managers (25%; n = 2), Local Emergency Managers (25%; n = 2), and the remaining respondent was a Hospital Department Manager (12.5%; n = 1).

Table 24
Mandatory Seismic Preparedness Training Programs

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	2	1	2	5
Health Authority Emergency Managers	0	2	0	2
Health Authority Program Directors	3	4	0	7
Hospital Department Managers	1	4	0	5
Local Emergency Managers	2	4	0	6
Total	8	15	2	25

As summarized in Table 24, a majority of respondents who said it was not mandatory to participate in regular seismic preparedness training programs were: Local Emergency Managers (26.7%; n = 4), Health Authority Program Directors (26.7%; n = 4), and Hospital Department Managers (26.7%; n = 4). The remaining respondents were Health Authority Emergency Managers (13.3%; n = 2) and a Provincial Emergency Manager (6.7%; n = 1). Both of the respondents who did not know whether it was mandatory to participate in regular seismic preparedness training programs, were Provincial Emergency Managers (8%; n = 2). It was found that 80% of Hospital Department Managers said it was not mandatory to participate in training programs.

Oriented to roles and responsibilities. More than half of respondents (68%; n = 17) said seismic preparedness training did not include an orientation to earthquake planning and roles and responsibilities, while seven respondents (28%) said seismic preparedness training included the orientation. One respondent did not know whether it was included (4%; n = 1).

The respondents who said seismic preparedness training did not include an orientation to earthquake planning and roles and responsibilities were evenly distributed

among Provincial Emergency Managers (23.5%; n = 4), Health Authority Emergency Managers (23.5%; n = 4), Local Emergency Managers (23.5%; n = 4) and Hospital Department Managers (23.5%; n = 4). The remaining respondent was a Health Authority Emergency Manager (5.9%; n = 1). These results are summarized in Table 25.

Table 25

Oriented to Roles and Responsibilities

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	1	4	0	5
Health Authority Emergency Managers	0	1	1	2
Health Authority Program Directors	3	4	0	7
Hospital Department Managers	1	4	0	5
Local Emergency Managers	2	4	0	6
Total	7	17	1	25

Respondents who said seismic preparedness training did include an orientation to earthquake planning and roles and responsibilities included Health Authority Program Directors (42.9%; n = 3), Local Emergency Managers (22.2%; n = 2) Provincial Emergency Managers (14.3%; n = 1) and Hospital Department Managers (14.3%; n = 1). The one respondent who was not sure if it was included was a Health Authority Emergency Manager. A majority of the following target groups reported that seismic preparedness did not include an orientation to earthquake planning and roles and responsibilities: Provincial Emergency Managers (80%; n = 4) and Hospital Department Managers (75%; n = 4).

Earthquake preparedness workshops. Respondents were asked if workshops focused on earthquake personal preparedness and if current disaster procedures and protocols were provided. More than half of respondents (52%; n = 13) said no workshops or training were provided, while nine respondents said workshops/training were provided (36%). Of the total

sample, three respondents did not know whether their organization provided earthquake preparedness workshops/training (12%).

The respondents who said preparedness workshops/training were provided included Local Emergency Managers (44.4%; n = 4), Provincial Emergency Managers (22.2%; n = 2), Health Authority Emergency Manager (11.1%; n = 1), Health Authority Program Directors (11.1%; n = 1) and a Hospital Department Manager (11.1%; n = 1). These results are summarized in Table 26.

Table 26

Earthquake Preparedness Workshops

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	2	3	0	5
Health Authority Emergency Managers	1	1	0	2
Health Authority Program Directors	1	5	1	7
Hospital Department Managers	1	3	1	5
Health Authority Program Directors	1	5	1	7
Hospital Department Managers	1	3	1	5
Local Emergency Managers	4	1	1	6
Total	9	13	3	25

Respondents who said that ongoing workshops or training were not provided included Health Authority Program Directors (38.5%; n = 5), Hospital Department Managers (23.1%; n = 3), Provincial Emergency Managers (23.1%; n = 3), and the remaining respondents were Health Authority Emergency Managers (7.7%; n = 1), and a Local Emergency Manager (7.7%; n = 1). Respondents who did not know whether ongoing workshops or training were provided were evenly distributed between Health Authority Program Directors (33.3%; n = 1), Hospital Department Managers (33.3%; n = 1) and Local Emergency Managers (33.3%; n = 1).

= 1). A majority of Hospital Department Managers (75%; n = 3) and Health Authority Program Directors (83.3%; n = 5) said that ongoing workshops or training were not provided.

Additional training for key position holders. More than half of respondents (60%; n = 15) said no additional training was provided for key position holders involved in the emergency response. The remaining respondents said either no additional training was provided (36%; n = 9) or did not know (4%; n = 1).

Respondents who said no additional training for key position was provided were comprised of Health Authority Program Directors (33.3%; n = 5), Hospital Department Managers (26.7%; n = 4), Local Emergency Managers (20%; n = 3), Provincial Emergency Managers (13.3%; n = 2) and the remaining respondent was a Health Authority Emergency Manager (6.6%; n = 1). These results are summarized in Table 27.

Table 27

Additional Training for Key Personnel

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	3	2	0	5
Health Authority Emergency Managers	1	1	0	2
Health Authority Program Directors	2	5	0	7
Hospital Department Managers	0	4	1	5
Local Emergency Managers	3	3	0	6
Total	9	15	1	25

Of the nine respondents who said additional training was provided for key position holders involved in the emergency response, three were Provincial Emergency Managers (33.3%), three were Local Emergency Managers (33.3%), two were Health Authority Program Directors (22.2%), and the remaining respondent was a Health Authority Emergency Manager (11.1%). The one respondent that did not know if additional training

was provided was a Hospital Department Manager. Over seventy percent (71.4%; n = 5) of Health Authority Program Directors and 80% of Hospital Department Managers (n = 4) said no additional training was provided to key personnel involved in the response.

Exercises and corrective actions. Exercises and corrective actions include drills, corrective action reviews, multi-jurisdictional exercises for earthquake response, multi-agency exercises for earthquake response, and multi-department hospital exercises for earthquake response.

Earthquake exercise or drill. The vast majority of respondents (88%; n = 22) reported having conducted an earthquake drill or exercise, while three of the 25 had not (3%). Of the 22 participants, a majority (77.2%; n = 17) said the last exercise conducted was The Great British Columbia Shakeout which was held in January, 26, 2011.

Respondents who reported having conducted an earthquake drill or exercise included Health Authority Program Directors (27.2%; n = 6), Local Emergency Managers (27.2%; n = 6), Provincial Emergency Managers (22.7%; n = 5), Hospital Department Managers (13.6%; n = 3) and the remaining two respondents were Health Authority Emergency Managers (9.0%). All of the respondents who reported having never conducted an earthquake drill or exercise were either a Health Authority Program Director (33.3%; n = 1), or Hospital Department Managers (66.6%; n = 2). Table 28 summarizes these results.

Table 28

Conducted an Earthquake Exercise or Drill

Target group	Yes	No	Total
Provincial Emergency Managers	5	0	5
Health Authority Emergency Managers	2	0	2
Health Authority Program Directors	6	1	7
Hospital Department Managers	3	2	5
Local Emergency Managers	6	0	6
Total	22	3	25

Corrective action reviews. Interviewed respondents were asked if Corrective Action Reviews were completed after disaster exercises and drills. Corrective Action Reviews are meant to review processes in place to identify and document strengths, areas of improvement and lessons learned which arise from conducting the exercise.

Almost half of respondents (41%; n = 9) who had conducted an earthquake drill or exercise, said that corrective actions had not been taken. The one respondent who did not know whether corrective actions had been taken was a Provincial Emergency Manager (4.5%). Respondents who said corrective reviews had been undertaken included Local Emergency Managers (41.7%; n = 5), Provincial Emergency Managers (33.3%; n = 4), Health Authority Program Directors (16.7%; n = 2), and Health Authority Emergency Managers (8.3%; n = 1). Table 29 summarizes these results.

Table 29

Corrective Actions Reviews

Target group	Yes	No	Don't know	Total
Provincial Emergency Managers	4	0	1	5
Health Authority Emergency Managers	1	1	0	2
Health Authority Program Directors	2	4	0	6
Hospital Department Managers	0	3	0	3
Local Emergency Managers	5	1	0	6
Total	12	9	1	22

Respondents who said corrective reviews had not been done included Health Authority Program Directors (44.4%; n = 4), Hospital Department Managers (33.3%; n = 3), and the remaining respondents were evenly split between Health Authority Emergency Managers (11.1%; n = 1) and Local Emergency Managers (11.1%; n = 1).

A majority of the Local Emergency Managers said corrective measures had been taken post exercise (83.3%; n = 5). In contrast, all of Hospital Department Managers (100%; n = 3) and more than half (66.7%; n = 4) of Health Authority Program Directors reported that corrective actions had not been taken.

Multi-jurisdictional exercise for earthquake response. Thirteen participants were asked whether their organization had ever conducted a multi-jurisdictional exercise for earthquake response. A majority of respondents (92.3%; n = 12) had never conducted a multi-jurisdictional exercise to deal with earthquake response, and only one Provincial Emergency Manager had conducted a *multi-jurisdictional exercise* (7.7%). Figure 19 summarizes these results.

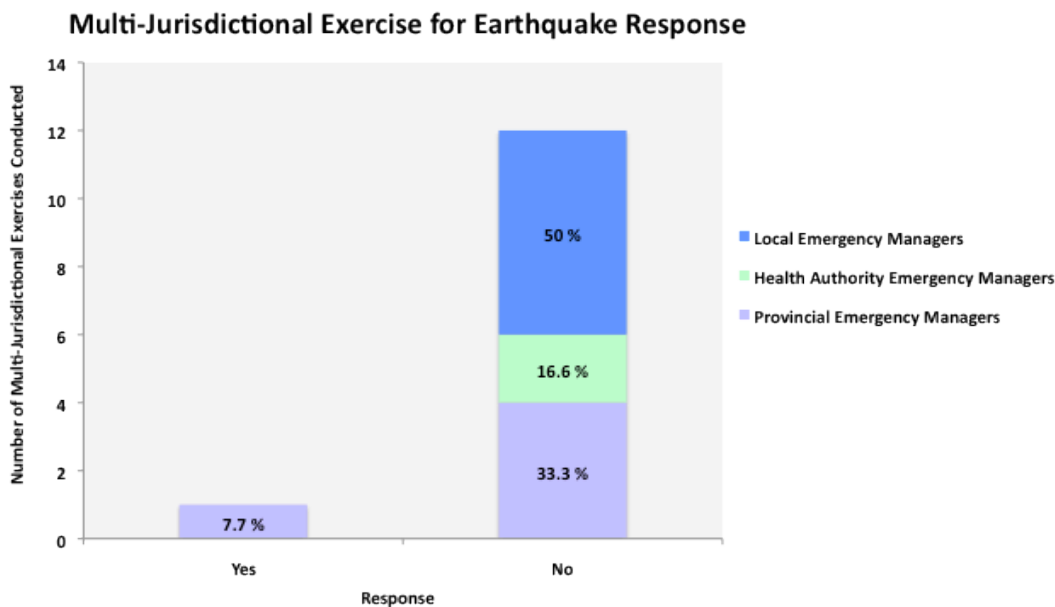


Figure 19. Multi-jurisdictional earthquake response exercise.

As shown in Figure 19, of those who had never conducted a multi-jurisdictional exercise to deal with earthquake response, six were Local Emergency Managers (50%), four were Provincial Emergency Managers (33.3%), and the remaining two respondents were Health Authority Emergency Managers (16.6%). It was found that all Local Emergency Manager (100%; n = 6) and Health Authority Emergency Managers (100%; n = 2) had never conducted a multi-jurisdictional exercise to deal with earthquake response. Similarly, a majority of Provincial Emergency Managers (80%; n = 4) had never either.

Multi-agency exercise for earthquake response. Of the 13 participants interviewed, an equal proportion both had (46.2%) and had not (46.2%) conducted a multi-agency exercise to deal with earthquake response. One Provincial Emergency Manager did not know whether their organization had ever conducted a multi-agency exercise (7.7%). Respondents

who had conducted a multi-agency exercise included Local Emergency Managers (50%; n = 6), Provincial Emergency Managers (33.3%; n = 2) and the remaining respondent was an Health Authority Emergency Manager (16.6%). The breakdown of respondents who reported having never conducted an exercise was exactly the same (see Figure 20).

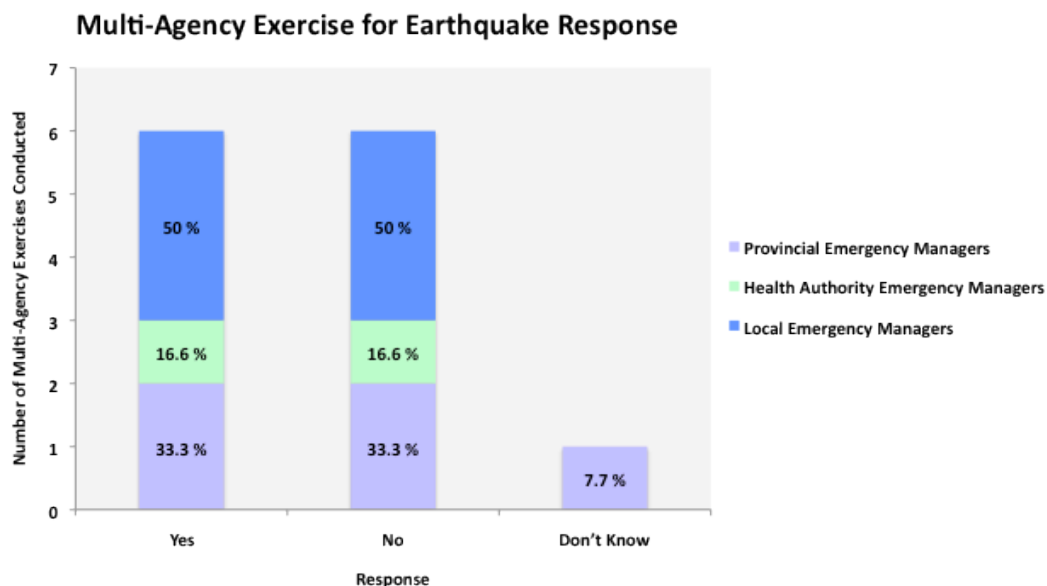


Figure 20. Multi-agency earthquake response exercise.

Multi-department hospital exercise for earthquake response. Fourteen respondents at the Health Authority/ Hospital level were asked if they had ever conducted a multi-departmental exercise in the hospital to deal with earthquake response. A majority of respondents (85.7%; n = 12) said that a multi-departmental exercise had never been conducted in the hospital to deal with earthquake response, and two respondents reported a multi-departmental exercise had been conducted (14.3%).

Both respondents who said a multi-departmental exercise had been conducted were Health Authority Emergency Managers (14.3%). Respondents who said no multi-departmental exercise had been conducted included Health Authority Program Directors (58.3%; n = 7) and Hospital Department Managers (41.6%; n = 5). One hundred percent of Health Authority Program Directors (100%; n = 7) and Hospital Department Managers (100%; n = 5) said their department had never conducted a multi-departmental exercise to deal with earthquake response.

Priority Areas

This section of the survey was asked in two stages. Respondents were first asked to identify challenges and barriers faced by their organization in terms of enhancing disaster preparedness, and then they were asked to identify priority areas for increasing seismic preparedness within their organization, assuming adequate funding and support were available. All five target groups (n = 26): Provincial Emergency Managers, Health Authority Emergency Managers, Health Authority Program Directors, Hospital Department Managers and Local Emergency Managers and were asked these questions.

Challenges and barriers. Respondents reported a variety of challenges and barriers. In order of importance, participants mentioned infrastructure (65%; n = 17), time (50%; n = 13), competing priorities (46.2%; n = 12), apathy and lack of personal preparedness (42.3%; n = 11), lack of resources (human and equipment) (42.3%; n = 11), unclear roles and responsibilities (34.6%; n = 9), poor regional planning (30.8%; n = 8) and funding (23.1%; n = 6) as all barriers to increasing seismic preparedness within their organization. A breakdown of responses based on target groups is presented in Figure 21.

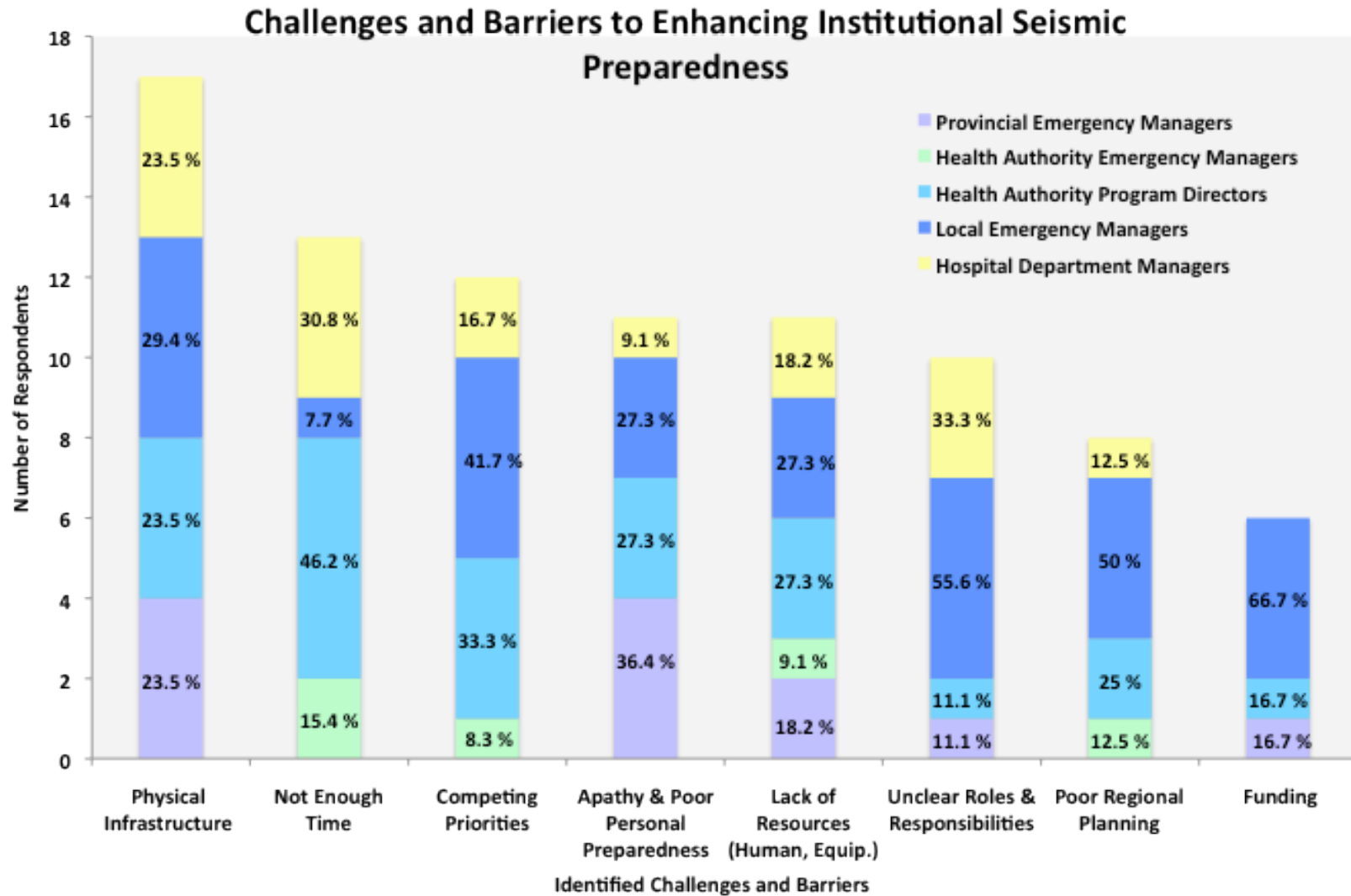


Figure 21. Challenges and barriers to enhancing institutional seismic preparedness.

Infrastructure was identified as a major challenge to increasing seismic preparedness. The responses were relatively evenly distributed across all five-target groups, with almost one quarter of each group saying infrastructure was an issue. These results highlight the increased awareness that the older infrastructure in our targeted region is a major point of weakness in terms of vulnerability.

Half of the respondents interviewed (50%; n = 13) said the lack of time available to dedicate towards seismic preparedness and emergency planning. A majority of these respondents included Health Authority Program Directors (46.2%; n = 6), and Hospital Department Managers (30.8%; n = 4). Three quarters of Health Authority Program Directors and 80% of Hospital Department Managers said lack of time was a barrier.

Almost half of respondents (46.2%; n = 12) said that competing priorities were a major barrier to increasing seismic preparedness within their organization. These respondents were mainly comprised of Local Emergency Managers (41.7%; n = 5), and Health Authority Program Directors (33.3%; n = 4). Eighty three percent of Local Emergency Managers, and half of Health Authority Program Directors said competing priorities were a barrier.

Almost half of respondents (42.3%; n = 11) reported apathy and the poor personal preparedness for the seismic hazard as challenges to increasing seismic preparedness. Of these eleven respondents, four were Provincial Emergency Managers (36.4%), three were Health Authority Program Directors (27.3%), and three were Local Emergency Managers (27.3%). It was found that 80% of Provincial Emergency Managers said apathy was a major barrier.

Of the 11 respondents who said that lack of resources (human and equipment) were a barrier to increasing seismic preparedness within their organization (42.3%), half were either

Local Emergency Managers (27.3%; n = 3), or Health Authority Program Directors (27.3%; n = 3). Half of the Local Emergency Managers said a lack of resources was a barrier.

More than a quarter of respondents (34.6%; n = 9) identified unclear roles and responsibilities as barriers to increasing seismic preparedness within their organization. More than half of these respondents were Local Emergency Managers (55.6%; n = 5), and more than a quarter (33.3%; n = 2) were Hospital Department Managers. Eighty three percent of Local Emergency Managers identified unclear roles and responsibilities as barriers.

Eight of the 26 participants interviewed said poor regional planning and the regional structure in terms of Emergency Management were barriers to increasing seismic preparedness within their organization (30.8%). Of these, half were Local Emergency Managers (50%; n = 4), and one quarter were Health Authority Program Directors (25%).

Lastly, of the six respondents who identified funding as a barrier to increasing seismic preparedness (23.1%) more than half were Local Emergency Managers (66.7%; n = 4). Eighty percent of Local Emergency Managers said poor regional planning was a barrier.

Future directions. All 26 participants were asked to identify priority areas to increase seismic preparedness within their organization. In order of importance, respondents reported disaster preparedness training and exercises (88.5%; n = 23), retrofitting buildings (38.5%; n = 10), more effective disaster plans and protocols (34.6%; n = 9), and better evacuation/relocation protocols (30.8; n = 8) all as priority areas for increasing seismic preparedness within their organizations. A breakdown of responses based on target groups is presented in Figure 22.

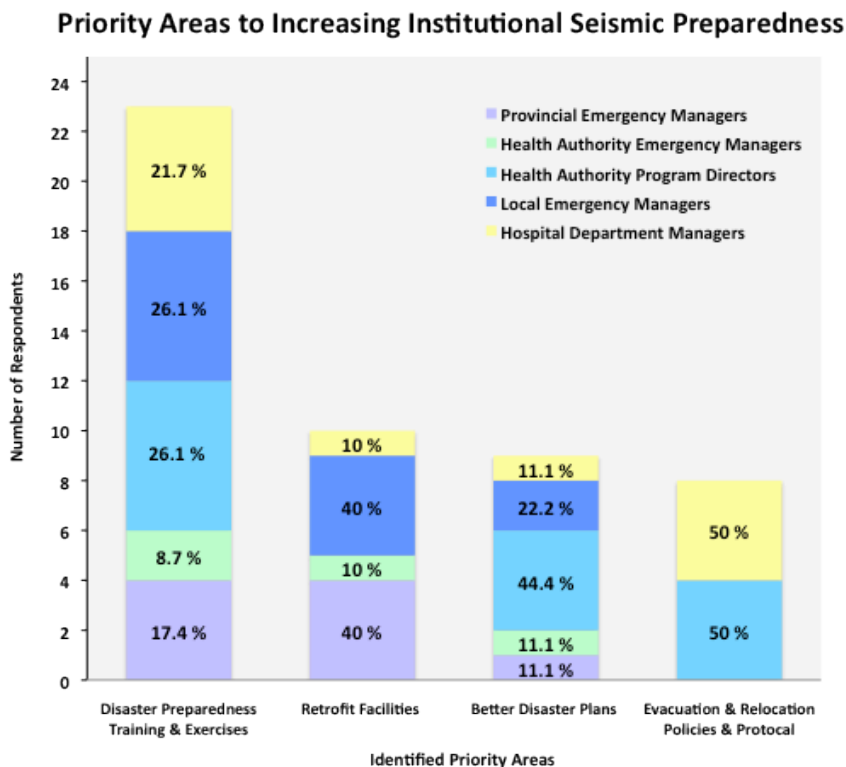


Figure 22. Priority areas for increasing institutional seismic preparedness.

A vast majority of participants (88.5%; $n = 23$) identified disaster preparedness training and exercises as major priority area for their organization. The responses were evenly distributed across target groups. Respondents included Health Authority Program Directors (26.1%; $n = 6$), Local Emergency Managers (26.1%; $n = 6$), Hospital Department Managers (21.7%; $n = 5$), Provincial Emergency Managers (17.4%; $n = 4$), and Health Authority Emergency Managers (8.7%; $n = 2$). The results show an increased awareness and need for Disaster Preparedness Training and Exercises at all levels. Seventy five percent of Hospital Program Directors ($n = 6$), and 100% of all Hospital Department Managers and Local Emergency Managers interviewed said disaster education and training was a priority.

Half of respondents (50%; $n = 13$) said retrofitting infrastructure was a major priority area. Eighty percent of these respondents were either Provincial Emergency Managers (40%;

n = 4) or Local Emergency Managers (40%; n = 4). Sixty six percent of Local Emergency Managers and 100% of Provincial Emergency Managers said retrofitting infrastructure was a priority. These results show the heightened awareness of infrastructure as a priority at the local and provincial levels.

Nine of the 26 respondents (34.6%) said developing more effective site, department and regional disaster plans were key priorities for increasing seismic preparedness within their organization. Almost half of these respondents were Health Authority Program Directors (44.2%; n = 4). The remainder of respondents were: Local Emergency Managers (22.2%; n = 2), a Provincial Emergency Manager (11.1%; n = 1) and a Health Authority Emergency Manager (11.1%; n = 1). Half of the Health Authority Program Directors said this was a priority area.

More than one quarter of respondents (30.8%; n = 8) said a greater focus was needed for evacuation and relocation plans and protocols. Half of these respondents were Health Authority Program Directors (50%; n = 4), and half were Hospital Department Managers (50%; n = 4). Based on these results half of the Health Authority Program Directors (n = 4), and 80% of Hospital Department Managers (n = 4) recognized that evacuation and relocation was a priority. Other priority areas included a better more efficient patient registration system post disaster, contingencies on how to deal with digital image storage in medical imaging, and provisions for cleaning up debris post disaster.

This chapter presented the quantitative results. The following chapter presents the qualitative highlights in a structure that parallels the results presented in this chapter.

Chapter 5: Qualitative Results

The qualitative results presented in this section, parallel the data presented in the previous quantitative results chapter. The purpose of this chapter is to view the data through a more interpretive lens. This first section presents results pertaining to current respondent Emergency Management/Response Education and Experience. The second section presents the results from the Assessment of Preparedness. This section is further broken down into four sub-sections that parallel the main themes in the CSA-Z1600, the Standard for Emergency Management and Business Continuity: 5.2.1) Program Management, 5.2.2) Planning, 5.2.3) Implementation and 5.2.4) Exercises, Evaluations and Corrective Actions. Lastly, section 5.3 will present Priority Areas, more specifically, current barriers and future directions to enhancing institutional seismic preparedness.

Emergency Management Response Education and Experience

Emergency management/preparedness education or training. Key results in this section point to the importance of disaster training and education at all levels. In addition, the results reflect extreme differences in disaster training and education levels. Both Provincial and Local Emergency Managers reported high levels of Emergency Management education and training. In contrast, the majority of Health Authority Program Directors and Department Managers had no Emergency Management education or training. One Hospital Department Manager explained, “I’ve received nothing in terms of disaster training. It’s purely lived experience. I’ve been asking around and have been directed to certain sites to look at, but there has been no formal training through JIBC or VIHA. So I’m basically doing it all on my own.” The respondent went on to explain how the lack of formal disaster education and training was the main reason why many of the hospital departments were not prepared to deal

with an event. Similarly, many Health Authority Program Directors expressed concerns over the lack of formal training and education they had received.

Participated in a disaster response. In this study, three quarters of all respondents had participated in the response to a disaster. Of these, 94.7% of respondents described the event as something other than an earthquake. Events varied by type and spatial extent. On a regional scale, events included the most recent radiation threat resulting from the M9.0 Tohoku Earthquake and Tsunami to the H1N1 Avian Flu Pandemic in 2009. Local events included the TS Sun Sea migrant ship that arrived in Victoria in August of 2009, and the Kelowna, Barrier/McClure Forest Fires in 2003. Overall, none of the events were considered Mass Casualty Incidents (MCI), but were classified instead as minor disturbances. Some respondents also reported having travelled to areas such as Christchurch, New Zealand, and to New Orleans to observe and participate in post-disaster recovery operations. A possible reason why many of the participants have never responded to an earthquake could be because we have experienced very few damaging earthquakes in this region over the past several decades. Only one respondent had responded to an earthquake disaster, and it was a massive earthquake on the island of Vanuatu in the South Pacific.

Further, the majority of Health Authority Program Directors had not participated in a disaster response, whereas almost three quarters of Hospital Department Managers reported having responded to a disaster. This may be because Health Authority Program Directors are more distanced from the acute hospital environment, because their roles focus more on administrative duties and less on the clinical care of patients.

Disaster exercises. When respondents were asked to indicate how many disaster exercises they had participated in, provincial and local level Emergency Managers

participated in more exercises compared with Hospital level respondents. There were also some Health Authority Program Directors, and Hospital Department Managers who had never participated in any type of disaster exercise. Hospital Department Managers said the low frequency of exercises at the hospital level was due to a combination of poor leadership and direction in the past, competing priorities, and the lack of time and financial resources to get the job done. In general terms, participants also reported doing more tabletop exercises and drills, and fewer full-scale exercises. This may be due to the investment of time and money required to facilitate a full-scale exercise.

Assessment of Preparedness

Program management.

Disaster preparedness policy. The majority of Provincial and Local Emergency Managers interviewed said a disaster preparedness policy existed:

We have a policy/bylaw. It was last updated in 2004, but it's due for another update. It's a document that outlines in broad-brush strokes what we are supposed to be doing as an Emergency Management Program, in addition to highlighting the roles and responsibilities of policymakers and government officials.

This increased focus on policy at all levels of government is important and consistent with the national Emergency Management and Business Continuity standards that state, "The entity shall establish a policy that includes a vision, mission statement, roles and responsibilities and enabling authority" (CSA-Z1600, p. 4).

In contrast, discrepancies arose in the answers provided by Health Authority Emergency Managers:

I would say in the past it's been more of an understanding that there was a department responsible for emergency planning. Most of the policies fit within overarching corporate policies. There were no actual policies specific to emergency management. But now we have some policies that we've created within the last year or so, in terms of callouts, exercises, who will staff the emergency operations centre and what their

responsibilities are. One of our goals as a program was to make the policies more specific to what we were doing.

The absence of specific Emergency Management specific policies could hinder the effectiveness of the program. In the past, VIHA's Emergency Management and Business Continuity program has lacked the necessary leadership and expertise. However, much work has been done over the past year to provide a better foundation for the Emergency Management Program in terms of policies and objectives.

Multi-stakeholder advisory committee. Although the majority of participants said a multi-stakeholder advisory group existed, concerns were raised regarding their overall efficiency - especially at the municipal level. Regionally, there are two stakeholder groups. The first is called the Local Government Emergency Planning Commission (LGEPC), and the second is the Regional Emergency Coordinators Advisory Group (RECAC). LGEPC is a working group comprised of all thirteen municipal Emergency Managers and focuses on local scale planning. RECAC focuses more on bringing together regional stakeholders who have a role in emergency management; for example agencies such as BC Hydro and the Department of National Defence. When asked about the regional groups, one Local Emergency Manager replied:

They are not very effective; by not effective I mean they have infrequent meetings. The dysfunctions that have occurred at RECAC specifically have impeded any regional progress. I think most people that are part of it would recognize that it's not anywhere near its full potential.

Another Local Emergency Manager explained,

There are local and regional political barriers that don't allow us the opportunity to enhance the planning process. We need to knock those barriers down. By barriers, I refer to the maintenance of the existing autonomies of each municipality or regional government.

Another Local Emergency Manager elaborated:

One of the big challenges is you have 13 municipalities and everyone is doing their own thing, and everybody's is competing for the same dollar. We can't even sit 13 municipalities at a table and decide how to write a disaster mutual aid agreement. When we look at regional and local planning, the politics come into play and you lose sight of the real issue fast. The politics are unbelievable in this region; you cannot get anything done around here.

Based on the respondents' comments, it is imperative that more work be done in terms of increasing the efficiency of both regional and local planning groups. It is important that regional and local groups come together and focus on the common goal—increasing the combined resilience of our communities. This will only be achieved with open communication, cooperation and unbiased facilitation.

There was less concern regarding the provincial level stakeholder committees. One Provincial Emergency Manager explained:

Our key stakeholder group is our Health Emergency Management (HEM) Council. This working group is comprised of all provincial health authority leads and emergency management leads from BC Ambulance to British Columbia Centre for Disease Control (BCCDC) and more. The Ministry chairs this group, and provides overall leadership. The HEM Council is responsible for setting the policy direction and priorities for the provincial Health Emergency Management program.

Another Provincial Emergency Manager described the HEM Council as being “a steering committee that works towards ensuring standards across the province.” However, “It doesn't always happen. Health authorities are their own entities, they do what they want, but the main goal is to try and standardize the planning process within the health care sector.”

The above comment reflects a potential disconnect between the Ministry of Health and regional Health Authorities. Many would assume that the Ministry of Health would have more control over the Health Authorities. However, this respondent described the relationship to be more distant.

The need for a bridging multi-stakeholder authority is crucial for ensuring a coordinated health system response. Franco et al. (2006) interviewed persons involved with

the medical response to Hurricane Katrina to identify possible reasons for the collapse of the healthcare system during this event. One reason for the collapse was the absence of a regional health system group or authority. The article concluded the surge of patients, combined with the destruction and devastation caused by the hurricane, surpassed the ability of any individual hospital to prepare for, or cope with the event (Franco et al., 2006). The study confirmed the need to coordinate hospital emergency planning and response activities, and highlighted this domain as a major deficiency in the local emergency planning. The development of these partnerships between agencies and organizations at all levels allows for knowledge, skills, and resources to be utilised efficiently and in a coordinated fashion (Paturas et al., 2010).

Significant efforts have been put forth over the past year by VIHA's Emergency Management and Business Continuity program to engage health stakeholders in the planning process for their emergency plans. When asked about multi-stakeholder input, one Health Authority Emergency Manager confirmed, "We have multiple stakeholders and we have a wide stakeholder input. I can't bring everyone together in to one working group, so I have a working group for each program and unit. At every level people are engaged."

Emergency management program goals and objectives. All of the Provincial and Local Emergency Managers interviewed said their emergency management program had specific goals and objectives. Based on these results, both levels of government are in compliance with national standards as outlined by the CSA-Z1600 which states that Emergency Management Programs should have formal written goals and objectives. Through the legislation of the Emergency Management Act, the government not only increases

accountability, but also ensures compliance with national standards. Legislation is the one way to increase compliance with such standards.

In contrast, both Health Authority Emergency Managers reported having no formal written goals and objectives. One Health Authority Emergency Manager explained the reason for this was that in the past the Emergency Management and Business Continuity department had goals and objectives that were embedded within the overarching VIHA corporate priorities of improving healthcare for high need populations, services for seniors, sustainable healthcare networks, and high quality and safe health care (Vancouver Island Health Authority (VIHA) Five- Year Strategic Plan (2008-2013)). However over the past year, the department has recognized a disconnect between corporate priorities and specific goals and objectives for the Emergency Management and Business Continuity Program. The team also recognized the need for developing specific goals and objectives, which relates to Emergency Management and the health system response. One Health Authority Emergency Manager explained, “We have them (goals) in our heads, and we are working towards it, but we don’t have it formally written down.” Many of the Hospital Department Managers mentioned the lack of leadership and direction received from the department in the past; this lack of direction could be attributed to the absence of formal written goals and objectives. That being said, over the past year, many hospital level participants have commented on how much effort the new team of individuals working at VIHA’s Emergency Management Branch has put in to increasing the efficiency of the program.

Percentage of emergency management program goals and objectives funded.

Although subjective, the majority of Provincial and Local Emergency Managers reported having a high percentage of their performance goals funded. One Local Emergency Manager

explained, “The only granting I get is through the JEPP grants (Joint Emergency Preparedness Program). It's a federal government grant that supports emergency management initiatives such as plan development, exercising and training. It's probably 10% of my budget, the rest of it is covered by the municipality.” Monetary support is only part of the commitment needed. Still, one Provincial Emergency Manager said:

Funding is more than monetary funding. In government, executive support can sometimes be far and above monetary funding. If you don't have support from the Executive, your project will suffer. I would say that all the projects are funded, but some of them have greater support than others because they have greater levels of ‘buy in’, and as a result, they are pushed a lot harder through government and they receive a lot more recognition.

In contrast, both Health Authority Emergency Managers perceived funding levels to be much lower. These results may highlight differences in access to potential funding between government organizations and private agencies such as VIHA. It is well known that in response to the current financial crisis facing the provincial healthcare system, in the past the government has looked specifically to hospitals to help reduce budget deficits. Health care cutbacks, combined with shortages in healthcare support staff, medical equipment and resources eventually compound and compromise patient care. Many Hospital Department Managers and Health Authority Program Directors expressed their frustrations for not having the time or money to increase preparedness within their departments.

Although very meaningful, the validity of these results could be questioned. The results are based on the respondents’ perceptions of funding received, not on actual funding received. However, it is apparent there are extreme differences in perceptions of funding at both government and hospital levels.

Evaluation of emergency management program. When respondents were asked how often an evaluation of the Emergency Management Program was conducted, the most

common response was annually. It was noticed that Provincial Emergency Managers were more likely to do a regular review compared to Local Emergency Managers. One Provincial Emergency Manager said:

We are constantly reviewing our program through our monthly teleconferences, and our face-to-face meetings. The whole point of the monthly meeting is for us to review the projects we've identified as our priorities by assessing where we are at with those projects, by identify existing issues and challenges, and addressing them. So there is always an ongoing review process. But when we talk about specific events such as the H1N1 Pandemic or the 2011 Japan Radiation Threat, we always do this after the action review which helps us recap everything we did, how it all went and where we need to make improvements for next time.

The study also found that half of the Local Emergency Managers reported no review process in place. One Local Emergency Manager said the reason there was no review process was because it simply was not a priority of the municipal leadership of the time. The participant went on to explain how priorities of local government change along with changes in leadership, which ultimately dictates how they function as a program.

Planning.

Earthquake hazard awareness. As expected, all 26 participants interviewed included earthquake hazards in their top three list. The validity of this result may be questioned, since participants were informed at the start of the interview that this research project was focused on earthquake preparedness in Victoria. One of the respondents said, “Earthquake is the one that scares the hell out of us, because it can really damage the infrastructure badly. Earthquakes are low probability, but high consequence.” Earthquakes are a common focus at the provincial level. Events such as The Great British Columbia Shakeout, which was held twice in 2011, emphasize a commitment at the provincial level to increasing disaster awareness and preparedness.

The second most common reported hazard was extreme weather events. This increased awareness may be due to the many weather events experienced in the region in the recent past; events which not only caused significant amounts of damage and chaos, but also received a considerable amount of media coverage.

Earthquake risk perception. Participants were asked to use a Likert scale of 1–10 (1 = low and 10 = high) to rate the level of risk our region faced to a damaging earthquake. For the sake of this discussion, a 1-3 rating was considered to be low earthquake risk, a 4–7 rating was medium earthquake risk, and an 8-10 rating was high risk. A total of 61.5% of people interviewed rated the level of earthquake risk to be high, and the remaining 38.4% of respondents rated the risk medium. A common sentiment among all respondents was ‘It’s not a matter of if, but when.’ One Local Emergency Manager explained:

Using the example of Christchurch I would suggest we would have fairly similar damage from an earthquake here. We wouldn’t have the scale of liquefaction, but we have lots of loose soils and the same variable low, soft story housing, and our downtown is equally vulnerable. We have a lot of older brick buildings and a lot of 60’s-70’s built steel concrete. We would definitely have some pretty major impacts with a large earthquake.

One Provincial Emergency Manager said, “The reality is that all the unreinforced masonry will struggle, even in a not so damaging earthquake. If it’s strong enough it will rupture water and sewer systems, even if our buildings don’t crumble, there will be a lot of unhappy displaced people”. The results show a heightened awareness of the earthquake hazard among the research participants. There are many reasons for this heightened awareness. First, events like The Great British Columbia Shakeout, a multi-jurisdictional, multi-agency event organized by the province was intended to increase the awareness of the seismic hazard, while emphasizing the importance of earthquake preparedness. Second, an

increased occurrence in large earthquakes over the past year around the globe, have influenced how the earthquake hazard is perceived in our area.

Perception of hospital earthquake preparedness. Participants were asked to use a Likert scale of 1-10 (1 = low and 10-high), to rate their perceptions of how prepared they thought the two hospitals in this region were to deal with a damaging earthquake. Again, for the sake of this discussion, a 1-3 rating was low earthquake preparedness levels, 4-7 rating was considered medium earthquake preparedness levels, and 8-10 rating was high. A total of 73% of participants felt the hospitals were in the medium range of preparedness to deal with a damaging earthquake. All the Provincial Emergency Managers rated hospital preparedness levels within the medium range. One Provincial Emergency Manager said, “First of all, having a new hospital (RJH) is good. This is only the new Patient Care Centre (PCC), not the whole hospital. Completed in March 2011, it was the largest capital project in Vancouver Island history. I give the Ministry of Health and the Vancouver Island Health Authority credit, they take earthquake preparedness very seriously, and they have been doing a very good job.” Another Provincial Emergency Manager said, “I am 100% confident that they will do very well, because they have an amazing staff that really promotes education throughout the Health Authority. From an emergency management perspective, the response will be amazing I have no doubt in my mind.” At the Local Emergency Manager level, there were some concerns regarding how prepared the Health Authority was to respond to a damaging earthquake. One Local Emergency Manager explained:

I'd say hospital preparedness levels are low. I base my comment on the fact that we haven't met or done any collaborative planning with the hospitals. My sense is if they haven't met with their stakeholders and community partners and they are not meeting with the people that are going to help with the response component, that tells me they are not very prepared for it. We ourselves don't have the staff or the resources. It's going to be a huge mess.”

Another Local Emergency Manager commented:

It's improving all the time. I know that the hospitals are currently lacking in surge capacity, given that they are usually running at 100% of their capacity on any given day. So that's a big challenge in their planning. But put simply, I think they are improving all the time, and it's really great to see. Their buildings are being improved, so that will reduce their vulnerability and their planning has improved, so I think that also is reducing their vulnerability. Having said that, I still think they are going to be adversely impacted by a damaging earthquake.

One Health Authority Emergency Manager further explained:

It's not so much that we are under prepared, it's more to do with our infrastructure. Even though we are making plans, encouraging personal preparedness, and we are looking at alternative sites, we still can't mitigate within a rapid time frame, we can't do anything about our aging facilities at this point in time. It doesn't mean that within the strategic plan there is not a plan for replacing the facilities, but it's over decades.

One Health Authority Program Director explained how the focus over the years has been "to improve the seismic resistance of the most critical buildings. Our major concerns are patient care areas, diagnostic and treatment buildings and the powerhouse and power substation. We focus especially on those buildings that are necessary to maintain service." In contrast, one Hospital Department Manager commented, "I think we are more prepared in the last two years than we were before. I think as a city we are not prepared. I think there is more awareness than before, but to say we are 100% ready, I doubt it." Although not a major finding in this study, the literature suggests a large discrepancy exists in the perception of readiness between hospital administrators and acute hospital workers. However, the results for this study showed that the majority of Health Authority Program Directors and Hospital Department Managers reported preparedness levels to be medium.

Community linkages.

Local government. One quarter of respondents interviewed said that Local Government was not engaged in the planning process for the earthquake response plan, and more than one quarter of respondents said Local Government had not integrated and

coordinated their respective earthquake response plans. More than half of the respondents who said Local Government was not engaged in the planning were Provincial Emergency Managers, and half of the Provincial Emergency Managers also reported that Local Governments had not integrated their plans with provincial level earthquake response plans. These results highlight a substantial disconnect between local and provincial governments in terms of regional planning for earthquakes. Eighty-three percent of Local Emergency Managers said the Local Government was engaged in the planning process, and had also integrated earthquake response plans. These positive trends maybe a result of the work done through the Local Government Emergency Managers working group. It should be noted that 100% of the Health Authority Emergency Managers said local governments were engaged in the planning process for their earthquake response plan, however only 50% of Health Authority Emergency Managers said local governments had integrated and coordinated their plans with the Health Authority. When asked whether local governments had contacted the Health Authority to integrate plans, one Health Authority Emergency Manager commented, “Not that I’m aware of. We do everything in isolation so far.” The role of local government is to develop and maintain an Emergency Management Program that works with various departments within the government, and with private sector organizations to develop emergency plans and identify local resource and support capabilities (McLoughlin, 1985). To do this, local governments must be engaged in the planning process.

BCAS. A majority of the sample made up of Provincial Emergency Managers and Health Authority Emergency Managers said that BCAS was engaged in the planning process for their earthquake response plans, and had integrated their plans with the province and Health Authority. This may reflect the excellent work being done at the provincial and

Health Authority levels through the Health Emergency Managers Council, the regional working body for the health sector. On the other hand, thirty-three percent of Local Emergency Managers said BCAS was not engaged in the planning process for their earthquake emergency plans, nor had they integrated their response plans. One Local Emergency Manager commented “BCAS has been at the table in the past, but they haven’t been there in the last couple of years. As of recently, they have been tough to work with because of labour strikes.” Another Local Emergency Manager commented, “We have not seen their plan, but they have done some work with us in the past to make sure we are all on the same page.” Both respondents mentioned that BCAS had reached out recently to re-engage in talks on emergency preparedness.

NGOs. The quantitative results indicated a low level of engagement with NGOs such as the Red Cross, and St. John Ambulance in the planning process for their earthquake response plans by all target groups. Fifty percent of each target group reported that NGOs were not involved in the respondents’ planning process. The same results were found when participants were asked whether NGOs had integrated their plans with the plans of the respondents’ organization; fifty percent of each target group reported that NGOs had not integrated their earthquake response plans. One Local Emergency Manager said, “It’s such a cyclic thing that focuses on changes in leadership and priorities on their end.” Another Local Emergency Manager added, “We do discuss earthquake response with Red Cross and Salvation Army however, it’s all through informal conversations.” The results highlight the importance of having a formal process for engaging with NGO stakeholders.

Hospitals. Sixty percent of the participants said hospitals were not engaged in the planning process for their earthquake response plans. More than 50% of these participants

were Local Emergency Managers. One Local Emergency Manager commented, “We recognize there's a severe lack of stakeholder planning, especially at the local level. The lack of planning creates unrealistic expectations ... the lack of planning with hospitals, that's why we are where we are today.” Another Local Emergency Manager commented, “We've had very little planning with hospitals. There have been conversations, particularly in the last year, about how to deal with vulnerable populations: the homeless, senior citizens, etc., and some questions about that have been asked back and forth, but again those are really informal conversations; we are not where we need to be.”

From a hospital preparedness perspective, having representation from each key stakeholder in the community planning process is essential to establishing good linkages (Braun et al., 2006). The opposite situation was evident when respondents were asked if hospitals had integrated their earthquake response plans with those of the respondents' organization. Seventy-five percent of Local Emergency Managers, and fifty percent of Provincial Emergency Managers said yes. This may be a direct result of the hard work done by VIHA's Emergency Management and Business Continuity Branch, the department responsible for the Health Authorities Emergency Management response and planning over the last year. When discussing engagement with hospitals, one Local Emergency Manager said, “Within this region, you have dozens of emergency response plans, so every time someone is writing a plan or changing the plan, to have a fully consultative process with everyone involved is not possible.” However, having a fully inclusive consultative process is important. Research suggests confusion over roles and responsibilities, poor communication and poor multi-stakeholder planning, and a lack of hospital integration into the community

disaster planning are major problems areas in terms of hospital preparedness (Kaji & Lewis, 2006). Engaging all stakeholders and integrating plans is one way to avoid such problems.

Fifty percent of Provincial Emergency Managers said hospitals were not engaged in the planning process of provincial earthquake response plans, and 50% said hospitals had not integrated their response plans with the provincial plans. These results show an apparent disconnect between the hospitals and Provincial Level Emergency Managers. When asked to expand on the relationship between the province and the Health Authority, one Provincial Emergency Manager commented,

We often look a lot to the health authority. We are not as close as most think. On a scale of 1 to 10 of knowing what the Health Authority is doing and in terms of accountability, I'd say it's about a 6 or 7. The health authorities really are independent entities they have their own CEO. The connection with the province is they get funding from us to do what they need to do. Most of our relationship is based through HEM Council. We give them money as a unit out of our budget we do provide the health authorities with quite a bit of money. We also provide the Justice Institute with money for training and development. But there really isn't any report back on it. At least at this moment whether this changes in the future I don't know. The health authority supports the hospital and we support the Health Authority.

It is crucial for hospitals to include external stakeholders in the planning process for emergency response plans, and for them to integrate response plans. The citation above highlights the importance of communication and accountability. The literature suggests that without proper communication and engagement, the creation of unrealistic expectations and assumptions are unavoidable. For example, many community disaster plans identify hospitals as the principal providers of immediate medical care after a catastrophic event (Schultz et al., 1996). This may seem like a reasonable expectation, however based on the damage and disruption caused by earthquakes, hospitals may be functioning in less than optimal conditions. For this reason, it is crucial for all stakeholders to communicate their capabilities, a process which will avoid the creation of unrealistic expectations and clarify roles and

responsibilities. Hospitals need to work closely with external stakeholders within the community to develop contingency plans before a disastrous event takes place, to ensure an integrated and coordinated post disaster response.

Fire department. Out of all the stakeholder groups included in this section, the Fire Department exhibited the most positive response. One hundred percent of Local Emergency Managers and Health Authority Emergency Managers interviewed said fire departments were not only engaged in the planning process of their earthquake response plans, but that the fire departments had integrated their earthquake response plans with each respective organization. The reliability of these results may be over exaggerated because many of the Local Emergency Managers work out of Fire Departments; some of Local Emergency Managers are also Deputy Fire Chiefs and firefighters.

Many of the Local Emergency Managers mentioned how the relationship between Local Emergency Management and the Fire Department was another issue altogether. One Local Emergency Manager/Deputy Fire Chief explained,

There are so many things thrown on the fire department. It's overwhelming. I'm thankful to my council because they actually recognize the need to have a paid person to deal with this - but he's overwhelmed. This is a two or three person position or job at best. It's hard to sell. We talked to our training officer about introducing this stuff to our fireman. He says I don't have enough hours in a year to train them on stuff they need to know, now you expect me to throw this on them. Emergency Management and fire got lumped together because someone said emergency, well the fire department does that stuff, give it to the fire department. They should be 2 completely different entities; they can't fall under the umbrella of one person. The notion of having the Deputy Fire Chief as the Local Emergency Manager is like having a plumber the electrician. Doesn't work. Do one and do it well. I can't do both.

Another Local Emergency Manager/Fire Chief talked about how he was unsure if in the event of a disaster his priority would be managing the Fire Department, or coordinating the Local level emergency response. These opinions reinforce the need for increased Emergency Management funding and planning at all levels.

Pre-identified roles and responsibilities. Almost 70% of respondents said their earthquake response plan identified the roles and responsibilities of external support organizations after an earthquake. Thirty percent of the respondents either said they had not identified the roles and responsibilities, or did not know if the roles and responsibilities had been identified.

By not clearly identifying their roles and responsibilities, all stakeholders remain unclear of each other's responsibilities, capacities and resources. Unidentified roles and responsibilities also lead to unrealistic expectations between stakeholders and various levels of government. It was also found that 83% of Local Emergency Managers had identified roles and responsibilities of external support organizations after an earthquake. One hundred percent of Health Authority Managers reported having identified the roles and responsibilities of external stakeholders. Pre-established relationships and pre-identified roles and responsibilities between hospitals and health service agencies, and other community response entities such as fire, law enforcement, and local government will increase the likelihood of an integrated and effective response during a large-scale emergency (Kaji & Lewis, 2006).

Communicated roles and responsibilities. Forty percent of Provincial Emergency Managers said the roles and responsibilities of external stakeholders had not been communicated. One Provincial Emergency Manager said "With the work that has been done I would say yes they have been communicated, but I think there has been limited work there. After being in Christchurch, and hearing about New Orleans, I think there is much more work to do there. The majority of Provincial Emergency Managers agreed that roles and responsibilities needed to be more definitively communicated.

A majority of the Local Emergency Managers and Health Authority Emergency Managers said the roles and responsibilities of external stakeholders had been communicated. However, one Local Emergency Manager said, “We found this out last week that VIHA had an expectation that we would be there for them after the earthquake. I told them flat out no we're not. We don't even have the staff or resources to deal with the level of damage and devastation we will see within our own municipality let alone to bail the hospitals out.” These results highlight the presence of unrealistic expectations and assumptions. Communicating such expectations is important. The literature states that hospitals that establish networks and effectively communicate the roles and responsibilities within those networks, promote interaction between essential personnel and available community resources, inevitably enhancing surge capacity (Braun et al., 2006).

An effective post disaster response should be based on a pre-designed contingency plan which clearly lays out the specific responsibilities, both internally within the health sector, and externally with community stakeholders, at both the local and provincial levels (Adini et al., 2006). Preparedness planning requires a cooperative effort by hospitals, community, and government officials to devise a comprehensive strategy to meet the needs created by major property damage and disruption of services (Waeckerle, 1991). A study done by Franco et al. (2006) interviewed individuals who were involved in the medical response for Hurricane Katrina. One key finding was that the federal, state and local disaster plans did not include strategies and provisions to help keep hospitals functioning during a large-scale emergency such as Hurricane Katrina (Franco et al., 2006). These findings echo the importance of integrated disaster and emergency planning.

Earthquake response planning.

Command and authority channels. The majority of participants (87.5%) said their earthquake response plans addressed Command and Authority Channels. As previously mentioned, Command and Authority refers to having the appropriate avenues and personnel for decision-making predefined and stated in the plan. There was a strong awareness of Command and Authority Channels at the management level. One Local Emergency Manager said,

There are well defined communications plans that fall under the British Columbia Emergency Response Management System (BCERMS), it presents a hierarchical, command structure for all emergencies and all incidents province wide. BCERMS is a comprehensive management system based on the Incident Command System (ICS).

All of the respondents reported using BCERMS as their main organizational framework for emergency response. These results highlight the success of BCERMS in standardizing and identifying Command and Authority Channels at all levels.

Mass casualty (MC) response protocol. More than one quarter of participants interviewed said that earthquake response plans did not address Mass Casualty Response Protocols. Many of the Local Emergency Managers interviewed said their earthquake response plans did not address these protocols. They also anticipated that BCAS and the Health Authority would be taking the lead on a Mass Casualty Response from a regional perspective. One Local Emergency Manager explained:

We have no plan. Mass casualty is under the responsibility of BC Ambulance, and I believe they have a mass casualty plan. We have firm expectations of BC Ambulance, but we are realistic, there are 11 ambulances for 350,000 people. The chances of getting an ambulance after that earthquake strikes will be nil. I hope the Health Authority has sat down with BCAS and figured out what the roles of ambulances will be – to bring people to the hospitals, or to move and transfer them across the island assuming transportation networks are intact.

Another Local Emergency Manager added,

We would likely look to the health authority to be the main agency to respond. We would of course assist in any way possible but for mass casualty events there would be different levels of involvement. It's addressed in our plans to the extent that we have identified that the certain recreation centres within our municipality could be potentially utilized as temporary morgue. But we would not anticipate being the lead from a response perspective.

Both Health Authority Emergency Managers said Mass Casualty Response Protocols were addressed in their earthquake planning. However, one quarter of Hospital Department Managers and three quarters of Health Authority Program Directors said Mass Casualty Response Protocols were not addressed as a part of their earthquake planning. When asked about this, one Hospital Department Manager commented, "I think it probably is addressed, but I don't think we really know what our role would be in it." Another added, "Basically again, everything will come through me – that's the plan." These discrepancies highlight issues between Health Authority Administration and Hospital Program Directors and Hospital Department Managers when it comes to knowledge of the existing plan and planning activities.

Public information and media relations protocol. Although three quarters of respondents said their earthquake response plans had addressed Public Information and Media Relation Protocols, many Local Emergency Managers expressed expectations that the province would take the lead on Public Information and Media Relation Protocols. One Local Emergency Manager explained:

It's going to be a regional event, and that's why this public information has to come through the province. Right now the regional conduit CFAX radio, that's the plan, phone CFAX they'll tell everyone what's going on. It's very loose. That's where the challenges are going to be, and that's where a lot of people are expecting the province to manage the information flow for the public. We have a 100% expectation for the province to organize the public information -they have to. In a large event it's their responsibility, it's going to be completely overwhelming for local jurisdictions to try and manage the issues.

More than half of the Health Authority Program Directors (57.1%) said Public Information & Media Relations Protocol was not addressed by their earthquake response plan. Many of the Health Authority Program Directors expressed having expectations that the Health Authority would be responsible for Public Information & Media Relations. In some instances this is a fair expectation, especially with the corporate structure used by VIHA. However having said that, protocols and procedures need to be in place to enable the transfer of information and knowledge from the acute hospital environment up to the Health Authority Administration. One Health Authority Program Director commented, “All the communication would be through VIHA communications. My responsibility and our program’s responsibility is simply to care for the patients. We don’t get involved in the public information and political stuff.”

In terms of Public Information and Media Relation Protocols, it seems that there are a lot of expectations at all levels. Local Emergency Managers have an expectation of the Province, and Hospital staff have an expectation of the Health Authority. This emphasizes the need for all emergency protocols and procedures to be discussed at all levels, in order to create meaningful and realistic expectations through concrete planning.

Training and exercise protocols. One hundred percent of the Health Authority Emergency Managers and Program Directors said that Training & Exercise Protocols had been addressed by their earthquake response plans. In contrast, all of the Hospital Department Managers said Training & Exercise Protocols were not addressed. One Hospital Department Manager commented:

Once I have a plan, then I’ll put together some exercises that will involve all players – but at the moment, I don’t have a plan for Training & Exercise Protocols. Believe it or not, we are really in our infancy in planning for this event. There is a huge

expectation on us, not only from our patients, from the province, but also from the public – that the hospitals have plans to deal with it all.

Once again, this highlights a disconnect between upper management and Hospital Department Managers. It is crucial that Hospital Department Managers and acute care staff have the appropriate training and staff to deal with a disaster, because they are the ones who will be dealing with the initial surge of patients.

Activated planning in response to an earthquake. More than three quarters of interviewed respondents had never activated their planning in response to an earthquake. Half of the participants who said they had activated their earthquake response plans were either Provincial or Local Emergency Managers, and these actions were not full activation of the plans. One Local Emergency Manager said, “On February 28, 2001, we began to activate our response plans in relation to the Nisqually Earthquake in Seattle. We immediately assessed what was happening in the community, and we quickly learned that we didn't have a lot of impact.” Another Provincial Emergency Manager described his experience:

It's been predominantly response focused, so far it's been events like the Nisqually earthquake, or the threat of a tsunami hitting the coast of British Columbia resulting from the earthquake in Japan. In both cases our Emergency Operation Centres were fully activated, and staffed. There was a lot of situational awareness gathering and reporting. There was a heavy focus on the communications side of things, mainly for the media and public.

None of the events described by participants who had activated their planning caused any damage in the region, and the activation of earthquake response plans focused more on taking the necessary precautions and initiating communication systems and situational awareness protocols and procedures.

None of the interviewed Health Authority Emergency Managers or the Hospital Department Managers had ever activated their planning in response to an earthquake. This may be because we have not experienced any significant earthquakes in the region, and the

events that have occurred only required high-level provincial and local involvement. A study examining the disaster preparedness of emergency departments at 941 rural hospitals in America, found that 55% of participants had activated their hospital disaster plan within the past two years (Manley et al., 2006). For this reason, it is important that hospitals conduct exercises to test how effective their disaster plans are. A plan written only on paper is as helpful as having no plan at all; exercising plans and disaster protocols of hospitals not only increases their resilience, but also ensure optimal health system responses.

Earthquake response plans readily accessible. All respondents were asked if their earthquake response plans were readily accessible, and 36% of participants interviewed said plans were not. Both Health Authority Emergency Managers said earthquake response plans were not readily accessible. One Health Authority Emergency Manager explained,

The 2006 orange binder Hospital Disaster Plan is in all units and departments, but those are now being expanded into full-scale plans. The new 2011 plans are being developed and those will be available online, so the one main source of truth will be on our intranet. The responsibility is on the units to print one copy and keep it on the floor. Then any updates done to that plan, will be done to the intranet copy, and departments will be instructed to print those once per year.

Another Health Authority Emergency Manager elaborated,

There isn't really a plan at either site that's the whole point. There are bits and pieces; it's not really pulled together. We are just developing specific site plans. We have binders that have the date 2006 on them and if you look at them they are actually templates that need to be filled in with the actual specific information that goes in an appendix. You'll find that there is nothing filled in the appendix. I think its because people didn't realize they actually had a component to complete. I think when the 2006 Disaster plan was introduced people were told, "Here is your plan." I don't think it's clear enough that there was a piece they needed to complete. I think some of it was around the implementation of it, the rest has something to do with the design of it. The organization has stepped up to the plate, and they are very anxious to get all this done, they wanted it done yesterday the problem is that it takes time and a lot of facilitation work to get it done and to get it done right. As I do the facilitation work with all the departments and sites across the Health Authority I can tell immediately no one has looked at the orange binder, and many have no idea what's in it, its a huge disconnect. We are working extremely hard to get the work done, and it will get done in due time.

This respondent went on to explain how VIHA's Emergency Management and Business Continuity department is working hard to developing assessment tools at the same time the plans are being developed. The development of assessment tools helps identify benchmarks which can be used to monitor progress. The study also revealed that a quarter of all Provincial Emergency Managers also said earthquake response plans were not readily accessible. One Provincial Emergency Manager explained,

We technically don't have a plan, what we have is a seismic strategy. Because our seismic planning started to take shape after a lot of our other planning had happened, and we already had robust business continuity planning, and really robust critical infrastructure planning, what we did, instead of reinventing the wheel and reinventing a new plan around the plans that already existed. We've made an attempt to fold seismic strategy and weave a seismic lens throughout plans that we already have built. So that is kind of how the strategy has taken shape. This strategy is only about a year. It's still pretty much in its infancy, in terms of what it looks like as a finished product, its constantly evolving. It may evolve into a plan. The health sector has a very large component in the provincial plan. But health may one day have a seismic plan that stands alone, but right now there is enough redundancy in the other plans we have going, it makes more sense to feed it in that way.

A static plan that sits on a shelf is not effective; the plan must be easily accessible, meaning all employees must know its location. It should also be regularly updated and tested through mock disaster drills and exercises.

Implementation. The following section will first present the qualitative results pertaining to hospital level Operational Components of Preparedness. This will be followed by department and program specific Operational Components of Preparedness.

Operational Components of Preparedness—Hospital. Operational Components of Preparedness in the context of the earthquake hazard were asked of Health Authority Emergency Managers and included Resource Management, Communication Systems, Emergency Operations Facilities, Departmental Contingency plans and Evacuation and Relocation.

Resource management. With respect to Resource Management, respondents were asked whether there had stockpiled supplies of generators (including fuel), blood, pharmaceuticals and water. For generators (including fuel) and water, one respondent said stockpiles existed, and the other respondent said stockpiles did not exist. Participants were then asked whether plans included 24-hour contact information for vendors and suppliers of food and medical equipment.

One respondent explained:

In terms of stockpiles, all of our sites have generators and some sites have backup generators. But I wouldn't say there are significant stockpiles of generators, except at the new Patient Care Centre (PCC) at RJH. The rest of the buildings have a main generator and a backup. In terms of fuel, it's 72 hours at PCC. Everyone else has a backup not a stockpile.

One Health Authority Program Director added,

At RJH and VGH for electrical power we have standby generators. They will last 72 hours at the RJH, and 48 at VGH on the fuel that we have, and indefinitely if we can obtain more fuel. For water, at RJH we have installed a secondary connection to the grid for potable water which will allow us to maintain water service in the event that one of those entries is damaged. We don't have that feature at VGH. We have installed emergency potable water connections for the renal services, which are the systems that need clean water to function at both sites. This is being done at all the acute sites on the Island. He continued to explain, "We have taken steps to do the best we can, at the end of the day the water comes from the Sooke Reservoir. If something happens to it, we are out of water, if we are out of water, we are out of business, so that concerns me. We've talked about storage tanks and a number of ways to satisfy this concern but we use so much water that it would be an expensive proposition. The big user of water is our heating plant. So that's the weak link in the chain are the municipal systems.

When a disaster strikes and power supplies are compromised, generators are essential for maintaining the functioning of critical care machines in acute hospital settings. A power failure at The University of Massachusetts Medical Center (UMMC) in 1992 reinforced the need of generator power for critical care machines. Without generator power and no individual machine backup battery packs, ICU ventilators failed and as a result all patients

required manual ventilation and additional monitoring (Aghababian, Lewis, Gans, & Curley, 1994).

Both respondents said stockpiles of blood supplies and pharmaceuticals existed. One respondent explained,

There is a blood plan within our Health Authority, and that plan is integrated with Canadian Blood Services and their contingency plans. We have stockpiles of pharmaceuticals leftover from the H1N1 Pandemic, and we have access to the National stockpiles of pharmaceuticals in Ottawa. There is no local supply centre.

When asked whether earthquake plans included 24 hour contact information of vendors, one Health Authority Emergency Manager said, “I don’t personally have them. They are available through logistics. We are working on putting in it our plans. It’s not in the plan as of now.”

One respondent said a policy to recall staff back to work in the event of a disaster existed, and the other respondent said there was no such policy. She explained, “No there's no policy. I would say that there is an understanding that if we have a disaster people would use their phone fan out list to bring staff in. There is no policy to say that people must report to work, but I would say there is a mutual understanding.” Both respondents were asked if mutual aid agreements with suppliers existed to provide the hospitals with materials immediately after an earthquake. One respondent said mutual aid agreements with suppliers existed, and the other respondent said they did not.

Both respondents said external avenues had been pre-identified which outlined how the Health Authority would obtain additional resources, both locally and regionally. In terms of human personnel, one respondent explained, “We are in the process of working with the Ministry of Health to look at implementing legislation that will allow us to use retired health care workers in the event of a disaster. There are all sorts of risks involved to make sure they

have the updated education and skills. We also have the ability to get more personnel from the private health care clinics.” In terms of equipment, both respondents mentioned the availability of leftover medical supplies from the Olympics, known as the “Olympic Legacy”, in addition to the availability of a mobile medical unit and National Emergency Stockpiles System (NESS) supplies.

Communication systems. Both respondents answered yes to having alternate communication systems (e.g. mobile phones, 2-way radios and satellite phones), and to having an interagency communication system in place for communicating with external response agencies. One explained, “ We also have a cross border interoperability committee that is looking at communications across the province, across Canada and into the USA.” Both respondents also answered yes to having protocol and procedures in place for disseminating information during an emergency to the following groups: public, hospital visitors, patients, and hospital employees. In dealing with the aftermath of the Pine Lake tornado, one of the recommendations made by the Red Deer Regional Hospital was to provide a site where relatives can congregate and receive accurate, up to date information regarding their loved ones (Hogarth & Neil, 2006).

Emergency operations facilities. Both respondents said primary and secondary locations had been pre-determined for the hospital Emergency Operations Centre (EOC). Also, both respondents said that the pre-determined EOC locations had access to auxiliary power connections, telecommunication equipment, and contained an up to date contact list for people who had roles and responsibilities in the EOC. One respondent explained, “Our regional EOC is the Patient Care Centre at RJH, which is also our most recent addition, therefore the most seismically prepared. The Patient Care Centre will act as the local and

regional EOC site. At VGH there are two EOC locations, the first is the new Emergency Room, and the other is the administrative wing. We have a pre-identified site, local and regional EOC.”

Department contingency plans. When asked whether departmental contingency plans had been developed to reflect how select departments would critical medical services after an earthquake, the respondents frequently reported conflicting answers. When asked whether contingency plans had been developed for Nephrology, Maternity, and Cancer Clinics, one respondent consistently answered yes, while the other consistently reported not knowing. When asked whether departmental contingency plans had been developed for the Surgery department, there was a discrepancy in the answers provided. One respondent answered no, and the other respondent yes. In contrast, both respondents said departmental contingency plans existed for Intensive Care Unit (ICU). The results show a disconnect either in communication or perception of existing plans and protocols.

The Cancer Agency belongs to the Provincial Health Services Authority (PHSA). In BC there are six health authorities, five are geographic ones, and there is one that is an overarching provincial one called Provincial Health Services Authority (PHSA). They are responsible for British Columbia Children’s Hospital, and the cancer agencies. So even though the cancer agency is on the RJH, it actually reports to PHSA. So we consider them like the other health authorities as a linked partner. We have met with the BC Cancer Agency, and have talked about how we would integrate our plans and we talked with the PHSA corporate director for emergency management. We have contingency plans which are based on PHSA contingency plans.” Both respondents said departmental contingency plans existed for Intensive Care Unit (ICU). When asked whether departmental contingency plans had been developed for Surgery, one respondent answered no, and the other respondent said yes. One Health Authority Emergency Manager commented, “There is more work to be done in surgery.

Hospitals need to develop departmental contingency strategies not only to deal with the surge of patients, but also to deal with services. A paper by Aghababian et al. (1994) explains how a ruptured city water main line and fear of a contaminated water sources at the

University of Massachusetts Medical Center (UMMC) forced the closure of outpatient clinics and the cancellation of elective surgeries (Aghababian et al., 1994). The event at UMMC highlights the need for departmental contingency plans to help deal with sudden disruptions in services that result from disasters.

Evacuation and relocation. Both respondents said Evacuation Plans existed, however when asked whether alternative care sites at been identified in the event the hospital had to be evacuated one respondent said yes, and the other respondent said no. One respondent explained,

We have a list of potential alternate sites: schools, tents, mobile medical unit, Olympic legacy, all non-traditional spaces. The mobile medical unit is housed in Vancouver. We can also move people around in Victoria, because there are three acute care centres here (Saanich Peninsula, RJH and VGH). We've looked at our own facilities first, and then looked at community halls. But we also have to be cognizant that the community maybe be using those places as well with the Emergency Social Services (ESS) team.” The other commented, “We don't actually identify alternate care sites, because we don't know what will be standing. We do evaluate neighbouring buildings, but we've looked more to what's going to be required so that the people in the EOC can say, Ok we need a space that will hold X number of beds and have whatever services are required. We don't really ID buildings we ID future requirements. I would say sure, we have some idea of what we might do.

Operational Components of Preparedness—Department and Program Specific.

Triage response protocols. Triage response protocols refer to specific protocols for diagnosing, managing and tracking the surge of patients and casualties immediately following a Mass Casualty event. Eighty five percent of respondents interviewed said triage response protocols were addressed by their earthquake response plan. One Health Authority Emergency Manager said the last event that was semi-mass casualty was the arrival of the TS Sun Sea migrant ship in August of 2009. She explained how the primary focus of the response was to decontaminate the migrants and ensure all 492 on board received the medical attention required. One Health Authority Program Director explained:

If something happened right now even without a plan, we would manage. We manage a semi-crisis all the time, so if you sent me 200 patients right now we would, and could probably figure that out. We do have that organizational plan to say well go on the concourse of the DNT will pull the stretchers from here and all that. It's not the response to the volume of patients that worries me that is something that's straightforward depending on the level of injury. You can direct patients' and triage accordingly. I think our biggest thing will be organizational. I think registration is huge; it's about having patients properly identified and being able to track them and having the system for tracking them. There is currently a system right now but I think we need to work with the other departments, so that they understand what's going on. We need to be able to track location of patients and all that.

The triage protocols and plans must be robust enough to deal with the large surge of patients. After the earthquake and tsunami that occurred in Thailand on December 26, 2004, Israeli Defense Forces (IDF) sent research delegates to Thailand to see how the hospitals responded to the disaster. Major findings revealed a shortage of ambulances, and air transportation inhibited the rapid evacuation and triaging of the severely injured (Leiba et al., 2006). These findings stress the importance of having robust triage protocols and procedures that may need to be implemented under less than ideal circumstances. It is important that all hospital employees know the location of the designated triage areas. It is also helpful to have pre-determined personnel or create medical response teams which will take leadership roles in triaging patients and those severely injured. Literature suggests the need for specific triage areas to be identified outside hospitals, and these areas should easily accommodate ambulance, stretchers, and a large volume of patients and family members (Lynn, Gurr, Memon, & Kaliff, 2006).

Volunteer coordination. When a disaster strikes, the availability of healthcare staff and support workers often becomes an issue. As previously mentioned, Volunteer Coordination refers to the management of people who come forth to help deal with the surge of patients. Plans and protocols must be in place for the coordination and management of

such volunteers. Results found that 42.8% of respondents said earthquake response plans addressed Volunteer Coordination, while 35.7% said Volunteer Coordination was not addressed, and 21.4% of respondents did not know whether earthquake response plans addressed Volunteer Coordination.

Both Health Authority Emergency Managers said protocols were in place and were a part of earthquake response plans. However, more than half of the Health Authority Program Directors said earthquake response plans did not address Volunteer Coordination. Similarly, more than half of the respondents who did know whether earthquake response plans addressed Volunteer Coordination were Hospital Department Managers. In the event of a disaster, it is the Health Authority Program Directors and Hospital Department Managers who will be working the frontlines, triaging patients and ensuring all patients receive the care they need. It can be very overwhelming during this process to have to think about coordinating and managing volunteers. One Hospital Department Manager added, “It’s not just the coordination of additional people; it becomes an issue of increased risk and liability. I don’t know what we are supposed to do outside of our own unit. All I know is that we are supposed to man our own unit.” Healthcare workers need to know how to deal with volunteers. The results highlight a disconnect between upper level administration and frontline acute care workers, when it comes to knowledge of volunteer coordination protocol.

Evacuation and relocation protocols. Results showed that half of respondents interviewed (50%) said earthquake response plans addressed Evacuation and Relocation Protocols, and half said they were not. All of the Hospital Department Managers interviewed said earthquake response plans did not address Evacuation and Relocation Protocols. One Hospital Department Manager explained,

We don't know who to take, what to take, or how to take it. It might be outlined in the orange binder but we are not well versed in it. We put people on ventilators, so in 11 or 12 years with VIHA we have asked the question what to we do with them, how do we move patients on ventilators, and no one has been able to give me an answer. I can't say my staff is comfortable in knowing what to do, if we had to evacuate and relocate.

In contrast, more than 75% of the respondents who said earthquake response plans addressed Evacuation and Relocation Protocols were Health Authority Program Directors (85.7%). Again, this discrepancy highlights different levels of awareness not only regarding the disaster plan, but Evacuation and Relocation Protocols.

Department level contingency protocols. Sixty percent of the respondents who said earthquake response plans did not include Department Level Contingency Protocols outlining how the department would continue to provide critical medical services after an earthquake were Hospital Department Managers. One Hospital Department Manager explained, "It's not specific for our department. It's more like a general plan, we don't have anything specific to my program or department." Another Hospital Department Manager commented:

As for my specific department, I'd say no. We haven't put a lot of thought into it to be honest. We haven't really considered specifically how we would respond if an earthquake compromised our infrastructure. Our response right now is based on the assumption that we are going to be able to work out of this facility and that BCAS will bring the people to us.

Sixty percent of Health Authority Program Directors said Department Level Contingency Protocols had been addressed by earthquake response plans. Also, both Health Authority Emergency Managers said plans also existed. This suggests that the content of plans has not been communicated efficiently to Hospital Department Managers, or that the plans do not exist. Because Health Authority Administrators are somewhat displaced from the acute hospital setting, their knowledge regarding earthquake plans and procedures may be greater, compared to the Hospital Department Managers.

Internal traffic flow protocols. Internal Traffic flow refers to the movement of patients and equipment inside the hospital. Results showed that more than one quarter of respondents (28.5%) said earthquake response plans did not address Internal Traffic Flow Protocols. One Hospital Department Manager explained, “Evacuation routes are all mapped out, I’d only assume we would follow those. As for which way, and where to go once outside the hospital – that’s my responsibility.” Another Hospital Department Manager said, “All we have done is to consider if everything fell down how would we set up a unit somewhere else. We have not done a lot about how we would manage in the building in less than ideal conditions.” It’s important for evacuation routes to be predetermined and clearly marked, in order to avoid confusion and chaos in an emergency.

While both Health Authority Emergency Managers said earthquake response plans had addressed Internal Traffic Flow procedures, it was interesting to note that half of the Health Authority Program Directors disagreed.

External traffic flow protocols. Both Health Authority Emergency Managers said earthquake response plans addressed External Traffic Flow Protocols, however, 66.6% of Health Authority Program Directors and Department Managers said earthquake response plans did not address External Traffic Flow Protocols. External Traffic Flow pertains to the movement of traffic outside of the hospital; the movement of first responding vehicles such as fire, police and ambulance. These plans look at how the surge of patients and visitors to the hospital will manage from a traffic perspective. External Traffic Flow becomes a problem when original designated transportation routes become inaccessible due to structurally vulnerable infrastructure or the use of areas for triage areas or field hospitals. One Hospital Department Manager explained, “We would have no idea even where to begin.” Another

commented, “These are decisions I have to make, because there are no plans about that. It’s not set up, and I don’t think it’s being talking about.”

Resource stockpiles. Although results showed that both Health Authority Emergency Managers, said earthquake response plans included an inventory of Resource Stockpiles, 75% of Health Authority Program Directors said an inventory had not been completed. One Health Authority Program Director said, “We have made a list, but at this moment if you asked me what’s in that stockpile I couldn’t tell you.” Another Health Authority Program Director commented, “We have our regular stock that we carry, we maintain our stock for the procedures we do for our patients. As far as an emergency stock, for staff and for the surge of patients we would get, we don’t have that.”

Results also showed that 80% of Hospital Department Managers said earthquake response plans addressed Resource Stockpiles. However, the lack of supplies available and the fact that many of the medical supplies for VGH are kept at RJH, was an issue brought up by a majority of Hospital Department Managers. One Hospital Department Manager explained:

I've been told I'm a hoarder. When my programs are here (VGH), I refuse to have supplies held over at the Jubilee especially when we have a very unique population. So I'm trying to address that right now to have all the supplies pulled back here to VGH. From an emergency management perspective, it's the worse thing you can do. All it takes is transportation networks to be destroyed, then how are you going to drive to the other site to get the material.

It is important that an inventory of resources be completed and kept up to date.

Knowing which resource stockpiles exist and what supplies are housed at each facility, it will be easier to identify what resources will be required.

Disaster training and education.

Seismic preparedness training. All 25 respondents interviewed were asked whether their organization provided seismic preparedness training and education for employees. Only 54.1% of the respondents said some form of preparedness training and education were provided. One Local Emergency Manager said “Its provided to all employees on a fairly inconsistent basis. We will do emergency preparedness talks as the managers in those departments allow us to. They were done in the past probably five years ago and are just now being redone.”

One Health Authority Program Director commented, “All the emergency management/ preparedness training is done at a corporate level, and doesn’t really focus on or involve individual hospital departments.” As for Hospital Department Managers, almost 30% of respondents said no preparedness training and education were provided, and the remaining 66% did not know whether preparedness training and education were provided to employees. The further the position was from the acute hospital environment, the less awareness there was regarding seismic preparedness training or education. One hundred percent of Provincial Emergency Managers said preparedness training and education programs were provided to all employees. One Provincial Emergency Manager commented, “We are starting to provide an overview of personal preparedness, but it’s not specific to seismic, it’s All Hazard. It shows staff and employees what personal preparedness looks like. They also talk about basic Business Continuity.”

Mandatory seismic preparedness training programs. Sixty percent of all respondents interviewed said it was not mandatory to participate in regular seismic preparedness programs. Sixty percent of Local Emergency Managers said participation in regular training

programs was not mandatory. One Local Emergency Manager added, “It's totally up to the discretion of the individual and Manager for that department.”

Both Health Authority Emergency Managers also said it was not mandatory to participate in regular preparedness training programs. One commented, “We are currently in the process of establishing an exercise and training process. However, “mandatory” is a tough word. When it becomes mandatory, there are union, and payment requirements you need to be aware of. Yes, we provide the education and training, but the expectation is that people will participate on their own.” Three quarters of Health Authority Program Directors also said participation was not mandatory. One Program Director commented, “This is a union environment, so anything you do, you have to pay your employees, and many Hospital Department Managers don't have the money.” The results show there is no mandatory training at the hospital level.

Oriented to roles and responsibilities. Almost 70% of participants interviewed said seismic preparedness training programs did not include an orientation to earthquake planning and their roles and responsibilities. Three quarters of Local Emergency Managers said disaster training programs did not orient employees to disaster protocols nor to their specific roles and responsibilities in the event of a disaster. One Local Emergency Manager commented, “It's primarily focused on individual preparedness.” Another commented, “ We have about 1400 employees, so it's not going to be role or function specific. The training and education we provide is very general.” However, one Local Emergency Manager explained, “We have 115 people who are trained with respect to their potential roles and responsibilities in the emergency operations centre. They all have varied levels of training from EOC level 1-3, to Introduction to Emergency Management, to Incident Command System training.”

Similarly, 80% of Provincial Emergency Managers said employees were not oriented to earthquake planning, including their roles and responsibilities as a part of the disaster training programs. One Provincial Emergency Manager said,

Part of the plan is to get to that level. Right now we are doing the shakeout, drop cover and hold on preparedness exercise. During Emergency Preparedness week we try to provide general education and awareness about employees having family plans and preparedness kits. I think the next step is to spend more time focusing on the roles and responsibility piece for employees within the context of staffing the health emergency coordination centre.

One Health Authority Emergency Manager said employees were not oriented to their roles and responsibilities as a part the disaster training programs. She went on to explain, “They know what their role is, in terms of clinical responsibilities, it’s how their roles and responsibilities will be restructured, maybe having to provide health care in a different location.” Almost 60% of Health Authority Program Directors, and 80% of Hospital Department Managers said there was no orientation regarding earthquake planning and roles and responsibilities a part the disaster training programs. One Hospital Program Director added, “I think for the most part they understand their roles and responsibilities. They understand they won’t be going home, and they understand they can be working multiple days in a row to help deal with the surge of activity.”

Earthquake preparedness workshops. More than half of the respondents said their organization did not provide earthquake preparedness workshops to ensure personal preparedness and currency of disaster procedures and protocols. Eighty percent of Local Emergency Managers said there were no earthquake preparedness workshops to ensure personal preparedness and currency of disaster procedures and protocols. One Local Emergency Manager commented, “We hold Ad hoc events sometimes, it’s very minimal, yes we’ve done some workshops but not as much as we should be doing. There is no formal

policy that says we need to do an earthquake drill or workshop.” Another Local Emergency Manager explained, “The workshops are open to everybody, and it’s all based on their managers willingness to provide that to us, it’s a two hour block of time we require. Senior level management needs to say, yes this is a priority.” Another Local Emergency Manager explained although the workshops were held on an annual basis, they were not very well attended.

Eighty percent of Health Authority Program Directors said there were no earthquake preparedness workshops to ensure personal preparedness and currency of disaster procedures and protocols. When asked how often these workshops were held, one Health Authority Program Director comment, “I don’t know, they are not so much about personal preparedness and disaster procedures and protocols, and they definitely are not held on a very consistent basis – I’d say one every couple of years.” Another commented, “ I don’t know how often they are held, again it’s structured at the corporate level, it’s whenever the communication comes out, and we as a department can spare the time and personnel to attend.” Three quarters of Hospital Department Managers said there were no earthquake preparedness workshops to ensure personal preparedness and currency of disaster procedures and protocols. One Hospital Department Manager explained:

They (meaning the Health Authority) has this information out there, but I don't know how we would access it and carry out daily operations. That's the piece we're struggling with. The staff wants it, but how do we get them away to it, who is going to run my unit? and how do we stay within our budget restrictions because we were hammered down to have no overtime and to stay within our budget. Because of these restrictions all disaster preparedness education has fallen on the units and departments.

Another Hospital Department Manager commented:

I wouldn't say ongoing, by no means. We've had some introductory disaster management education where we talked a little bit about our response as a department, in addition to talking about personal preparedness, earthquake kits, and

how to respond to an earthquake. Our last one was within the last year, 8-9 months and that was the first time we had any formal education, and they have not been repeated since. We had over 50% of staff participate. I'm waiting for some regional direction as well, so we have the same regional emergency management education. It is one of our priorities for our department portfolio for the Island.

Additional training for key position holders. The results showed that 60% of participants interviewed said key position holders involved in the emergency response were not required to take additional training. One Local Emergency Manager commented, "I don't think we require anybody to do anything. The responsibility falls 100% on the individual and on the manager of that specific department." One Provincial Emergency Manager commented, "Staff are encouraged to take advantage of whatever training they deem necessary to support their emergency response role, it's all available, but is up to the individual to pursue such opportunities." It was also found that 80% of Hospital Department Managers said key position holders who were involved in the emergency response were not required to take additional training. One Hospital Department Manager commented, "We are all doing this off the side of our desks."

Exercises and Corrective Actions.

Earthquake exercise or drill. Eighty eight percent of participants interviewed had conducted an earthquake drill or exercise. All Provincial Emergency Managers, Health Authority Emergency Managers, and Local Emergency Managers reported having conducted an earthquake drill/exercise. One Local Emergency Manager said,

Our Emergency Social Services (ESS) team does a full-scale exercise every 5 to 6 months, and we exercise our Emergency Operations Centre (EOC) plan by running tabletops regularly. Other components like the Urban Search and Rescue team are always training for earthquakes. They do probably have couple of full day exercises a year ... it's an opportunity for people to reaffirm their roles and responsibilities. They don't do this on a daily basis, they often need to have that reinforcement of what to do you and how to problem solve. It's also a chance for people to refresh their skills regarding the use of the disaster plan and equipment.

Surprisingly, 85.7% of Health Authority Program Directors had conducted an earthquake drill or exercise, however, more than half of the Hospital Department Managers had not. This may be because of the time it takes to organize disaster exercises. Hospital Department Managers are already taxed with many responsibilities and often do not have the time to invest in non-clinical activities. One Hospital Department Manager recalled doing a tabletop exercise “4 or 5 years ago.”

More than three quarters of the respondents said the last earthquake drill/exercise they did was The Great British Columbia Shakeout on January 26, 2011. Aimed at increasing personal and organizational preparedness, the event highlighted the provincial commitment to increase the safety of people all across the province. It also gave local municipalities and organizations an opportunity to reflect on earthquake preparedness, both from an organizational preparedness perspective and a personal preparedness perspective. One Local Emergency Manager said,

We used The Great British Columbia Shakeout as an opportunity to go one step further. We conducted a corporate Drop, Cover, and Hold On drill, followed by a municipal level EOC activation. This is where senior staff that fulfils a role within the EOC conducted a tabletop to exercise the first operational period following an earthquake.

Disaster drills and exercises are a very effective way to increase staff engagement with the disaster plan and protocols. A study by Bartley, Stella, and Walsh (2006) set out to determine whether an audio-visual presentation of the hospital disaster plan, followed by a simulated disaster exercise and a debriefing increased staff knowledge, confidence and overall hospital preparedness. The study administered a pre- and post-intervention survey to 50 hospital employees; the surveys assessed basic knowledge of the hospital disaster plan and personal perceptions of personal and departmental preparedness. Interventions included a one-hour lecture and a simulated disaster exercise. The findings revealed no significant

increase in perception of preparedness, however a majority of individuals who participated said it was of benefit to them and their department. The study concluded that simulated disaster exercises are extremely beneficial, and also emphasized that more time and resources must be allocated to increasing hospital disaster preparedness (Bartley et al., 2006).

Corrective action review. More than half of the participants interviewed said their organization completed corrective action reviews after a disaster drill or exercise. All of the interviewed, only Provincial Emergency Managers reported making changes to their recovery plans based on earthquake drills and exercises. From The Great British Columbia Shakeout in particular, many lessons were learned and many areas of weakness were identified. A Provincial Emergency Manager commented on how much was learned about earthquake preparedness as a result of The Shakeout, not only as a province, but also as a Ministry. He explained:

One of the things we've come away from this with is, from Shakeout and from our appreciation for recent disasters around the world, is the importance of developing an earthquake specific strategy at the Ministry level, and we are working on that now. Our intentions are to look at the health sector strategy, and engage all partners to address issues of interdependencies, critical infrastructure, business continuity, all those considerations in a health context.

Another Provincial Emergency Manager explained:

Shakeout taught us what public messaging looked like for people, and how to use social media outlets like Facebook, and Twitter.” She went on to comment about lessons learned from reviewing recent earthquakes like Christchurch and Chile: “One of the things that we’ve been looking at is how Chile used field hospitals when they lost use of their health care facilities. Christchurch played a large part in how we’ve been looking at how to use external resources like the NESS supplies and the mobile medical unit. Since seeing what happened in Christchurch, we’ve started to really look at the impact that unreinforced buildings have on urban centres. It also led us to look at public health issues, like health and water sanitation safety from a health perspective.

Eighty percent of Local Emergency Managers conducted corrective action reviews following The Shakeout. One Local Emergency Manager said,

There were over 50 EOC forms which had to be filled out post event, most of which have come through Emergency Management British Columbia (EMBC). We have now greatly condensed these forms and reduced them to about eight key forms that we believe are required following an earthquake. The reason for doing so is based on feedback from The Shakeout exercise. It became clear that staff were not familiar with the forms. In my opinion, there is a significant flaw in my mind to begin with that these forms are developed by an organization that's not a local authority. It makes it challenging.

Another Local Emergency Manager stated,

One of the things that we learned and changed quickly was that we had pre-identified specific department heads to perform specific tasks and roles. What we realized early on in the exercise was that if that particular department head was not there, the role would remain empty. So since the Shakeout, we have been training people to backfill, trying to build in some redundancy.

Another Local Emergency Manager explained,

After the Shakeout, township staff started asking about this kit at my desk and it's got some things like work gloves, dust masks, a whistle, glow sticks so things that are pretty much related to light urban search and rescue or rapid damage assessment. So the question started around what is this for, is this supposed to be a preparedness kit? So, it opened the door around it's not a personal preparedness kit it's a tool to help facilitate the immediate evacuation of the building. It opened dialogue around being clear on what is "personal preparedness" versus what is "corporate preparedness" and how they interweave." She continued, "Other questions were raised around food and water stockpiles for first responders.

For the Shakeout, the Health Authority exercised their employee fan out list, and quickly realized even though they thought the list was up to date, it was incomplete and inaccurate. One Health Authority Emergency Manager explained, "We found some of our employees with young children, said "it's a practice drill, so I'll say yes I would come in if you needed me. But in reality I would not be leaving my children." As a result of this one of the things we are trying to build into our EOC plan, is to potentially provide childcare for people's children."

Corrective action reviews are critical and have proven to increase institutional disaster preparedness. An article by Mahoney et al. (2005) summarized lessons learned

during a nightclub fire in Rhode Island on February 20, 2003, that resulted in 215 victims being rushed to Rhode Island Hospital for treatment. Before the event, the Rhode Island Hospital had conducted multiple disaster drills, and after each drill, the response was critiqued for response time, accuracy and efficiency. Areas of improvement were identified and respective changes were made to the disaster plan and protocols (Mahoney et al., 2005). The re-evaluation sessions proved to be invaluable, as one of the major lessons learned was that previous disaster planning drills facilitated a quick institutional response, resulting in an optimal and integrated response to a mass causality incident (Mahoney et al., 2005).

Fifty percent of Health Authority Program Directors had never conducted corrective action reviews post exercise, and 100% of Department Managers interviewed said corrective action reviews had not been done. When referring to The Shakeout, one Program Director commented, “We didn’t have any lessons learned or corrective actions. It seemed to go very well.” This comment highlights a disconnect between the actual situation, and the situation as perceived by Health Authority Administration. One Hospital Department Manager commented,

We really didn't talk about what we would do if we weren't able to work out of our Department. So that something as I'm talking to you, I realize we need to focus on. I think one of the big things came from the Shakeout was the recognition of what Department Managers need to do to prepare at home, and how to make sure they know what to do in the event of an earthquake while at work. But as far as the fallout from the actual exercise we did not review anything.

These results show the need for more accountability at the Program Director level.

Large scale regional exercises such as The Great British Columbia Shakeout not only heighten awareness around earthquake preparedness, but they encourage and empower agencies to make changes internally, such as amending policies and procedures, procuring equipment, and investing in training and educating staff and employee’s in disaster

preparedness (Serino & Williams, 2009). A drill is not complete without an after action evaluation, where all participants are encouraged to engage in an open critique of all the activities that took place (Lusby & Leonard, 2006). This provides the space to talk about successes, as well as failures and weaknesses.

Multi-jurisdictional exercise for earthquake response. A majority of participants (92.3%) had never conducted a multi-jurisdictional exercise to deal with earthquake response. More than half of these respondents who said they had never conducted a multi-jurisdictional exercise for earthquake response were Local Emergency Managers. These results illustrate the potential disconnect between regional local jurisdictions, in addition to highlighting the inefficiency of regional planning entities such as the LGEPC and RECAC. One Local Emergency Manager commented, “We have not done an exercise in recent memory. There have been in the past, but not in recent memory and certainly not multi-jurisdictional.” Another commented, “I’m sure at times they were done in the past, certainly not regularly” Similarly, 100% of Health Authority had never conducted a multi-jurisdictional exercise to deal with earthquake response. Multi-jurisdictional exercises and planning serve to enhance collaboration, coordination and preparedness across health care, first response and public safety agencies communities (Serino & Williams, 2009).

Multi-agency exercise for earthquake response. Results showed that only 50% of Provincial Emergency Managers and Local Emergency Managers said they had ever conducted a multi-agency exercise to deal with earthquake response. That being said, the most recent successful multi-agency exercise was the provincially led Great British Columbia Shakeout. Although self-directed, the event brought together multiple agencies and

organizations across different sectors and levels for a common goal of increasing earthquake preparedness awareness. One Local Emergency Manager said:

All our exercises are multi-agency. Every time we exercise, we have external agencies come in to observe. It serves two purposes because it's good to have an independent body to come observe the exercise. Also as an example, when we had our EOC exercise last year, the Emergency Manager from the City of Victoria was one of the evaluators for the exercise. After the event can talk about what the roles and responsibilities are in the case the other agencies are concerned or feel we may have strayed away from what their expectations were. It's not strictly observing, if there are questions about roles and responsibilities during the exercise, it's an opportunity to provide the information.

Fifty percent of Health Authority Emergency Managers had never conducted a multi-agency exercise to deal with earthquake response. One Health Authority Emergency Manager added, "We have not conducted but we have participated. We did a cross border international Mass Casualty incident exercise called CAN-AM SAREX in 2000, and in 2006. We have also done exercises with CFB Esquimalt Military base around Mass Casualty response." By conducting multi-agency exercises for disaster preparedness, different agencies work together and share knowledge, information and resources (Serino & Williams, 2009).

Multi-departmental hospital exercise for earthquake response. All of the Health Authority Program Directors and Hospital Department Managers said they had never conducted a multi-departmental in house exercise to deal with earthquake response. This may be a reflection of the lack of time available to perform non-clinical tasks.

Priority Areas

Challenges and barriers. Overall, the interviewed respondents reported a variety of challenges and barriers. In order of importance, participants mentioned infrastructure (65%; n = 26), time (50%; n = 13), competing priorities (46.2%; n = 12), apathy and lack of personal preparedness (42.3%; n = 11), lack of resources (human and equipment) (42.3%; n = 11),

unclear roles and responsibilities (34.6%; n = 9), poor regional planning (30.8%; n = 8) and funding (23.1%; n = 6) as barriers to increasing seismic preparedness within their organization.

Seventeen of the 26 participants (65.4%) said a major barrier to increasing their seismic preparedness was the integrity of the civic infrastructure and municipal facilities. The fact that one quarter of Local Emergency Managers mentioned infrastructure as a barrier to seismic preparedness within their municipalities, only reinforces the vulnerability of local infrastructure. One Local Emergency Manager shared this comment:

The current fire station (primary Emergency Operations Centre) and city hall (secondary Emergency Operations Centre) are not up to post disaster seismic code. So, in the event of an earthquake, I have an almost nil response capability because both buildings are coming down- we know that. It will hinder our ability to respond 100%.

In the context of structural vulnerability of the infrastructure, one Local Emergency Manager commented,

Using the example of Christchurch, I would suggest we would have fairly similar damage from an earthquake here. We have lots of loose soils and some variable low soft story housing, and our downtown is equally vulnerable. We have a lot of older brick buildings and a lot of older 60's and 70's built steel concrete that has aged over the years. We will definitely have some pretty major impacts with a large earthquake.

Half of the respondents interviewed, 13 (50%), reported they did not have the time to dedicate to seismic preparedness and emergency planning. Of these 13 respondents, 10 were a part of the hospital level target groups, 6 (46.2%) were Health Authority Program Directors and 4 (30.8%) were Hospital Department Managers. One Health Authority Emergency Manager explained,

There are so many things happening on a day-to-day basis that there is barely enough time to deal with regular everyday crises, never mind what might or might not happen. So it's a challenge getting people's attention to talk about earthquake preparedness. The mentality is, I don't have time for an earthquake, I've got this crisis happening this day, this day and this day, that needs my attention.

One Health Authority Program Director commented, “The time it takes to do it. I'm hopeful this new process initiated by Health Authority Emergency Managers will allow us to finally get there, get where we need to be. We just haven't done it.” When asked about challenges to increasing seismic preparedness within their hospital department, one Hospital Department Manager replied:

I think its setting the time aside and saying this is a priority. And simply, the time it takes to decide and plan out what equipment we would need if we had to evacuate, as well as getting a really good understanding of what the process would be for our department immediately post a big earthquake. It all takes time, time I don't necessarily have.

Another Health Authority Program Director explained:

The time it takes to execute the solutions in our business is a challenge. We are a little different than most businesses because we are 24/7, this site has never stopped in 100 years. Any construction is very complicated especially when it involves working on frame or with heavy equipment. We have to think carefully about anything that needs to shut down our services as a hospital, it's a big challenge.

Another Program Director commented, “I am one person for over 200 people, all of who report directly to me. So besides my daily routine that I have to deal with crisis, somewhere in there I actually have to fit in the disaster planning part of this. Because ultimately it falls to me, I think that's the biggest barrier.”

Twelve of the 26 respondents (46.2%) said that competing priorities were a major barrier to increasing seismic preparedness within their organization. More than one quarter of these respondents were Health Authority Program Directors (33.3%), and almost half were Local Emergency Managers (41.7%). One Health Authority Emergency Manager said,

It's a regular everyday crisis, and there are so many competing priorities. So getting attention and getting people to buy into the fact that they need to spend some time around this planning process and putting things into place is a huge challenge. Trying to get people to make time for it. It's the “what if's.” I don't have time to deal with the what if's, I need to deal with the here and now.

One Health Authority Program Director said, “The biggest challenge is trying to do it in the face of 24/7 operations, and giving it the prominence it needs, when you're just trying to keep your business running.” One Local Emergency Manager commented “Internally there is always a barrier of support from senior management and competing corporate priorities. There are always hundreds of priorities at a corporate level.”

Eleven of the 26 participants (42.3%) said that apathy and poor personal preparedness for the seismic hazard and risk we face in this region are a challenge to increasing seismic preparedness. It was found that more than one quarter of each target group said that apathy and lack of personal preparedness were barriers, illustrating that apathy and lack of personal preparedness are issues at all levels. As noted previously, possible reasons for this could be due to the fact that we have not experienced a damaging earthquake in this region, in many people’s life times. One Local Emergency Manager commented:

We are not prepared for this. If what happened in Japan were to happen here, forget the tsunami, let's just have a big earthquake and pancake half of the city and cut off gas and water. I say 99% of the population of Greater Victoria don't have a grab and go bag, they don't have an evacuation plan, they don't have food, and they don't have water. It's going to be a nightmare. And everyone's going to call on the government; everyone's going to rely on the local government, the provincial government. Not enough people are taking this stuff seriously and they think the fire department and the police will come save them; it's not going to happen. At some point everyone has to say okay we are screwed and we'd better do something about this.

Another Local Emergency Manager commented:

I guess there's an apathy as well to the actual earthquake, we haven't had one for 300 years that has done any major damage, so you get a bit apathetic towards the risk and potential consequences associated with it.” A Provincial Emergency Manager added, “I think sometimes you have cultural challenges. There is a tendency for people to sometimes think this won't happen to them. From a cultural perspective, a major challenge is getting people to pay attention to something that’s never impacted them. Its' not insurmountable, but it’s a challenge.

One Provincial Emergency Manager commented:

Earthquakes in particular, because they have been so infrequent, its something that can be risk managed, it may not happen in our lifetime. Most people have not lived through it, and do not realize the severity of it. So common developing a understanding is very difficult, I think. Because It's that constant educational aspect in trying to make sure folks realize it's a very serious risk and that it's effects could be absolutely devastating, more devastating than we've ever experienced both through loss of life and economically.

One Hospital Department Manager commented, "There is a definite level of apathy within our own department and hospital, and I'd even go so far as saying it's throughout the whole health authority."

Many of the Local Emergency Managers expressed the need for more staff to not only help with the disaster planning aspect, but to also be there to assist during the response and recovery stages. One Local Emergency Manager commented:

The availability of human resources is a major challenge. We are primarily a volunteer fire department so the focus for most volunteers will be to ensure their family is safe. There is no obligation for them to come to work at the fire department. We have basically five paid positions. So human resources like the people who are actually going to be on the on the ground responding to the issues is going to be a challenge.

The main concern on the minds of Health Authority Program Directors was the lack of equipment, supplies, and contingencies. One Health Authority Program Director explained:

We have an emergency water connection at each of our dialysis facilities but we would need to access a tanker truck of potable water in order to run our system. Our backup systems would last as long as we had potable water and electricity. There's no water storage. Basically we need water and electricity. Thinking more long-term, supplies would be an issue, not only getting supplies to Vancouver Island but to our sites all across the Island.

Another Health Authority Program Director explained:

I think a primary concern for us is our digital imaging capacity and digital imaging storage. Everything we do now is digital, if we have no power, we have no digital images. Our fall-back on that one if you don't have power you don't have machines to produce images either, so on a large-scale earthquake disaster of sorts were kind of hooped in our world. Because if there is no power, you can't look at images, you can't

produce images on machines. If you have power down, if you can look at images on the call packs, then you can still look at the in the CT room. So there is that interim step for us, looking at the machines that produce the images themselves rather than using image storage. That would be the most critical thing for us to maintain, is access to our images, apart from producing them. A primary goal for us is to develop a contingency plan around digital imaging.

One Hospital Department Manager commented:

The food supplies. All the food is prepared at the Jubilee; there is very little food here, juice, crackers, yogurt, and some bread. That's it. So if it was after a meal delivery there maybe some food. But if it was any other time, and if the transportation networks were damaged, it would be a huge issue. Also all the food and supplies are in the basement, so if the building were to collapse we'd have a problem. The place where all the equipment is stored is inside the building. I have asked for that many times for a building outside of the hospital to store supplies, because it's not going to help us if the building collapses on top of the supplies. All the supplies are in the basement, and now most of it is kept at Jubilee like IV bags, dressings, etc. We have a cart on the unit, full of supplies. We are on the 7th floor and the carts are not tethered and will probably turn over and spill everything.

Almost thirty five percent of respondents (34.6%) said unclear roles and responsibilities was a major barrier in increasing seismic preparedness within their organization. Of these, more than half were Local Emergency Managers (55.6%) and more than one quarter were Hospital Department Managers (33.3%). One Local Emergency

Manager commented:

I think another barrier would be the expectation that external entities in our municipality have that there will be a response - this comes down to not clearly stating roles and responsibilities. So it's a lack of awareness on our stakeholder's part. VIHA was surprised the other day to find out that we are primarily a volunteer fire department, and they were surprised to hear that our building is not up to seismic code, and they were surprised to hear that they are on their own in a disaster. Now that you know, then let's get to the table and talk about what we're going to do.

Another Local Emergency Manager said:

Thinking in terms of the hospitals there is a danger in this business that we assume someone else is coming to solve our problems in a disaster, and it has been proven over and over again that this is not the case. Over the years we have had this impression from hospitals around the province that the municipalities are going to take on that extra surge that may happen from more of a first aid nature. And local authorities don't have adequate plans for that; it needs to be a partnership. There are

some deficiencies around roles and responsibilities and who does what. I think its important to have these conversations and look at how we can assist one and another in defining what the needs are and sorting out who can do what to match those needs.

One Local Emergency Member said:

I would say one thing that would be really helpful would be really clear Human Resource policies, around what is the responsibility of staff in the EOC response. It's not really laid out in people's job descriptions, but we have that expectation of people.”

One Department Manager commented,

We need to know what our roles and responsibilities are in the event of an earthquake. It’s all about maintaining health care, I know my clinical role and responsibilities, but after an earthquake it’s not going to be business as usual, and so all of this needs to be discussed and communicated beforehand.

More than 30% of participants interviewed said poor regional planning and the regional structure in terms of Emergency Management was a challenge and a barrier to increasing seismic preparedness within their organization. Fifty percent of the respondents who said regional planning and structure was a challenge to increasing seismic preparedness were Local Emergency Managers. One Local Emergency Manager attributed this to the fact that all 13 municipalities have their own Emergency Manager, who does much of the planning in isolation, “Can you imagine if all 13 people working in the same office, under the same roof were collectively doing the same thing every day? It would be a lot more efficient.” Another Local Emergency Manager said the “dysfunctions at the regional level, impede the progress in terms of regional planning.” Another Local Emergency Manager alluded to multiple political barriers that exist within the regional planning entities, and noted how by knocking down these barriers, we can move forward in our planning as a region.”

Another Local Emergency Manager explained:

There is a sense of proprietorship – that information is key, and knowledge is power and we are not going to share it with you. That mentality at the regional level permeates the RECAC and the LGEMC. There needs to be an overarching authority

that clearly needs to define who is in charge, especially after an earthquake. If much of the pre-planning is done in isolation in municipalities and everyone has their own agenda, what makes you think the response and recovery is going to be smooth?

Another Local Emergency Manager stated, “Regionally we need to develop disaster plans that identify how we are going to assist with recovery in our region, while continuing to fulfill our role and responsibility to our own municipalities.”

A Health Authority Emergency Manager expressed the need for better site and unit planning with the regional Health Authority. She went on to explain,

Part of it is being under resourced for so long, two people were doing the planning for the whole island for 20 years—it’s impossible to do. The second part has to do with the design and implementation of the disaster plan in 2006.

Of the six respondents who said that funding was a barrier to increasing seismic preparedness (23.1%), more than half were Local Emergency Managers (66.7%). There are various needs for monetary funding: retrofitting and upgrading infrastructure, disaster training and education, and for the purchase of equipment and preparedness supplies. One Local Emergency Manager commented “funding is one of the most difficult things to acquire, it involves continuously going to the City Council and asking for funding so you can provide training for your personnel.” Another Emergency Manager stated, “A challenge is cost and budget restrictions. A lot of our facilities need to be seismically upgraded including the fire hall. So there are massive cost associated with seismic upgrades. We have had support to do them, it cannot be done in one year- upgrades take time and money.”

Future directions. A vast majority of participants interviewed (88.5%; n = 23), said Disaster Preparedness Training and Exercises were a major priority area for their organization. These respondents included Health Authority Program Directors (26.1%; n = 6), Local Emergency Managers (26.1%; n = 6), Hospital Department Managers (21.7%; n =

5), Provincial Emergency Managers (17.4%; n = 4), and the remaining respondents were Health Authority Emergency Managers (8.7%; n = 2).

A significant percentage of each target group identified disaster preparedness training and exercising as priority areas for increasing seismic preparedness. One Provincial Emergency Manager said:

Education and awareness is a huge one. I think it's the first step and it's always one of the hardest ones to get people to be personally prepared. I think the Shakeout is doing such great work to bring it to the forefront of people's mind. It's important to ensure there is an understanding of roles and responsibilities as well. There is an understanding that their role could shift substantially, so people need to be trained and educated about what these changes may look like.

Another Provincial Emergency Manager commented on the importance of educating the public, "I think public information is huge and is really underestimated. I think if people in general are prepared at home they are more likely to come to work and help respond to an event." Another Provincial Emergency Manager said "We need to develop an entire strategy around training staff in a range of different areas including: rapid damage assessment and personal preparedness for seismic events."

A study by Manley et al. (2006) examined disaster preparedness of emergency departments at 941 rural hospitals in America. Hospital Emergency Room nurses were asked if they were awarded \$100,000 for training, what would be their top priority. Results showed the most common answer was general disaster preparedness as a top priority (Manley et al., 2006). When asked about disaster preparedness training and exercises, one Health Authority Emergency Manager explained, "We've made it a priority within our department to have everybody trained, educated, prepared – and we hope to expand this across the whole health authority."

More than 25% of Local Emergency Managers identified disaster training and education as a priority area for increasing seismic preparedness within their organizations. One Local Emergency Manager stated that a priority area for him was “to increase the training and disaster preparedness awareness of city hall staff, and municipality workers.” Another Local Emergency Manager commented, “In addition to training staff in terms of roles and responsibilities and personal preparedness, I’d love to see the development of an Urban Search and Rescue capacity.” One Local Emergency Manager said, “We need to train and educate the public and our employees about mitigation. If we could get out there in the public and do some preparedness and mitigation pieces and get the public thinking mitigation and educate them about how to become less vulnerable, then obviously response and recovery become a lot easier.”

More than 25% of Health Authority Program Directors identified disaster preparedness training and education as a priority for their programs. One Hospital Program Director commented, “There should be more frequent drills. Meaning instead of once a year they should do it three or four times a year. They should do a tabletop at least once a year, where they are opening up an Emergency Operations Centre (EOC) and show us how that works and refresh us on what our roles and responsibilities would be.” Another Hospital Program Director commented, “Ongoing staff and more education for leaders within my program plus, the training and education needs to be continuous and ongoing. It should certainly focus on personal preparedness, as well as inform staff about specifics about plan, and more importantly what their roles and responsibilities are. The backbone of our plan is having people available to treat our patients. Patient preparedness is another area we should spend more time on. All of our patients are outpatients, and so the chances of them being at

one of our sites when there's an earthquake are 50-50, so they need to be prepared at home in the event that the site they routinely go to is not available.” Another Hospital Program Director commented, “We should have exercise days, where it's mandatory and people come in and participate not just within the health authority but within the whole region so including our partners within the community. These exercise days should be opportunities to refresh all players about their roles and responsibilities.”

Ten of the 26 respondents (38.5%) identified retrofitting of facilities and infrastructure as a priority. Four of the 10 were Provincial Emergency Managers (40%), and 4 were Local Emergency Managers (40%). One Provincial Emergency Manager commented, “A priority for me is to support an infrastructure assessment, a quantitative assessment that will give us a concrete idea of that state about the civic buildings.” One Local Emergency Manager noted the importance of the “construction of a post-disaster seismic fire station. That's the number one priority for my office, might not be the number one priority for the political office, or the town hall but it's my number one priority.” Another Local Emergency Manager commented, “The first place I'd start is probably with our heritage buildings, updating heritage structures to earthquake standards fixing our infrastructure, and trying to reduce that structural vulnerability of the old buildings in our municipality.

Nine of the 26 respondents (34.6%) said better site, unit and regional emergency planning was a key priority for increasing seismic preparedness within their organization. Almost half of the Health Authority Program Directors interviewed said better site and unit emergency planning would be a priority for increasing seismic preparedness within their organization (44.4%). One Hospital Program Manager commented, “It would be nice to have an actual plan, and to have the ability to educate people about the plan and to exercise the

plan. It would be really helpful to also provide some support in actually developing the plans.” When asked to comment on a recent power failure at the hospital, one Hospital

Program Manager commented:

The poor response was due to the lack of plans. I think the plans are in place to a degree, but they need fine-tuning and everybody needs to know the plan. I just don't know the capacity for how to make that happen in an organization this large even though it needs to happen. We are heading in the right direction with this work. I would say very few people in my department know the plan, even though they get the links, they get the information, they know where the orange binder is. They are sent all the information, but because we don't do drills and we have never had an event, it's not second nature – it's just not there.

One Hospital Department Manager explained, “We have a plan but it doesn't feel like a complete plan. If I went up to the unit and said we just had an earthquake, your power is out, the floor is a mess, windows are broken, what are you going to do- they would just stare blankly. We need a more detailed comprehensive plan.” Another Health Authority Program

Director added:

I think we need some better direction. I think we need more of a central plan specifically for earthquakes. We have water on site and we try and maintain some of our supplies within other departments but we don't have a specific response to earthquakes we haven't talked about that. So we haven't had organizational direction. We developed a disaster plan, and we developed our pandemic plan. It's not robust, but we have done work within our department around that.

One Health Authority Program Director argued, “We need more detailed plans that identify how the program could run across the health authority. VIHA is not a huge health authority, but it encompasses a large geographic area.” Another Health Authority Emergency Manager brought up the issue of clean up, “cleaning up debris of course’, priority areas are not buildings anymore, the priority areas are systems that we in order need to maintain services.”

Of the respondents who said more of a focus was needed on evacuation and relocation plans and protocols (30.8%; n = 8), half of these respondents were Health

Authority Program Directors, and half were Hospital Department Managers. One Hospital Program Director commented, “We need to work on evacuation and relocation, and what would this look like. Which door would you go through if the elevator was not functioning, how do you schlep machines down the stairs, I still can’t fathom how we are going to do that.”

Another Hospital Department Manager commented:

I don’t know of a contingency plan if we had to relocate. What are we supposed to do when we have a person on a ventilator? As a staff nurse I asked the physicians, surgeons, colleagues, and of managers but no one seemed to have a clear answer. It kind of comes down to if we are going to be evacuating our patients might not be coming with us. I think the staff doesn’t have the support to deal with that. I’m concerned about how we are going to do this. It’s important, and I just don’t know.

One Hospital Department Manager commented, “If our area of the hospital was so damaged, and we couldn’t practice here, I would not know where to go, or how to evacuate all my patients. If it were to happen today, I don’t know what I’d take or leave, or even where I would set up. I really want to know who would make these decisions.”

This chapter presented the qualitative results as collected through respondent interviews. The next chapter presents the discussion.

Chapter 6: Discussion

This discussion aims to highlight major findings based on the collected data. The chapter is organized into five sections: (1) challenges and barriers to enhancing seismic preparedness, (2) operational components of preparedness (3) earthquake response planning and integration, (4) disaster education and training, and (5) disaster exercises.

Challenges and Barriers

Respondents reported on a variety of challenges and barriers in relation to enhancing disaster preparedness. In order of importance, the top three barriers reported were infrastructure (65%; n = 17), time (50%; n = 13) and competing priorities (46.2%; n = 12).

More than three quarters of Provincial and Local Emergency Managers interviewed included infrastructure, more specifically the structural integrity of civic buildings and facilities as major barriers to enhancing seismic preparedness. One Local Emergency Manager explained, “The current fire station (primary emergency operations centre (EOC) and City Hall (secondary EOC) are not up to post disaster seismic code. So, in the event of an earthquake, I have an almost nil response capability because both buildings are coming down- we know that. It will hinder our ability to respond 100%.” The results highlight the increased awareness of how vulnerable infrastructure would be in our region during a damaging earthquake. Assuming adequate funding and support, retrofitting physical infrastructure was the second most common priority area identified by respondents. Although a major priority, many respondents described retrofitting infrastructure as a very costly and time-consuming task. For this reason, concerted efforts need to be placed on implementing non-structural mitigation strategies to reduce the vulnerability to a damaging earthquake.

The second most commonly reported barrier amongst all respondents interviewed was the lack of time to spend on disaster planning and training. A majority of Health Authority Program Directors (75%; n = 6) and Hospital Department Managers (80%; n = 4) Health Authority Program Directors and Department Managers expressed concern about the difficulties associated with finding the time to provide staff with the appropriate training.

One Hospital Department Manager explained:

There are huge pressures to stay within budgets. We are constantly being told no overtime, and with more self-education and training falling to the unit it's very hard to get people away and get them educated. Basically, if I send them for training we have to get replacements, or we shut down our department for the day.

One Health Authority Emergency Manager explained how challenging it was to get the attention of individuals:

There are so many things happening on a day-to-day basis that there is barely enough time to deal with regular everyday crises, nevermind what might or might not happen. So it's a challenge getting people's attention to talk about earthquake preparedness. The mentality is, I don't have time for an earthquake, and I've got this crisis happening this day this day and this day, that needs my attention.

The results highlight the need for more support at the department level. Hospital Administrators need to reach out to external stakeholders such as NGOs and the Ministry of Health to establish and foster linkages and to gather more support and assistance to ensure the necessary planning and training is getting done.

The third most common barrier to enhancing seismic preparedness was the issue of competing priorities. More than three quarters of Local Emergency Managers (83.3%; n = 5) and half of Health Authority Program Directors (50%; n = 4) said competing priorities were a barrier. A majority of the respondents who reported competing priorities as a barrier had a management role of some kind. Many of the respondents explained how other corporate and political priorities receive the necessary time, funding and executive support needed to

increase disaster preparedness. The results highlight the need for upper management to take a leadership role and make disaster preparedness planning and training a priority for their organization.

Earthquake Response Planning and Integration

The findings suggest a need for better integration of earthquake response plans and planning between all stakeholders, in particular with NGOs, and hospitals. Almost half of the respondents interviewed said NGOs had not been engaged in the planning process for their earthquake response plan, nor had NGOs integrated their earthquake response plans with those of the respondents' organization. This is a major gap, especially since in a disaster situation NGOs are often expected to provide secondary support and intervention. Following the M6.7 earthquake in Northridge California in 1994, the Red Cross and Salvation Army led recovery efforts to deal with the estimated 20,000 persons in need of shelter and food (Tierney, 1994). Following the disaster, both organizations operated approximately 42 "refuge centres" for many weeks (Tierney, 1994). That event highlighted the importance of engaging and integrating plans with NGOs like the Red Cross and Salvation Army. The Northridge experience also showed how even a moderate earthquake could easily challenge and overwhelm a community's ability to respond to a disaster.

More than half of the respondents said hospitals were not engaged in the planning process for their earthquake response plan; a majority of these were Local Emergency Managers. Not engaging external stakeholders in the planning process of earthquake response plans, leads to unrealistic expectations and assumptions. One Local Emergency Manager explained: "We found this out last week that VIHA had an expectation that we would be there for them after the earthquake. I told them flat out no we're not. We don't even

have the staff or resources to deal with the level of damage and devastation we will see within our own municipality let alone to bail the hospitals out.” Engaging external stakeholders is crucial, especially since there are thirteen regional municipalities.

Half of the Provincial Emergency Managers said hospitals had not been engaged, nor had their plans been integrated. One Provincial Emergency Manager from the Ministry of Health explained, “We often look a lot to the health authority. We are not as close as most think. On a scale of 1 to 10 about knowing what the Health Authority is doing and in terms of accountability, I'd say it's about a 6 or 7. The health authorities really are independent entities.” These findings highlight a gap at two levels: first, between Hospitals and Local Government and second, between Provincial Government and Hospitals.

More than one quarter of interviewed respondents mentioned unclear roles and responsibilities (34.6%; n = 9), and poor regional planning (30.8%; n = 8) as a barrier to increased preparedness. More than half of these respondents were Local Emergency Managers. The results also reflect the need for increased engagement between all stakeholders during the planning phase, to ensure response plans are integrated and roles and responsibilities are communicated and well defined.

There are two main problems that arise from emergency response planning done in isolation. First, roles, responsibilities and expectations are never communicated; and second, because of this failure to communicate, no one is aware of the other's response capacity or capabilities. Based on these two problems alone, it is difficult to ensure an integrated and coordinated emergency response to a disaster. A study by (Kaji & Lewis, 2006) assessed hospital disaster preparedness of 45 hospitals in Los Angeles, and concluded that disaster preparedness was limited by a failure to fully integrate inter-agency training and planning, as

well as a failure to develop aid agreements. The literature suggests several ways to enhance community linkages including: (1) rigorously exercised plans and drills designed to stress community level response, (2) the development of health care coalitions to facilitate a community wide inventory of medical assets and supplies, and (3) the development of benchmarks and standards to test the effectiveness of community linkages (Braun et al., 2006).

Operational Components of Preparedness

Mass casualty response. Findings suggest more attention needs to be focused on Mass Casualty Response Protocols and Disaster Training and Exercises. More than half of the respondents said Mass Casualty Response Protocols were not addressed in current earthquake response plans. Many Local Emergency Managers expressed an expectation that the Health Authority would take a leadership role in coordinating the regional Mass Casualty response. More importantly, more than half of respondents (62.5%; n = 5) who said earthquake response plans did not address Mass Casualty response were either Hospital Department Managers or Health Authority Program Directors. Despite this, both Health Authority Emergency Managers said it had been addressed. These results highlight differences in the levels of awareness regarding earthquake response plans, specifically between hospital administration and hospital staff.

Mass Casualty events such as the M9.0 Tohoku Earthquake and Tsunami in Japan in 2011 have illustrated the enormity of the disruption and damage that is possible. Given the potential for this region to experience a similar earthquake in magnitude, it is essential that the health systems have a Mass Casualty plan and more importantly, for all Health Authority Program Directors and Hospital Department Managers to know specific protocols. The plans

must be robust enough to deal with the surge of injured patients, in addition to having to deal with possible loss of civic systems and damaged hospital infrastructure. Mass Casualty plans must also be integrated with other community plans to ensure a well-coordinated disaster response.

It has been well known that demands imposed by Mass Casualty events often exceed the capacity of the health and community systems to respond (Yasin, Malok, Nasreen & Safdar, 2009). A study by Yasin et al. (2009) examined the types of injuries most commonly seen at a military hospital following the massive earthquake in Pakistan in 2005. The findings concluded that the total number of patients who arrived at the hospital within hours of the earthquake was 1698, half of whom were admitted to the hospital immediately due to the severity of their injuries. Overall, a total of 2289 operations were performed, and 76 dead bodies were received within hours of the event. The findings of the study illustrate two main points: (1) Mass Casualty events are very complex in nature; and (2) following the event there is a great need for additional medical supplies and resources.

Mass Casualty protocols must address triaging the injured to surrounding facilities, the non-electronic tracking of patients, and the establishment of potential field hospitals. Hospitals should have specific Mass Casualty plans that highlight contingencies on how to deal with the surge of patients and the increased demands for resources, all in less than ideal conditions and in a timely manner.

Resource stockpiles. From the data collected, there were discrepancies reported as to whether stockpiles existed or not. It is also crucial for hospitals to have backup generators, potable water supplies and additional medical supplies. For example, without power, critical care machines such as ventilators are unable to remaining functioning, and without water,

dialysis patients are unable to undergo dialysis. In such conditions, there is an increased risk of these patients experiencing complications and potentially placing them in life threatening conditions. A concerted effort must be made to ensure the continuation of critical medical services post disaster, thus protecting existing vulnerable patient populations. Additionally, knowing which resource stockpiles exist will make it easier to identify what resources will be required, and how they can be accessed most quickly.

It was found that 75% of Health Authority Program Directors said earthquake response plans did not include an inventory of resource stockpiles. One Hospital Program Director said, “We have our regular stock that we carry, we maintain our stock for the procedures we do for our patients. As far as emergency stock, for staff and for the surge of patients we would get, we don’t have that.” In addition to concerns regarding the lack of supplies, many Hospital Department Managers expressed concerns regarding the fact that much of the medical supplies, food and additional resources for Victoria General Hospital are kept at the Royal Jubilee Hospital. One Victoria General Hospital Department Manager explained,

I’ve been told I’m a hoarder. When my program is here (VGH), I refuse to have supplies held over at the Jubilee especially when we have a very unique patient population. I have some of the sickest patients in the hospital under my watch. From an emergency management perspective, it’s the worst thing you can do. All it takes is transportation networks to be destroyed, then how are you going to drive to the other site to get the supplies?

Respondents were also asked whether provisions had been made regarding how resources (personnel and equipment) would be managed. Respondents disagreed when asked whether their earthquake response plan included 24-hour contact information for vendors of medical supplies, food etc., and whether mutual aid agreements with these suppliers existed to outline how and if services will be provided post disaster. Disaster plans need to include

24 hour contact information. Mutual aid agreements with vendors and suppliers of medical supplies, equipment and food are also critical to ensure the arrival of supplies after an earthquake. Maintaining contact with vendors after an earthquake is essential for three reasons. First, such vendors and stakeholders will help ensure the continuity of medical care and services post-disaster. Two, the intense shaking resulting from an earthquake may result in broken medical equipment and restricted access to storage supply rooms and therefore hospitals may require additional supplies. Third, hospitals not only have to have plans to provide services to the surge of patients, but to existing patients, hospital staff and any additional people who will come to the hospital seeking safety or to work.

These results suggest that more effort needs to be made to ensure that an inventory of resource stockpiles are maintained, and plans to acquire supplies and avenues to acquire additional resources from stakeholders are pre-identified and well defined through aid agreements.

Discrepancies were also reported in whether a Staff Recall Policy existed. One Health Authority Emergency Manager explained that although no official policy existed that management has an expectation that staff would report to work after a damaging earthquake. She went on to explain how this expectation was matched with an understanding on behalf of hospital staff. Whether there is or isn't a policy in place, what staff understand as their role in the event of an emergency is important. In the future more staff should be interviewed for their perception and understanding pertaining to their roles and responsibilities following an earthquake. Specific expectations need to be communicated, because experience has shown that most staff will either not report back to work or will only do so after ensuring their families and relatives are safe.

A study by Leiba et al. (2006) of the Thai medical system response after the 2004 M9.1 South Asian earthquake and tsunami revealed that within 15 minutes of the first call, 70% of employees reported back to work. For another hospital in the area, it took 30 minutes to recall an additional 20% of staff. It was also noted that many hospital personnel arrived later after searching for family members, and many hospital employees brought family members with them to work seeking safety and shelter (Leiba et al., 2006). This study shows that provisions must be made in advance for recalling staff to work post disaster and hospitals must have contingency plans in place in case staff are unavailable including: recruiting volunteers, and obtaining additional staff from other health facilities.

Department level contingency plans and protocols. When Health Authority Emergency Managers were asked whether department level contingency plans had been developed to reflect how select departments would provide critical medical services after an earthquake, the respondents frequently gave conflicting answers. When asked whether contingency plans had been developed for Nephrology, Maternity, and Cancer Clinics, one respondent consistently answered yes, while the other respondent consistently reported not knowing. When asked whether departmental contingency plans had been developed for the Surgery department, one respondent answered no, and the other respondent yes. In contrast, both respondents said departmental contingency plans existed for Intensive Care Unit (ICU).

At the department and program level, more than half of Hospital Department Managers (60%; n = 3) said earthquake response plans did not address department level contingency protocols to outline how each specific department would continue to provide critical medical services after an earthquake. One Hospital Department Managers commented:

As for my specific department, I'd say no. We haven't put a lot of thought into it to be honest. We haven't really considered specifically how we would respond if an earthquake compromised our infrastructure. Our response right now is based on the assumption that we are going to be able to work out of this facility and that BCAS will bring the people to us.

The above citation highlights the need for earthquake response plans to identify how each department will continue to provide services, especially in less than ideal conditions. In contrast to the above results, a majority of Health Authority Program Directors (71.4%; n = 5) said department level contingency protocols had been addressed.

It is essential that each department have specific contingency protocols in place to ensure the continuation of critical medical services after a damaging earthquake. It is important to develop such plans to protect vulnerable patient populations, to reduce mortality rates post-disaster, and to ensure sufficient resources are available to deal with the increased demands following a disaster (Nates, 2004). These results reveal a disconnect either in communication or perceptions of existing plans and protocols, and are important because they highlight the pressing need for good communication with regards to contingency plans and procedures. It is also important to note that the scale of planning extends beyond the hospital department and more specifically, for each program spanning across the entire health authority.

Evacuation and relocation protocols. When asked about evacuation and relocation protocols the results were evenly split, with half of the respondents saying earthquake response planning addressed evacuation and relocation protocols, and half saying they had not been addressed. A majority of Health Authority Program Directors (85.7%; n = 6) said they had been addressed, while (100%; n = 5) of Hospital Department Managers said evacuation and relocation protocols had not been addressed. These results once again

highlight a difference in awareness and familiarity of existing plans. One Hospital

Department Manager commented:

We don't know who to take, what to take, or how to take it. It might be outlined in the orange binder, but we are not well versed in it. We put people on ventilators, so in 11 or 12 years with VIHA we have asked the question what to we do with them, how do we move patients on ventilators, and no one has been able to give me an answer. I can't say my staff is comfortable in knowing what to do, if we had to evacuate and relocate order.

When asked about evacuation and relocation protocols, one Hospital Department Manager said, "These are decisions I have to make, because there are no plans about that. It's not set up, and I don't think it's being talked about." The results show there is room for improvement in pre-identifying transportation routes. It is crucial for Hospital Department Managers and staff to be comfortable and well aware of evacuation and relocation protocols, especially since they will most likely be the ones leading the evacuation. Another Hospital Program Director reinforced the importance of such protocols and stressed the need for better evacuation and relocation plans:

We need to work on evacuation and relocation. What would this look like? Which door would you go through if the elevator was not functioning? How would we schlep machines down the stairs? I still cannot fathom how we are going to do that.

After the M6.7 Northridge, California, earthquake in 1994, Schultz et al. (2003) surveyed all acute care hospitals that reported having to evacuate as a result of the earthquake. Results confirmed eight of the 91 acute care hospitals had to be evacuated entirely, and six of these hospitals evacuated patients within 24 hours of the earthquake because of structural damage, loss of power, and water damage from burst pipes (Schultz et al., 2003). The study concluded that even after a moderate earthquake, hospitals might experience sufficient damage to result in the need for evacuation.

To reduce the chaos and confusion after an earthquake strikes, it is essential for hospital administration to have pre-determined sites to relocate to in the event an evacuation is ordered. Plans should include information about who has the authority to order an evacuation, and how this information will be communicated to all departments. It is important to ensure alternative sites that do not expose patients to a greater risk resulting from falling debris or unstable infrastructure. Three advantages to having robust evacuation and relocation protocols include: quick and timely evacuation, less personnel required to implement the evacuation, and fewer potential injuries as a result of the evacuation (Nates, 2004). Addressing evacuation and relocation protocols is important. Staff will most likely be moving patients under less than ideal conditions and circumstances. For instance, the building may lose power, supply carts may be tipped over, and workers may need to evacuate severely fragile and ill patients. These are all reasons that Hospital Department Managers and staff need to be aware of and trained in evacuation and relocation procedures.

Volunteer coordination. Volunteer Coordination is another key area that should be better addressed in earthquake response plans. More than one third of respondents (35.7%) said Volunteer Coordination was not addressed, and 21.4% of respondents did not know whether it was addressed or not. More than half of the Health Authority Program Directors (57.1%) said it had not been addressed, and 80% of Hospital Department Managers said either Volunteer Coordination had not been addressed or were unsure if it was. In terms of recruiting volunteers to help with the medical response, one Health Authority Emergency Manager explained, “It’s not just the coordination of additional people; it becomes an issue of increased risk and liability. There are all sorts of risk involved to make sure they have the updated education and skills. We are in the process of working with the Ministry of Health to

look at implementing legislation that will allow us to use retired health care workers in the event of a disaster.”

The lack of Volunteer Coordination in the past has been identified as a gap within the literature. An article by Franco et al. (2006) analyzed aspects of the medical response to Hurricane Katrina, and found that not having a system in place for managing volunteers contributed to the less optimal response. Experiences following a massive earthquake in Northern Pakistan concluded that although the mobilization of medical students and undertrained volunteers took a significant amount of time to implement, the process was essential in reducing mortality post disaster losses (Yasin et al., 2009).

Internal traffic flow. The findings suggest earthquake response plans need to do a better job of addressing Internal Traffic Flow patterns. Only 64.2% of respondents said earthquake response plans had addressed Internal Traffic Flow. Of the respondents who said they were not addressed, 60% were Health Authority Program Directors. After an earthquake, the surge of patients and casualties can lead to increased chaos and disorder. Within 72 hours of the M6.7 earthquake that struck Northridge, California, over 2,800 persons were treated at area hospitals, a number which climbed to approximately 7,000 in the ten days following the earthquake (Tierney, 1994). These numbers give an idea of the surge that can be expected following a moderate earthquake, thus highlighting the importance of developing routes and protocols for managing the surge of people after a major disaster.

External traffic flow. Earthquake response planning must also better address External Traffic Flow patterns. Even though 57.1% of respondents said it had been addressed, half as many respondents said it was not addressed. Forty percent of Hospital Program Directors said earthquake response planning had not addressed External Traffic

Flow. Not having clearly defined routes could add to the chaos after an earthquake. If the hospital needs to be evacuated, specific routes need to be mapped out with the awareness of how traffic (vehicles and pedestrians) will be moving outside the hospital. After a disaster emergency vehicles, injured patients, concerned family members will all be arriving at the hospital, for this reason hospitals must have a plan to manage the surge of incoming vehicles and traffic.

Disaster Education and Training

The results of this study confirm the need for increased disaster education and training at the acute care level. Based on the results, all Hospital Department Managers (100%; n = 5) interviewed reported having no disaster education or training. Similarly, Health Authority Program Directors (85.7%; n = 6) reported having relatively low levels of Emergency Management education or training. When specifically asked about disaster education and training provided, a majority of Hospital Department Managers (80%; n = 4) and more than half of Health Authority Program Directors (57.1%; n = 4) said no orientation had been provided for earthquake planning in terms of roles and responsibilities, nor was such training mandatory.

A majority of hospital level respondents also reported the lack of ongoing workshops and formal education opportunities available to them in terms of increasing personal preparedness and ensuring currency in disaster plans, procedures and protocols. The above findings highlight a disconnect between the need for disaster education and training, and how much has been implemented. Furthermore, assuming adequate funding and support was available, 88.5% of all respondents identified disaster preparedness education and training as a priority area for their organization. Similar findings were reported in a study by James and

Duarte (2006), which surveyed 80 nurses in Colorado to determine whether they had received specific disaster training and education. The study concluded that 96% (n = 67) of respondents received very little or no training in disaster nursing protocols and procedures. The results also found that 68.8% of nurses who had received disaster training, reported feeling very confident in their ability to respond in a disaster situation. The study not only highlights the need for disaster training to occur in acute environments, but also shows how receiving the necessary training and education increases the confidence levels of hospital staff.

These findings are important for three reasons. First, when an earthquake occurs, Hospital Department Managers and Program Directors are likely to be the ones coordinating the initial medical response. Responsibilities include ensuring set resources are in place to deal with the sudden surge of injured people, care is maintained for existing patients, and other disruptions are dealt with in less than optimal conditions. For these reasons alone, it is crucial that Hospital Department Managers and Program Directors to receive the necessary training and education to help them function under such circumstances. Second, the post disaster patient surge will be unique and different from daily hospital surge. Even though staff may have the clinical skills to deal with a disaster, they may be forced to exercises their skills in alternative care settings or under different circumstances. As a result, specific training needs to be provided to ensure staff have the knowledge and ability to function. Lastly, acute care staff that have not received the appropriate education and training regarding how their roles and responsibilities will change post disaster and in disaster protocols, may inadvertently increase the vulnerability of patients and add to the chaos.

The literature suggests that the education and training of healthcare professionals is inadequate, especially pertaining to disaster specific content (Farmer & Carlton, 2006). Despite these inadequacies the skills, knowledge and training necessary for healthcare professionals in terms of disaster response and patient care are still not a part of the present day curriculum (James & Duarte, 2006). For the reasons stated above, specific education and training regarding disaster plans and protocols is essential.

There are many reasons for low levels of disaster education and training in acute hospital environments. An assessment of preparedness levels at 1750 randomly selected U.S medical surgical hospitals concluded the low levels of Emergency Management education, training and awareness were attributed to insufficient time and resources, competing priorities, and poor executive attention and support for emergency preparedness (Braun et al., 2006). The literature also suggests a major reason for low levels of disaster education and training is that disaster preparedness education is not standardized, nor well implemented in acute care settings (Chapman & Arbon, 2008).

In the face of limited resources, time and funding, Hospital Administrators still perceived the risk for an earthquake to be immense, and for this reason, increasing disaster education and training in acute care environments must remain a high priority.

Disaster Exercises

Another finding of this research suggests that more attention needs to be focused on performing disaster exercises at three levels: multi-jurisdictional, multi-agency and multi-department. Results showed that a majority of respondents (92.3%; n = 12) reported having never conducted a multi-jurisdictional exercise to deal with earthquake response. Even though slightly more respondents had conducted a multi-agency exercise (46.2%; n = 6) the

results still showed there was significant room for improvement. Lastly, a majority of respondents (85.7%; n = 12) reported having never conducted a multi-departmental exercise to deal with earthquake response.

It is essential for stakeholders in this region to focus on performing multi-jurisdictional and multi-agency exercises for three reasons. First, more than 75% of respondents had never activated their planning in response to an earthquake, and in actual fact, need to rely on such exercises to test the efficiency and effectiveness of their disaster response plan. Second, although it was found that 76% (n = 19) of respondents had participated in a disaster response of some kind, only 5% (n = 1) of these respondents had responded to an earthquake. The lack of actual experience in responding to an earthquake once again stresses the importance of performing disaster exercises focused around earthquake response. Lastly, the need for performing such exercises is even greater due to the fact that the risk of a damaging earthquake to occur in the near future is immense.

Serino and Williams (2009) stated that multi-jurisdictional or multi-agency collaborations are important for a number of reasons. First, they build awareness and skills, and become a platform for bridging agencies, promoting partnerships, strategies and collaborations. Second, they help identify misunderstandings in protocols, determine the strengths and weaknesses of disaster plans, and illuminate gaps in communication channels. Unable to perform such exercises and training sessions leads to unclear roles and responsibilities, unrealistic expectations and ultimately an uncoordinated response.

Concerted efforts also must be made to conduct and organize multi-departmental exercises within acute care environments. Not only did 100% of Hospital Department Managers and Program Directors report having never conducted a multi-departmental

response, there was also a large discrepancy in the number of disaster exercises hospital level respondents reported participating in, compared to provincial and local level respondents with hospital level participants experiencing far fewer disaster exercises.

Despite the importance of conducting disaster exercises at all levels multi-jurisdictional and multi-agency disaster exercises, the findings here are consistent with those of other research. A study by (Kaji & Lewis, 2006) assessed the hospital disaster preparedness of 45 hospitals in Los Angeles California and found that although 96% of hospitals had conducted multi-agency drills, only 18% actually involved other agencies in their disaster training.

To increase engagement in disaster exercises requires overcoming many challenges. Institutional challenges include lack of time; resources and funding required to facilitate such exercises. In addition to the institutional challenges that can arise, there are regional challenges including politics, and inefficient regional planning and coordination. Multi-stakeholder disaster exercises and training can help to address some of the challenges identified above. Disaster exercises not only help to identify areas of improvement, but they present key personnel involved in the disaster response the opportunity to become reacquainted with their roles and responsibilities during an actual disaster.

Research Limitations and Uncertainties

This study had several limitations. First, participants were not randomly selected but rather were selected intentionally based on their knowledge, experience and current roles and responsibilities pertaining to Disaster and Emergency Management. Secondly, due to the time constraints, hospital level target groups only included people who had an administrative role in emergency planning. Future research should aim to include Frontline Hospital Staff,

because they will have a different level of experience and specific roles and responsibilities when it comes to responding to a disaster. Third, social desirability bias and self-reporting may have introduced a level of bias into the respondents' answers. Levels of preparedness were reported based on self-perceptions, not on actual reported data and therefore participants may have been inclined to over-exaggerate the current state of disaster preparedness for fear of making their organization look unprepared. Both of these issues influence the accuracy and validity of the findings. Lastly, the questions asked of participants addressed a broad range of areas, and the research did not attempt to quantify preparedness. Fourth, the assessment of preparedness focused particularly on the emergency response planning for the seismic hazard, and for this reason, it is difficult to generalize the results and findings to other hazards.

This chapter highlighted major findings, gaps and limitations in the research process. The following chapter presents the final conclusions and recommendations for this research project.

Chapter 7: Conclusions and Recommendations

The conclusions and recommendations presented in this chapter are based on the data collected from surveys and key informant interviews, and represent a distillation of key results of the research. The initial aim of the study was to conduct a high level assessment to determine how prepared Victoria hospitals were to deal with a damaging earthquake in the region. The research objectives focused on: (1) highlighting current strengths in terms of health system emergency preparedness, (2) reducing the vulnerability of the health sector by identifying key areas of improvement and (3) making recommendations to increase the capacity of the health sector to respond to any future earthquakes. Although a considerable focus was placed on hospital preparedness, another dimension of the study looked into the extent and nature of the connection between hospitals and community stakeholders. Based on the data collected, it can be concluded that the Vancouver Island Health Authority is working to take the necessary steps to increase levels of earthquake preparedness. Still, the data suggests that a significant amount of work remains. The conclusions that are presented below are all considered important and are not ranked or prioritized. The conclusions are framed in the context of community and hospital level recommendations and are organized into three main sections: (1) Earthquake Response Planning and Integration, (2) Operational Components of Preparedness, and (3) Disaster Education Training, and Exercises.

Earthquake Response Planning and Integration

Given that the risk of a damaging earthquake to occur is significant, and that emergency management is a shared responsibility falling on the shoulders of all stakeholders and levels of government increased engagement and integration of plans and protocols disaster response is crucial. The findings highlight the need for increased engagement,

planning and integration between all stakeholders at the community level, in particularly with NGOs and the BCAS.

At the hospital level, more effort needs to be directed towards engaging community stakeholders during the planning process for earthquake response plans, and to integrate hospital and health authority level disaster plans into community disaster plans. Increased mutual aid agreements developed through such a consultative process will help to ensure the availability of resources and external support resulting in a more integrated disaster response that will ideally reduce losses.

Although hospitals are their own entities, more direction, and leadership needs to come from provincial organizations such as the Ministry of Health and Emergency Management British Columbia in an attempt to increase accountability in terms of disaster preparedness and response and ensure compliance with national emergency management standards as identified by the Canadian Standards Association (2008). Provincial organizations need to provide more than just monetary support. More work also must be done to increase the efficiency of regional and local entities such as the RECAC and LGPEC.

Operational Components of Preparedness

While the findings suggest that although a majority of operational components of preparedness have been addressed, some areas for improvement remain. The likelihood of Southern British Columbia experiencing a Mass Casualty event some time in the near future is very likely. With this being said health system stakeholders, health authorities and community stakeholders must take the necessary steps to reduce the vulnerability of the health system and thus increase it's capacity to respond to and recover from such an event. At both community and hospital levels, increased attention needs to be directed in developing

a mass casualty plan. The plan will highlight and outline the logistics of how the health and community stakeholders will work together to cope with a mass casualty event. The development of such plans and protocols before an event occurs will help to reduce the chaos and confusion post disaster. Previous disasters have shown how easy it is for hospitals to become overwhelmed. For this reason, it is important to engage external stakeholders and to identify response capabilities. Other areas that need to be better addressed by hospital level earthquake response plans included securing resource stockpiles, the development of specific department level contingency plans to ensure the continuity of critical medical services following an event, and the development of specific evacuation and relocation protocols and procedures. Volunteer coordination protocols, internal and external traffic flow were also identified as areas of improvement.

Disaster Education, Training, and Exercises

Overall, the results of this study confirm the need for increased disaster education and training at the acute care level. The Vancouver Island Health Authority is located in a seismically active area, and for this reason it is important for employees at all levels be aware of the risk and vulnerabilities which exist. Concerted efforts must be made by hospital administrators to make increasing disaster education and training a priority within acute hospital environments.

Educating employees on how their roles and responsibilities will change, on disaster plan and protocols, and how to be better prepared at home are all key areas which would inevitably increase resilience. By providing adequate disaster education and training opportunities, hospital management can ensure their health care employees have the knowledge, skills and resources to confidently respond to a disaster. Also, more effort must

be made to engage community stakeholders in education and training workshops. Attention should also be aimed at performing disaster exercises at all levels: multi-jurisdictional, multi-agency, multi-department and at personal levels.

Fostering emergency preparedness across the Capital Regional District will be important in the future for saving lives and reducing mortality in the event of a damaging earthquake disaster. Lessons from Japan, Christchurch, South Asia, Haiti and other jurisdictions emphasize a need for proactive planning and action, rather than reactive crisis management. Such a task is not easily achieved by any individual organization, and for this reason, it is crucial for all regional stakeholders work together to increase the resilience of our communities.

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Appendix B: Participant Consent Form



**University
of Victoria**



Research Project Title: Seismic Preparedness of Hospitals in Victoria, B.C, Canada

Dear Sir/Madame:

Thank you for participating in this research regarding the Seismic Preparedness of Hospitals in Victoria, B.C. My name is Harpreet K. Jaswal and I am a Masters of Science student in the Department of Geography at the University of Victoria. This research is being conducted under the supervision of Dr. Denise Cloutier-Fisher Associate Professor in the Department of Geography. The purpose of this research project is to understand how prepared Victoria hospitals are to respond to and recover from a damaging earthquake in the region.

Benefits of Research

From an academic perspective, this project will provide a baseline against which future emergency management research can be measured, in order to assess levels of emergency preparedness. On a broader level, the framework used in this research, including the results, may also have relevance for other communities across the province, across the nation, and possibly world wide. The results will provide the Regional Health Authority with a preliminary preparedness assessment of two tertiary level care facilities. The focus of the research three-fold: (1) to highlight current strengths regarding health sector emergency preparedness (2) to reduce the vulnerability of the health sector, by identifying key areas of improvement, and (3) to increase the capacity of the health sector respond to the damages sustained by an earthquake in this province. The province can also use the results of the preliminary assessment to assist in the decision making process for allocation of resources and funding. The health care framework in British Columbia uses an integrated response model such that emergency management roles and responsibilities fall at various levels and organizations. For this reason, understanding preparedness levels and roles and responsibilities of external stakeholders, is crucial for ensuring an integrated response.

Participating in this research provides you with the opportunity to share your knowledge, experience and insights regarding seismic preparedness within your organization. This research will allow for a better understanding regarding hospital preparedness in our community.

Your participation in this research is completely voluntary. You may withdraw at any time without any consequences or any explanation. If you choose to withdraw from the study, your data will only be used in the analysis and discussion with your permission.

The Survey

If you agree to voluntarily participate in this research, your participation will involve a 45-minute face-to-face survey consisting a series of open and close-ended questions regarding key elements of emergency preparedness. In order to maintain accuracy and eliminate any possibility of misunderstanding the interviews will be tape-recorded.

Data storage and Disposal:

Audio files will be stored on a password-protected computer. Completed surveys will be stored in a locked filing cabinet at the University of Victoria. All data including digital audio and paper files will be disposed of five years after the study is completed.

Anonymity and Confidentiality of Participant Information

Given that you have been selected to participate in this project based on our expertise, the information that you provide will not be anonymous or exclusively confidential. The findings of this research will be contained in a publicly accessible thesis, which can be obtained by contacting the University of Victoria. Direct quotations from the interview may be included in the thesis. Under these circumstances, you will be notified for approval. In addition to the thesis, the findings will be summarized and presented in a report to Victoria Island Health Authority (VIHA) and to representatives from each hospital in the study. The research will also be submitted for presentation at appropriate academic conferences and to pertinent academic journals.

If you have any questions regarding the current research, please contact either my supervisor or myself:

[Contact Information Removed]

You may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria at (250) 472-4545 or the VIHA Research Ethics office at (250) 370-8620.

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you agree to participate in this research.

Name of Participant

Signature

Date

Appendix C: Facilities and Maintenance Survey Instrument

A. Respondent Information

1. Participant Code: _____
2. Telephone: _____ Email: _____
3. Age: ____ 35-40 ____ 41-45 ____ 46-50 ____ 51-60 ____ 60 +
4. Gender: ____ Male ____ Female
5. Employer: _____
6. Position: _____

B. Assessment of Seismic Emergency Preparedness

1. Could you please list the top three hazards you think our region is exposed/susceptible to?
2. How would you rate the level of risk our region faces to a damaging earthquake?

1	2	3	4	5	6	7	8	9	10
Low			Medium				High		
3. What is your overall perception of how prepared the hospital(s) is/are for a damaging earthquake in the region?

1	2	3	4	5	6	7	8	9	10
Low			Medium				High		
4. Are you aware of the implications of short and long duration shaking that would result from an earthquake in our region?
 ____ Yes ____ No ____ Don't Know
5. Does your hospital have a hazard mitigation/prevention program?
 ____ Yes ____ No ____ Don't Know

- 6a. Has a Risk Assessment been conducted for each of your facilities?
_____ Yes _____ No _____ Don't Know
- 6b. If yes, can you please summarize the risks identified as a result of this Assessment?
- 6c. Have the results of this assessment been incorporated into the Emergency Response plan?
_____ Yes _____ No _____ Don't Know
- 7a. Have provisions been made to ensure the continuation of essential utilities such as electrical, water and waste management systems within your facility?
_____ Yes _____ No _____ Don't Know
- 7b. If yes, please elaborate.
8. What structural mitigation measures (e.g. support building with beams, columns, foundations, supporting walls) been used throughout your facility?
9. What non-structural mitigation measures (e.g. shelves bolted to walls, computers strapped down) have been used throughout your facility?
10. Have arrangements been made to assess the structural integrity of your facility after a damaging earthquake?
_____ Yes _____ No _____ Don't Know
11. Have arrangements been made for the cleanup and removal of debris after a damaging earthquake?
_____ Yes _____ No _____ Don't Know
12. Can you identify any priority areas for increasing seismic preparedness within your facility?

13. Can you identify any challenges/barriers to increasing seismic preparedness within your facility?

C. Respondent Emergency Preparedness and Response Background

1. In your current position, can you please briefly describe your role and responsibilities as they pertain to emergency preparedness/ management?
2. Please describe your role in the emergency response for a damaging earthquake in the region?

D. Building Information Spreadsheet

1. Which buildings fall within your area of responsibility?
2. Which building code are these structures in compliance with?
3. Which buildings have been retrofitted to latest seismic standards ?
4. In the event of an earthquake, which building(s) would you be most concerned about and why ?

Appendix D: VIHA Administration, External and Hospital Level Survey Instrument

* The other instruments contained a subset of questions from this more comprehensive survey.



**University
of Victoria**



Date: _____
Time Started: _____
Time Ended: _____
Code: VIHA_ADMIN

Seismic Preparedness of Hospitals in Victoria, B.C, Canada

A. Respondent Information

1. Participant Code: _____
2. Telephone: _____ Email: _____
3. Age: ____ 35-40 ____ 41-45 ____ 46-50 ____ 51-60 ____ 60 +
4. Gender: ____ Male ____ Female
5. Employer: _____
6. Position: _____

B. Respondent Emergency Preparedness and Response Background

1. In your current position, can you please briefly describe your role and responsibilities as they pertain to emergency preparedness/ management?

2. What education/training specific to emergency preparedness/management have you received?

3. Can you please tell me how many times you have participated in the following types of disaster exercises:

___ Table Top Exercise ___ Full Exercise ___ Drill ___ None

- 4a. Have you ever participated in the emergency response for a disaster?

___ Yes ___ No

- 4b. Can you please describe the event (e.g., When, where, and the nature of your role and responsibilities)?

C. Assessment of Preparedness

I. Organizational Framework

1. Is there a disaster preparedness policy within your organization?

___ Yes ___ No ___ Don't Know

2. Which of the following response systems does your organization use:

_____ Hospital Incident Command System (HICS)

_____ Incident Command System (ICS)

_____ British Columbia Emergency Response Management System (BCERMS)

3. Is there a clear response structure (e.g. Emergency Operations Center) defined at the:
- _____ Site Level _____ Regional Level _____ Corporate Level
4. Is there a multi-stakeholder advisory committee to support the program coordinator in the planning, implementation, evaluation, and revision of the Emergency Management Program?
- _____ Yes _____ No _____ Don't Know
- 5a. Does your Emergency Management Program have formal/written performance goals/objectives?
- _____ Yes _____ No _____ Don't Know
- 5b. Are these performance goals/ objectives integrated into short and long-term work plans?
- _____ Yes _____ No _____ Don't Know
- 5c. What percentage of these performance goals and objectives are fully funded?
- _____ %
6. Is your Emergency Management Program evaluated, based on a review of goals and objectives?
- _____ Annually ___ Biannually ___ 5 years

II. Earthquake Hazard Awareness

1. Could you please list the top three hazards you think our region is exposed/susceptible to?

- 4b.** Are earthquake emergency response plans easily found within any umbrella disaster response plan that may be used (e.g. "All-Hazards Response Plan)?

Yes No Don't Know

- 4c.** Please explain:

- 5.** Which of the following areas are addressed by your earthquake response plans?

Command and Authority Channels

Mass Casualty Response Triage Response Decontamination

Internal Traffic Flow External Traffic Flow Public Information

Resource Stockpiles Evacuation/ Relocation Training & Exercises

Volunteer Coordination Media Relations Pandemic Control

Records Management Safety and Security

- 6** Has each of the following departments developed contingency plans to reflect how each of the following departments will provide critical medical services after an earthquake?

- | | | | | |
|-----------|-------------------|-----|----|------------|
| a. | Nephrology | Yes | No | Don't Know |
| b. | Maternity | Yes | No | Don't Know |
| c. | Cancer Treatments | Yes | No | Don't Know |
| d. | ICU | Yes | No | Don't Know |
| e. | Surgery | Yes | No | Don't Know |

IV. Community Partnerships

1. Which of the following groups are engaged in the "**planning process**" for your earthquake plan?

Multi-Disciplinary Hospital Staff Local Authorities Bedline

Other Health Authorities Nurse Line BCAS

Non-Governmental Organizations (NGO) Other _____

2. Which of the following stakeholder groups integrate and coordinate their response plans with your earthquake plan?

Local Government(s) Non-Governmental Organizations (NGO)

Capital Regional District Air and Gas Suppliers Drug Suppliers

Food Suppliers Bulk Water Fire

Police BCAS

3a. Does your emergency response plan identify roles and responsibilities of external support organizations after an earthquake? (E.g. police for security/traffic control)?

Yes No Don't Know

3b. Have you communicated these responsibilities, and are these organizations in agreement?

Yes No Don't Know

V. Facilities

1a. Has a space been designated for the hospital Emergency Operations Center?

Yes No Don't Know

1b. If yes, where?

3. Does your organization have mutual aid agreements with suppliers (e.g. blood, food, water, gas, waste management) to provide you with materials immediately after an earthquake?

Yes No Don't Know

- 4a. Should your organization require additional personnel, equipment, or supplies have external support resources and avenues been identified? (e.g. locally, regionally)?

Yes No Don't Know

- 4b. If yes, please elaborate:

5. Do you have 24-hour contact information for local vendors for medical equipment?

Yes No Don't Know

6. Is there a current policy in place to recall staff back to duty in the event of a disaster?

Yes No Don't Know

VIII. Education and Training

- 1a. Does your organization provide seismic preparedness training for "new" employees?

Yes No Don't Know

- 1b. Is it mandatory for employees to participate in regular preparedness training programs?

Yes No Don't Know

- 1c. As a part of this training are employees formally oriented to the earthquake planning and their role and responsibilities?

Yes No Don't Know

- 2a.** Does your organization provide ongoing earthquake education workshops/classes to facilitate staff preparedness and to ensure currency of procedures?

_____ Yes _____ No _____ Don't Know

- 2b.** If yes, how often are they held?

- 3.** Are key position holders involved in emergency response required to undertake earthquake training?

_____ Yes _____ No _____ Don't Know

IX. Exercises

- 1a.** Have you ever conducted an earthquake drill/exercise?

_____ Yes _____ No _____ Don't Know

- 1b.** If so, when was the last drill/exercise?

- 2a.** Were corrective action work plans, based on the lessons learned incorporated into the earthquake planning?

_____ Yes _____ No _____ Don't Know

- 2b.** If yes, can you provide any specific examples of this?

- 3.** Have you ever conducted multi-jurisdictional exercise to deal with earthquake response?

_____ Yes _____ No _____ Don't Know

- 4. Have you ever conducted multi-agency exercise to deal with earthquake response?
 Yes No Don't Know

X. Relocation

- 1. Do you have earthquake building evacuation plan?
 Yes No Don't Know

- 2a. If evacuee relocation is required, have alternative care sites been identified?
 Yes No Don't Know

- 2b. If yes, where?

- 3. Have these alternate care sites been evaluated for seismic integrity?
 Yes No Don't Know

- 4. Have evacuation routes been identified?
 Yes No Don't Know

D. Future Directions

- 1. Can you tell me some challenges/ barriers to increasing seismic preparedness within your organization?

- 2. Assuming adequate funding and support what are the priority areas for increasing seismic preparedness within your organization?

