

## Individual Emergency Preparedness Survey Among Canadians in Lower Mainland, BC

Eric Yam<sup>1</sup>, Dale Chen<sup>2</sup>

1 Lead Author, B. Tech Student, School of Health Sciences, British Columbia Institute of Technology, 3700 Willingdon Ave, Burnaby, BC V6G 3H2

2 Supervisor, School of Health Sciences, British Columbia Institute of Technology, 3700 Willingdon Ave, Burnaby, BC V6G 3H2

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### Abstract

**Background:** BC residents are prone to natural disasters and emergencies such as earthquakes and prolonged power outage due to severe weather and flooding. To minimize and mitigate the impacts, individuals should prepare in advance for any potential emergencies. There are studies showing only half of the Canadians, in general, are well prepared. Concrete evidence of factors affecting individual's emergency preparedness are not clear. Therefore, this research study aims to investigate the association between BC residents' emergency preparedness level and demographic/socio-economic factors.

**Methods:** Housed on SurveyMonkey, the online self-administered survey was distributed via Facebook and Reddit to survey local BC residents. The survey was posted on sub-groups based on topic-relevance and geographic areas that are located within Lower Mainland. The sampling period is approximately one month, which the results were analyzed by the NCSS program.

**Results:** Overall, less than half (41%) of the participants reported to have an emergency kit at home. The chi-square test results show that two factors, language ( $p=0.025$ ) and status of occupancy ( $p=0.048$ ) are significantly associated with level of emergency preparedness.

**Conclusion:** There are significant associations between level of emergency preparedness and demographic factors - language barrier and status of occupancy. People who do not use English as their primary language found to be less prepared to those who use English as their primary language. Renters, as compared to homeowners, found to be less prepared as well. This serves as supporting data and evidence to transit these findings to promote emergency readiness among residents in Metro Vancouver.

Key words: emergency, emergency preparedness, disaster, Canadian, survey, earthquake, Lower Mainland

## **Introduction**

Natural disasters including climate-related and geophysical disasters have affected hundreds of millions of people every year around the globe (Leaning & Guha-Sapir, 2013). Over the last four decades, climate-related disasters have grown considerably in terms of scale and frequency, largely due to climate changes caused by rapid urbanization, deforestation, and environmental degradation (Leaning & Guha-Sapir, 2013). Inevitably, like many other countries, Canada is prone to natural disasters such as earthquakes, wildfires, and floods. According to Natural Resources Canada, experts predicted that there is a 30% chance of a massive earthquake hitting Western Canada in the next 50 years (Insurance Bureau of Canada, 2015). Disasters can result in devastating consequences including environmental and public health issues such as poor water supplies, food deficits and lack of sanitation management. As such, emergency preparedness among individuals, organizations, public agencies, and government levels are necessary to mitigate and minimize the health risks during an emergency.

In 2014, for the first time in Canada, Statistics Canada examined Canadians for their emergency preparedness and resilience via phone survey (Taylor-Butts, A., 2016). Similarly, Government of BC conducted an online survey of local Canadians focused on their personal emergency readiness (Ipsos Public Affairs, 2017). With a growing concern of a significant earthquake hitting BC, little has been done on assessing public knowledge in emergency readiness. Therefore, this research project aims to further examine the contributing factors that affect individuals' emergency

preparedness in Metro Vancouver, and to discuss the knowledge gap on promoting effective emergency preparedness to the general public.

## **Literature Review**

### **What is Emergency Preparedness?**

In BC, risks and hazards associated with earthquakes, floods, wildfires, and tsunamis are monitored by British Columbia Provincial Emergency Program (Government of Canada, 2019). In order to respond effectively to emergency, individuals and families can prepare in advance to minimize health risks and recover more quickly. British Columbia Emergency Management System (BCEMS) is a comprehensive guideline that outlines standardized four-phase emergency management system (mitigation, preparedness, response, and recovery) for all stakeholders including private and public industries, organizations, and non-government/government agencies (Government of BC, 2016). Preparedness is a stage involved planning, training, exercises, and public education that prepares individuals and stakeholders to respond promptly to emergency and recovery (Government of BC, 2016).

Although the BCEMS is developed mainly for large groups and organizations, the principles are applicable in individual level. Using the same principles in BCEMS, PreparedBC educates the public that there are three elements to prepare for emergencies - know your hazards, make your emergency plan, and build your emergency kit (Government of BC, 2019). Depending on your geological area, you might be at risk to different hazards and potential disasters. By understanding the hazards that might affect the household, the

public can properly prepare specific strategies to mitigate the risks as well as an emergency plan to execute during the emergency.

An emergency plan consists of information that guide your actions during an emergency. For example, contact list of family members and friends, pets' information, plan of actions, escape route, location of water and gas valve, emergency kit location, and much more (Government of BC, 2019). Consideration of family members are important factors when developing a plan, especially if one has pets or seniors at home since the course of action may be different. Onukem concluded that 57% of Canadian households own pets, and their emergency plan lacks adequate procedures for evacuating animals (Onukem, M. 2016). Depending on the situation, the affected individuals may need to remain at home with the emergency kit or leave with a grab & go bags (Government of BC, 2019). Basic supplies in the kit and bag should include water, non-perishable food, first-aid kit, extra clothing, radio, and flashlight (Government of BC, 2019). Canadians are expected to prepare adequately to sustain themselves for at least 72 hours (Government of BC, 2018).

### **Public Health Significance**

Natural disasters can lead to devastating impacts on community in various ways. Public health problems can arise when a sudden impactful natural disaster affects a community.

Communication, transportation, and utilities can be compromised due to the damage caused by disasters. The inaccessibility to resources such as food, water, or medical attention can be devastating

to those who do not have adequate supplies or emergency kit at home. The sanitation facilities and sewage disposal may be disrupted, which could lead to unsanitary conditions (WHO, 2013). Potable water may become unavailable, power outages can last for days (Du, Fitzgerald, Clark, & Hou, 2010). These problems can lead to disease outbreaks such as typhoid and shigellosis (WHO, 2013).

Out of all natural disasters, floods are the most common disaster; it accounts for 40-50% of all disaster-related deaths in the world (Du, Fitzgerald, Clark, & Hou, 2010). In fact, floods have increased two-fold in frequency since 1980 (Tucker, 2000). According to Canadian Disaster Database, flooding is the most prevalent disaster that affect Canadian from 2000 - 2014 (Taylor-Butts, A., 2016). Human health can be impacted either directly or indirectly by the flooding water (Du, *et al*, 2010). For example, water could be contaminated from failed sewage system, causing waterborne illness via ingestion or wound infection (Du, *et al*, 2010). If local potable water line is damaged and contaminated, people can only rely on bottled water for drinking and sanitation. In addition, there are concerns for zoonotic and vector-borne disease due to animal displacement (Noji, 2005). Rats and mosquitoes can emerge in the affected area (Du, *et al*, 2010).

### **Risks in BC**

In BC, Canadian have been facing many different natural disasters such as wildfires, floods, earthquakes, avalanches and so forth. Depending on the geological location, different cities face different risk of natural disasters. For examples, communities located in low-lying areas and near

water are most at risk of flooding (Du. *et al.*, 2010). Furthermore, Vancouver is well known for its long and heavy rainfall season. Based on Figure 1., it is noted that many areas such as Port Coquitlam, Richmond and Delta along the Fraser River are low-layer areas that are prone to flooding.

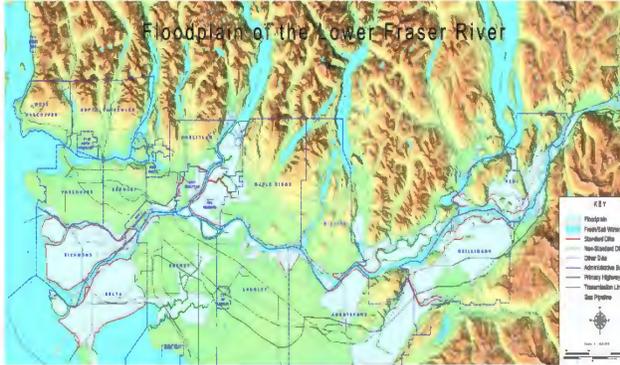


Figure 1. Floodplain of the Lower Fraser River. Retrieved from [https://www.fraserbasin.bc.ca/Library/Water\\_Flood/floodplain\\_image2.jpg](https://www.fraserbasin.bc.ca/Library/Water_Flood/floodplain_image2.jpg)

Historically, recorded in 1948, the second largest flood in Fraser River caused hundreds of millions of dollars in damages and 16000 people needed to evacuate (Fraser Basin Council, 2019). Although the last significant flood is in 1948, an upcoming earthquakes and tsunami can trigger floods that cause devastating loss in BC because there is extensive urbanization of residential, commercial, industrial, and other infrastructures in the floodplain (Fraser Basin Council, 2019). The Lower Mainland is considered as a high-risk zone to flooding due to concentrated development and large growing population (Tucker, 2000).

In addition to floods, BC is also at risk of earthquake. Situated at the Cascadia subduction zone (active earthquake zone), there is a 30% probability that coastal BC is struck by a massive earthquake in the next 50 years (Insurance Bureau

of Canada, 2015). Subduction zone earthquakes, which is the only source zone that is able to generate magnitude greater than 8.5 earthquake, will hit coastal BC in the near future (Pacific Northwest Seismic Network, 2019). In Figure 2 below, it shows that two different earthquake source zones may affect Canada.

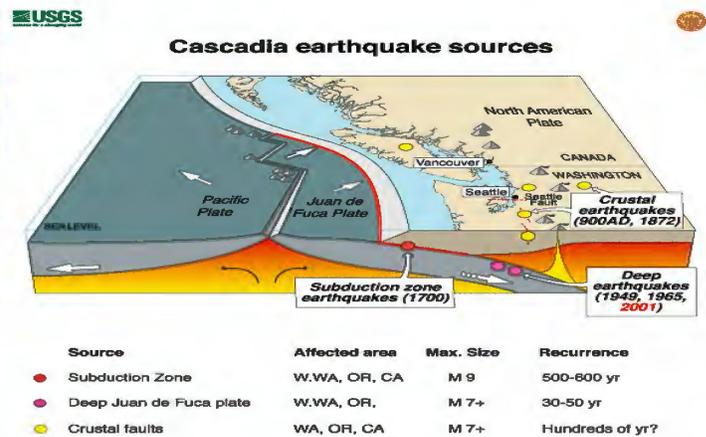


Figure 2. Map of Cascadia Earthquake Sources. Retrieved from <https://pnsn.org/outreach/earthquakesources/csz>

### Current Emergency Legislation and Guidelines

In BC, for private industries, organizations, or other stakeholders, there are acts and regulations that specify the duties in emergency management in their operation areas (Government of BC, 2016). For instance, the Drinking Water Act requires the water operators to have a written emergency plan in place (Drinking Water Act, 2019). While there are several acts and regulations that set forth to govern all the stakeholders related to emergency planning to minimize risk of health risk during an emergency, there are only guidelines that provide information for the general public.

### Current Emergency Preparedness Promotion Programs

On the other hand, emergency preparedness

programs are implemented via government agencies and non-profit organizations to educate the general public. For example, Emergency Preparedness Week, hosted by Emergency Management BC annually, is a national awareness initiative that collaborate stakeholders such as fire services, insurance companies, and community groups that promote emergency preparedness at the local level (Government of Canada, 2019). Throughout the year, City of Vancouver offers free earthquake preparedness workshops to the general public (City of Vancouver, 2019).

### Emergency Preparedness Survey Findings

The first emergency preparedness survey in Canada was conducted via phone in 2014 by Statistics Canada (Taylor-Butts, 2016). The purpose of the survey was to investigate Canadian risk awareness and overall preparedness in ten provinces. Similarly, on behalf of Government of BC, Ipsos Public Affairs conducted an online survey on British Columbians in 2017 (Ipsos Public Affairs, 2017). Arguably the difference between the two surveys is minimal, and it suggests that only about half (47% & 54% respectively) of the Canadian have a partial emergency response plan. Chart 1 below illustrates the comparison between findings.

### Risk perception

Nationally, Canadian are most concerned about severe weather and power outages (Taylor-Butts, A., 2016). In contrast, British Columbians recognize their communities are most at risk of earthquakes (Ipsos Public Affairs & Taylor-Butts, A., 2017 & 2016). Consequently, it suggests emergency perception vary significantly among provinces in Canada.

### Personal & socio-economic factors

Based on both surveys, different approaches are used to assess the underlying reasons why Canadian are not heavily involved and participated in emergency planning. In particular, personal motives, social, economic, and demographic variables are investigated (Ipsos Public Affairs & Taylor-Butts, A., 2017 & 2016). In general, individuals with lower socio-economic status lack resources to participate in emergency preparedness (Taylor-Butts, A., 2016). Other factors such as age, income, immigration status, visible minority, health conditions, property occupancy, and sex were associated with level of preparedness (Taylor-Butts, A., 2016).

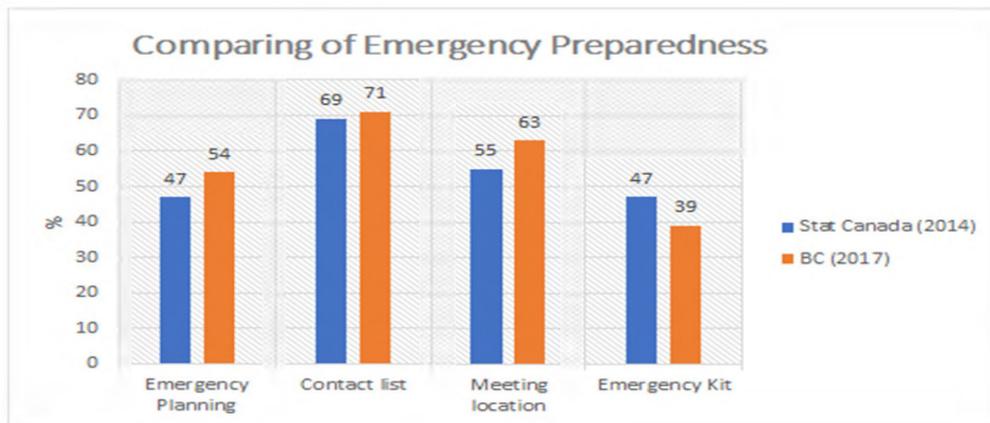


Chart 1. Comparison of Emergency Preparedness. Adopted from Ipsos Public Affairs & Taylor-Butts, 2017 & 2016

Although both surveys explored a wide range of factors that could affect people's emergency preparedness, the surveys were not comprehensive. Ethnicity, education level, property's proximity to coastline/water, and language barrier were not discussed in the surveys. In addition, two years have passed since the last survey in BC, a new survey is needed to assess whether emergency readiness promotion from the government is effective in changing British Columbians' behavior over the last two years. Furthermore, the previous survey did not include geographical differences that might affect the level of preparing for an emergency. Based on the two previous surveys, risk perception is different among provinces; likewise, Canadians who reside in different geographic areas in Vancouver may have different perceived concerns, resulting various emergency planning. Research is required to confirm whether residence location will affect people's emergency preparedness within BC.

While both surveys investigate individual emergency preparedness in a national and provincial level, no findings are specific to municipal level. In BC, coastal cities in Lower Mainland are at greater risk of devastating earthquake that could lead to severe flash floods. A new research survey should be conducted to specific cities in the Lower Mainland that are at risk of earthquakes and floods. By conducting a new survey that examines the missing elements, new associations can be proposed among local BC Canadians and enhance their emergency preparedness level. New emergency guideline, promotion, and practices can be developed to tailored to local BC Canadian.

## **Purpose of the Study**

The purpose of this study is to examine associations between emergency preparedness level and factors such as ethnicity, education level, living location, and language barrier among local Canadians in Metro Vancouver - mainly the Lower Mainland.

## **Methodology**

### **Materials**

The materials used in this study include a computer, a statistical analyzing software – NCSS, as well as Survey Monkey for hosting the online survey (Survey Monkey, 2019).

### **Methods**

Using Survey Monkey, the online self-administered survey was created and housed in a Canadian server. The survey was distributed to local BC residents via social medias on Reddit and Facebook. Community groups on social medias were chosen based on topic-relevance and geographic. Consequently, the survey was published on sub-Reddit groups named "ClimateCrisisCanada" and "Vancouver" as they are most relevant to this research. For Facebook, the survey had been posted in different local community groups such as "BC Environmentally Friendly Community". After BCIT Ethic Boards approved the research survey method, the survey became available online for approximately a month from January 12 to February 18, 2020. According to Deuskens *et al*, small prizes used in survey can increase the response rate (Deuskens, *et al*, 2004). In order to encourage more participants, for each participant who completed the survey and provided an email, they automatically enter a draw

for a chance to win a \$40 wireless speaker. Furthermore, participants can gain an additional draw by referring the survey to another participant. The referred participants will be asked to provide the email address from the referrer for verification. Nonetheless, it is optional to provide an email for the prize drawing.

The survey has a series of nine questions designed to assess demographic information and their level of emergency preparedness. All questions are either multiple choice or checkbox (able to select more than one answer). The average time of survey completion is around 3-5 minutes.

### **Inclusion and Exclusion**

Any permanent residence or citizens resided in Greater Vancouver, the metropolitan area that include major urban centers in the Lower Mainland, are eligible to participate in this study.

For the purpose of this study, participants from nearby areas such as Vancouver Island were included. Anyone who is not a permanent resident or citizen, for example an individual with temporary working permits and study permits, or those who do not reside in Metro Vancouver were ineligible in this study. Therefore, this study is only interested in assessing level of emergency preparedness among local BC Canadians/permanent residents in Metro Vancouver.

### **Ethical Considerations**

According to BCIT Research Ethics Boards (REB), any BCIT study that involves human participants must be reviewed and approved by REB (BCIT, 2019). This review process ensured all researches were conducted in a manner that met ethical

standards (Tri-Council Policy Statement, 2014). Ethical standards include informed consent, fairness and equity, privacy and confidentiality, conflicts of interest, and so on (Tri-Council Policy Statement, 2014). Therefore, information collected from this study were kept confidential where participants who did not provide an email remained anonymous. If participants provided an email to enter the draw for the prize, the email will be encrypted and stored in a computer that is protected by password and will only be accessible by the research principle investigator. All emails collected from the study will be discarded once the prizes are delivered. The consent form followed by the cover letter will be included in the survey. Participants must give consent and understand the purpose, risk and benefits, inclusion and exclusion criteria of the study in order to complete the survey. In addition, participants are able to skip any question and withdraw from the survey at any time.

### **Statistical Analysis**

#### **Description of Data**

All data collected are multichotomous or dichotomous nominal and ordinal data. Questions on the survey are close ended. To assess level of emergency preparedness, participants are asked to indicate their involvement in emergency planning activities. Examples of activities include whether they have an emergency kit in place, or whether they have a copy of contact list of their family members. The full list of activities is described in Appendix C (survey question 9). Participants who scored more than four or more emergency planning activities are rated “strong” in level of emergency preparedness, where “moderate” and “weak”

ratings indicate two to three and zero to one activities respectively.

At the end of the study, there were total of 54 completed surveys. As a result, there was a 96% completion rate for all the questions, where two participants did not answer the question regarding the “most concerning emergency/disasters”. Based on the inclusion and exclusion criteria, three surveys are omitted. One of the omitted survey respondents is located outside Greater Vancouver area, and the other two respondents are underage (under 18).

**Descriptive Statistics**

Based on the collected data, a total of N=11 (22%) non-primary English users and N=40 (78%) primary-English users have participated in the survey. Their corresponding level of emergency preparedness is shown in chart 2 below.

Among the 51 respondents, the proportion of emergency readiness level are shown in pie chart 3 and 4. Most (91%) of the participants who do not use English as their primary language have a weak level of emergency preparedness. In comparison, only 45% of primary English users are rated weak, while 48% and 7% of respondents have moderate to high level respectively.

Participants not using English as their Primary Language



■ Strong ■ Moderate ■ Weak

Chart 3. Proportion of emergency preparedness level among non-primary English users.

Number of Primary/non-English User and Their associated Level of Emergency Preparedness

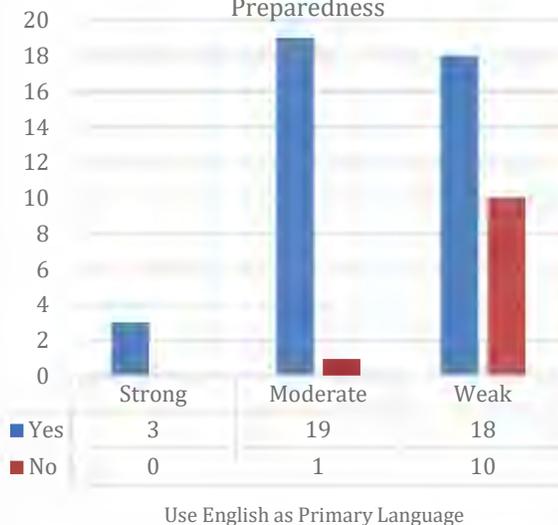
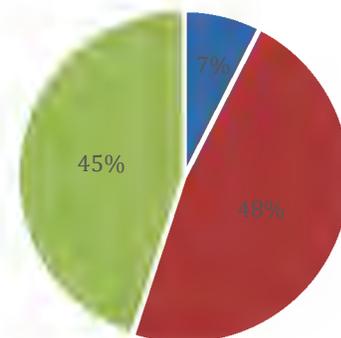


Chart 2. Number of primary English users/non-English users and their associated level of emergency preparedness.

Participants using English as their Primary Language



■ Strong ■ Moderate ■ Weak

Chart 4. Proportion of emergency preparedness level among Primary English users

On the other hand, a total of 26 tenants and 25 owners responded to this study. Their corresponding level of preparedness is shown in chart 5.

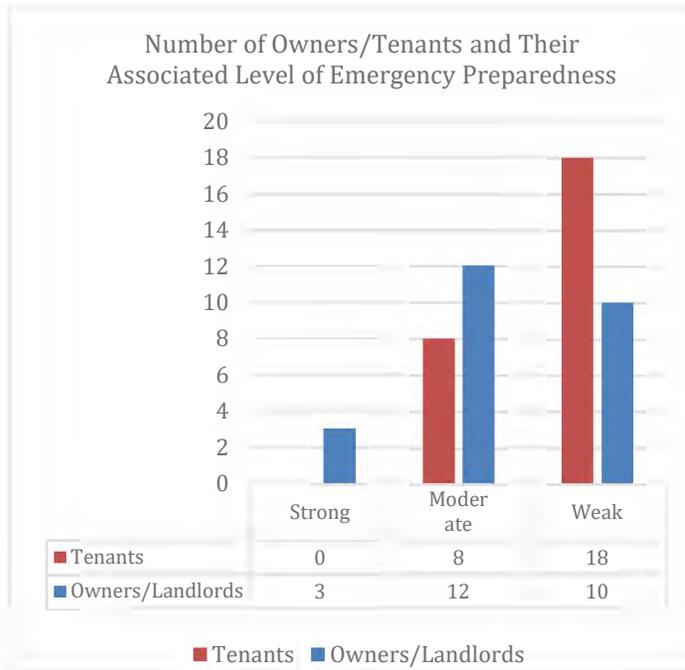


Chart 5. Number of tenants/owners and their associated level of emergency preparedness.

There are 69% of the tenants rated weak in terms of level of emergency preparedness as compared to 40% in Landlords. In addition, more owners (48%) scored “moderate” than tenants (31%).



Chart 6. Proportion of emergency preparedness level among owners/ landlords

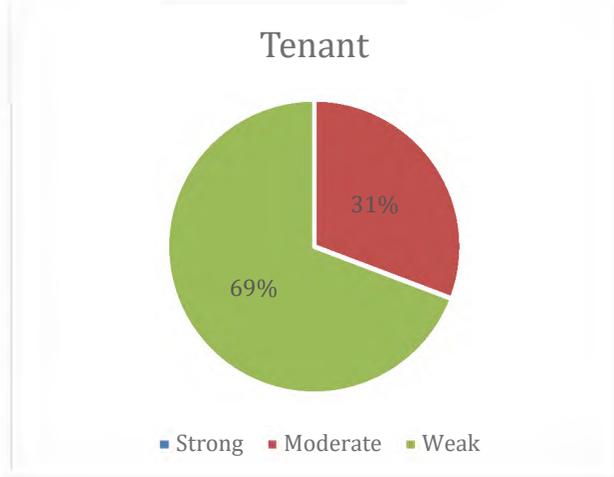


Chart 7. Proportion of emergency preparedness level among tenants.

### Inferential Statistics

In this research study, NCSS is used for statistical analysis. Chi-square test is used to examine the association between emergency preparedness and demographic/socio-economic factors. The independent variable is level of emergency preparedness, and the dependent variable is all the other factors. The list of collected data is attached in the Appendix D.

### Results

This study investigated the potential association between the level of emergency preparedness and factors in questions. Two demographic factors are found to be significantly associated with the level of emergency of preparedness. The hypothesis and the results are listed as follows:

**Table 1. Results of the hypothesis**

H <sub>0</sub> and H <sub>A</sub>	Test used	Result p-value = 0.05	Conclusion (alpha or beta error if relevant)
H <sub>0</sub> : There is no association between the level of emergency preparedness and whether individuals use English as their primary language H <sub>A</sub> : There is an association between the level of emergency preparedness and whether individuals use English as their primary language	Chi-square test	P = 0.025	P = 0.025, therefore <b>reject</b> null hypothesis and conclude that there is statistically significant association between the level of emergency preparedness and whether individuals use English as their primary language. Primary English users seem to have higher level of emergency preparedness than non-English users. Potential alpha error, therefore, the p-value can be reduced to 0.01 which can minimize the error.
H <sub>0</sub> : There is no association between the level of emergency preparedness and the status of occupancy H <sub>A</sub> : There is an association between the level of emergency preparedness and the status of occupancy	Chi-square test	P = 0.048	P = 0.048, therefore <b>reject</b> null hypothesis and conclude that there is statistically significant association between the level of emergency preparedness and the status of occupancy. Tenants seem to have weaker level of emergency preparedness than owners. Potential alpha error, therefore, the p-value can be reduced to 0.01 which can minimize the error.

## **Discussion**

### *Language Barrier*

Based on the statistical analysis, there are two findings that show significant results – language barrier and status of occupancy, individually, are significantly associated with level with of emergency preparedness. Among the 51 respondents, 91% of participants who do not use English as their primary language have a weak level of emergency preparedness as compared to only 45% of primary English users. The results indicate that language barriers potentially compromise individuals’ ability to prepare for emergencies. Based on the current emergency preparedness promotional programs offered by the City of Vancouver, all workshops are only available in English (City of Vancouver, 2019). Local BC residents who do not use English as their primary language may lacks the opportunities to enhance their knowledge and skills on emergency preparedness due to language barrier.

Canada is one of the most multicultural countries, proudly recognizing and values Canadians of all ethnic groups and languages. In Metro Vancouver, there are more than 728,000 non-English-language mother tongues, representing around 30% of the total population (Statistics Canada, 2012). Due to diversified immigrants that come from all over the world, Language programs such as Language Instruction for Newcomers to Canada (LINC) are available to help new immigrants to overcome language barrier (Government of Canada, 2018). Similarly, as the emergency preparedness promotional programs provided by various organizations are primary in English, there is a need to tailor the programs to different language users.

### *Status of Occupancy*

The results also suggested that status of occupancy is significantly associated with level of

emergency preparedness. Out of the 25 owners, 52% reported to have moderate or strong level of preparedness. In comparison, only 31% of the tenants have moderate level. This finding agrees with both previous research studies, which reported that emergency preparedness behaviors are less common among renters (Ipsos Public Affairs, 2017) & (Taylor-Butts, A., 2016). Emergency events such as floods and wildfires can cause significant damage to homes. Therefore, it is not surprising to see homeowners more likely to participate in emergency preparedness to mitigate the impacts.

### *Overall Findings*

Overall, less than half of the participants (41%) reported to have an emergency kit at their homes, which has similar results with the study in 2014 (Taylor-Butts, A., 2016). Similarly, 54% of the respondents reported that they only participated in one or less emergency planning activities, as compared to 42% in the study in 2014. Other socio-economic and demographic factors such as age, education level, and type of properties show no significant results, which is contradicting to previous research findings done by Taylor-Butts and Ipsos. However, the results may not be valid because of small sample sizes of the study (51 samples). Based on the design of the questions in the survey, there are many segmented answers for age (6 choices) and education level (9 choices) which lead to scattering responses. In other words, there are only a handful of responses on each answer choice. A larger sample size is required to increase validity of the findings. In addition, there is a limitation of sample randomness since the collected samples are solely from people who have access to internet. The results can only be extrapolated to

local Canadians who uses social medias on Facebook and Reddit.

### **Limitation**

The main limitation of this study is the restricted sample size due to restraints on time and money. With four weeks period of sample collections, only 51 (3 were excluded) responses were collected. Also, the prize of participating to this study is a BCIT-sponsored wireless speaker, which may not be appealing to many. A longer sample collection period and a more valuable prize should increase the sample size which can increase external validity and decrease beta error. On the other hand, as mentioned earlier in this paper, the online self-administered survey could be a limitation itself. While online survey can generate the highest response rate and thus more useful in a time-restrained project, it is limited to participants who have access to the internet only. In addition, people who do not have an account with Facebook and Reddit are excluded from participating. Self-selected sub-groups on social medias also lead to limited sample randomness and sample size which can compromise the external validity. A combination of online survey and in person interview will be the best option to obtain more randomized sample populations.

### **Knowledge Translation**

In general, the results from this study agree with Talors-Butts & Ipsos research studies in 2016 and 2017– less than half of the Canadian have prepared for emergency preparedness. Also, from this study, it shows that English barrier and occupancy status are associated with level of preparedness. As such, emergency preparedness

promotions programs and workshops should be made available in different languages to accommodate residents who do not use English as their primary language. Other non-profit organizations such as RedCross should be aware of their promoting materials' language options. Renters are associated with weaker level of preparedness. Therefore, there is a need to increase renters' awareness of emergency preparedness. Perhaps the Government of BC can provide incentives to insurance company to offer a discount on emergency kits for renters who purchase home insurance.

### **Future Research**

#### **Conclusion**

As BC coasts are prone to natural disasters and emergencies, increasing awareness of emergency preparedness will allow Canadians to mitigate the potential impacts economically and socially as a whole. Several studies, including this research study, have found that in general, less than half of the Canadians have reported to participate partially in emergency response plan only. Socio-economic and demographic factors are found to be related to level of preparedness. In order to address the low level of preparedness, it is important to assess these factors and develop strategies in accordantly. From this study, it is determined that language barrier and occupancy status are one of those factors that associate with level of emergency preparedness. This serves as supporting data and evidence to transit these findings to promote emergency readiness among local residents in Metro Vancouver.

Recommendations of future research studies are shown as follows:

- Replicate of this study 2-4 years later to compare results and assess whether Canadians have improved their overall level of emergency preparedness
- Assess other socio-economic factors such as household income and ethnicity and their association with level of emergency preparedness
- Assess knowledge level of emergency preparedness among local Canadians (KAP study)

#### **Acknowledgement**

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#### **Competing Interests**

The authors have no competing interests.

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