



Jacksonville State University
JSU Digital Commons

[Dissertations](#)

[Theses, Dissertations & Graduate Projects](#)

[Explore JSU's Graduate Programs](#)

Summer 2017

The Fort McMurray Wildfire 2016: Risk Perceptions and Behaviours Among Evacuees

Christopher James Kearns

Jacksonville State University, chris.kearns@telus.net



Part of the [Emergency and Disaster Management Commons](#)

[See all JSU Student Works](#)

Recommended Citation

Kearns, Christopher James, "The Fort McMurray Wildfire 2016: Risk Perceptions and Behaviours Among Evacuees" (2017). *Dissertations*. 2.

https://digitalcommons.jsu.edu/etds_dissertations/2

This Dissertation is brought to you for free and open access by the Theses, Dissertations & Graduate Projects at JSU Digital Commons. It has been accepted for inclusion in Dissertations by an authorized administrator of JSU Digital Commons. For more information, please contact digitalcommons@jsu.edu.

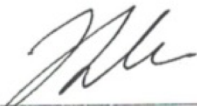
Dissertation Approval

Candidate: Christopher James Kearns

Major: Emergency Management

Dissertation Title: The Fort McMurray Wildfire 2016: Risk Perceptions and Behaviors Among Evacuees


Approval:



Tanveer Islam
Assistant Professor of Emergency Management
Major Professor

8/17/17

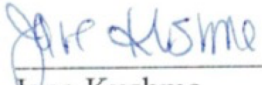
Date



Shih-Kai Huang
Assistant Professor of Emergency Management

8/17, 2017.

Date



Jane Kushma
Professor of Emergency Management

8/17/17

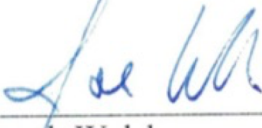
Date



William Lowe
Professor of Emergency Management

8-17-17

Date



Joseph Walsh
Dean, College of Graduate Studies

11/10/17

Date

THE FORT MCMURRAY WILDFIRE 2016:
RISK PERCEPTIONS AND BEHAVIOURS AMONG EVACUEES

A Dissertation Submitted to the
Graduate Faculty
of Jacksonville State University
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Science in Emergency Management

By

CHRISTOPHER JAMES KEARNS

Jacksonville, Alabama

August 17, 2017

Copyright 2017

All Rights Reserved

A handwritten signature in blue ink, appearing to read 'CJ Kearns', is positioned above a horizontal line.

Christopher J. Kearns

August 17th, 2017

ABSTRACT

The devastating wildfires in the Fort McMurray, Alberta, region in May of 2016 forced the evacuation of almost 90,000 people from their homes. This study examines and compares risk perceptions and evacuation behaviours between young adults, 18 to 24 years of age and older adults, 25 years and older, and between genders. The study participants ($n = 299$) were students and staff at Keyano College in Fort McMurray. They indicated only slight differences in their perceptions of risk and their evacuation behaviours between both the age groups and by gender. Environmental cues were significant indicators of risk for all participants. The majority of respondents (82 percent) fled the day the mandatory evacuation order was issued. Social media and local news were the most relied on sources of disaster and evacuation information utilized by respondents. Facebook was the most popular for social media platforms. Emergency managers must ensure effective use of these two information sources to communicate disaster information.

VITA

Chris Kearns has been involved in public safety since he first served with the Canadian Coast Guard, as summer employment, throughout his early university days. He landed a career in emergency response communications, starting out as a 9-1-1 call taker/dispatcher in Fredericton, New Brunswick, in 1991. Chris is currently the manager for the City of Lethbridge Public Safety Communications Centre, in Lethbridge, Alberta. When required, he serves on the city's incident management team for disaster and emergency response. Chris, a Certified Emergency Manager (CEM), has been deployed to the Emergency Operations Centres for both the 2013 Flooding in Southern Alberta (High River), and the 2016 Wildfire in Fort McMurray - the two most costly natural disasters, to date, in Canadian history. Chris holds a Bachelor of Business Administration degree from the University of New Brunswick and a Master of Science degree, in Emergency Management, from Jacksonville State University. In his spare time, Chris has developed and taught both the crisis management and critical incident analysis courses at Lethbridge College, for their criminal justice degree program. Chris is happily married to Nancy and they have three great kids, who are all grown up, traversing the globe, and earnestly chasing their own academic pursuits.

DEDICATION

This doctoral process, for me, started in 2011 when both my father and my father-in-law were still alive. This is dedicated to them. My dad, was the first Dr. Kearns in our family and always had a penchant for anything emergency response related. My father-in-law, Deryk Sparks, had a lifelong love of learning, and always had positive and encouraging comments to say about continuing education. Both would be very proud of seeing this completed.

ACKNOWLEDGEMENTS

Taking six years out of one's life to work on and complete a doctoral program is a fairly big commitment. It isn't solely a personal commitment, as this type of effort is sure to impact and disrupt more than just one life throughout the process. That being said, my first and foremost acknowledgement goes to my wife, Nancy. She is the one who has persevered through missed summer vacations and not being able to use her dining room table (as it is my workspace) since 2011. Her support and encouragement have meant the world to me and I would not be finished had it not been for her. My family has to be next. Our children, Ben, Emily, and David have likewise been encouraging, supportive, and proud of me. All of them have a healthy respect for advanced education and it is uplifting to see them plan their futures with a university underpinning as their foundations. Special kudos to Emily, as she has been home the most...her interest in my studies, and her assistance with the survey, as my research assistant, was most helpful and appreciated. She has been a great sounding board as I've tried to arrive at "just what it is I'm trying to accomplish" – some days it seemed more vague than others. As for family, I'd be remiss not to mention my mother. She checked in every week and wanted to have an update... "Where are you at?"; "What have you got left to do?" My two brothers, Glen and Tim, and their respective families, have also been very supportive and proud of my work.

A huge thanks to the students and staff at Keyano College in Fort McMurray, Alberta; they were welcoming and fun. They allowed us the opportunity and privilege of peering into their lives, as they recalled one the most tumultuous times that some of them will ever experience. Special thanks to Mr. Louis Dingley, the chair of the Research Ethics Board, who not only approved the research, but assisted with making the arrangements for us to visit the campus.

A word of thanks goes to my neighbours, the Wildwood Cres. gang, for listening to my rants...while passing me another beverage. This includes a handful of academics, who, because of the nature of their professions, were easy targets for discourse. I truly appreciate the friendship and the patience. I should also mention Kathy Jang, a family friend, who made it her mission to question, "Shouldn't you be working?", at every opportunity.

To my work family, thanks for listening! Joel McDonald, Dana Terry, Ward Eggli, Luke Palmer and Holly Wright – all happy to hear of my study and offer comments and advice. Special mention to my boss, Tony Vanden Heuvel, for being incredibly supportive and encouraging. For a football guy, he makes a darn good cheer leader! Thanks!

To Cohort #1, "Non Omnis Moriar!" (loosely translated, "Not everyone will die!") We set the tone for the entire program and helped with its development. Congratulations to those who have already defended and/or graduated – Mike Ryan, Wayne Bergeron, Kay Vonderschmidt, and Scott Manning. To those still writing... you've got this! Special thanks to Wayne Bergeron and Royce Woodruff – you two truly helped me to get through this – your texts, your calls, they were all timely and so much appreciated.

Thanks to the rest of you around the pool, newer cohorts included. Although I didn't get to know all of you as well as others, it was and is so nice to have a community of fellow students, that understand, and that we can talk to and share with – whether it be at the pool in person or on the poolside pontification on Facebook. Thanks to Russell Peterson, Jeff Smith, and Larysa Murray – your poolside conversations and occasional texts have always made me smile, or outright laugh, and encouraged me – thanks!

Lastly, to my professors, Dr. Tanveer Islam, my committee chair, Dr. Jane Kushma, Dr. Bill Lowe, and Dr. Huang. Thank you all for your help, your guidance, your sage advice, and your commitment. You all played a statistically significant role (at the 0.05 level) in shaping me as the researcher I am today. Thank you. Dr. Ryan, although not part of my committee, thanks for the push. “Everyone works better with deadlines”, he said. It is the truth. Thank you for that.

A final word of thanks goes to Dr. Barry Cox. I met Barry at the Association of Public Safety Communications Officials (APCO) Canada Conferences and he encouraged me to enroll in the Master's program in Emergency Management at JSU. When the Doctoral program was starting, Barry called me up and suggested I apply. If not for Barry, I would not have even been aware of the emergency management programs at JSU – Thanks Barry.

To anyone I missed, my apologies, it wasn't intentional. Thanks to everyone again.

Chris

TABLE OF CONTENTS

	Page
ABSTRACT	IV
VITA	IV
DEDICATION	V
ACKNOWLEDGEMENTS	VI
TABLE OF CONTENTS	VIII
LIST OF FIGURES	X
LIST OF TABLES	XII
I - INTRODUCTION	1
PROBLEM STATEMENT	1
PURPOSE OF THE STUDY	2
RESEARCH QUESTIONS	2
SIGNIFICANCE	2
STUDY AREA.....	3
ASSUMPTIONS	4
INTRODUCTION TO THE INCIDENT.....	4
BACKGROUND.....	5
DEMOGRAPHICS	8
ORGANIZATION OF THE STUDY	10
II – LITERATURE REVIEW	12
EVACUATION DURING DISASTERS	12
DECISION TO EVACUATE	18
WARNINGS.....	23
SOURCES OF INFORMATION	25
RISK PERCEPTION	31
WILDFIRE EVACUATION	34
SLAVE LAKE FIRE.....	41
ABOUT YOUNG PEOPLE.....	43
STUDENTS IN DISASTERS.....	46
CONCLUSION OF THE LITERATURE REVIEW	47
III – METHODOLOGY	49
THEORETICAL FRAMEWORK.....	49
CONCEPTUAL FRAMEWORK.....	53
RESEARCH QUESTIONS	55
HYPOTHESES.....	56
DATA COLLECTION.....	58
ETHICAL CONSIDERATIONS	59
THE SURVEY AND MEASUREMENT.....	60
<i>Information Sources</i>	60
<i>Social Media</i>	61
<i>Risk Perceptions and Thoughts on Evacuation</i>	61
<i>Evacuation</i>	62
<i>Demographics</i>	63

<i>Qualitative Questions</i>	63
METHOD OF ANALYSIS	64
MULTIPLE RESPONSE SETS	64
HANDLING OF MISSING VARIABLES	66
THE DEPENDENT VARIABLES	70
THE INDEPENDENT VARIABLES	72
DATA ANALYSIS	73
IV - RESULTS	75
HYPOTHESES	77
<i>Hypothesis 1</i>	77
<i>Hypothesis 2</i>	80
<i>Hypothesis 3</i>	82
<i>Hypothesis 4</i>	86
DESCRIPTIVE STATISTICS	88
<i>Question 1 – Risk Perceptions</i>	88
<i>Question 2 – Information Sources</i>	95
<i>Question 3 – Evacuation Behaviours</i>	99
A REVIEW OF THE DEMOGRAPHICS	111
THE QUALITATIVE QUESTIONS	115
V – DISCUSSION	119
HYPOTHESES	119
DESCRIPTIVE STATISTICS	122
QUALITATIVE QUESTIONS	128
LIMITATIONS	129
OPPORTUNITIES FOR ADDITIONAL RESEARCH	133
CONCLUSION	134
APPENDIX A – CENSUS INFORMATION	137
APPENDIX B - FORT MCMURRAY EVACUATION STUDY (THE SURVEY)	140
APPENDIX C - EMAIL TO STAFF AND STUDENTS AT KEYANO COLLEGE	155
APPENDIX D - JACKSONVILLE STATE UNIVERSITY IRB APPROVAL	157
APPENDIX E - KEYANO COLLEGE RESEARCH ETHICS BOARD APPROVAL	159
APPENDIX F – LOCATIONS WHERE PARTICIPANTS EVACUATED.....	161
APPENDIX G – DEMOGRAPHIC DETAILS OF THE PARTICIPANTS.....	162
APPENDIX H – COMMENTS FROM QUESTION 22 AND QUESTION 23.....	163
QUESTION 22	163
QUESTION 23	170
REFERENCES.....	176

LIST OF FIGURES

1. Map of the Province of Alberta, highlighting Fort McMurray.
2. Visual depiction of the social media sources that U.S. adults receive news.
3. Visual depiction of social media use by age by U.S. adults.
4. Visual depiction of frequency of social media use by Americans.
5. 2016 Survey of Canadian social media use.
6. Growth in share of “at home” users within respondents who use smartphones as a primary device for activity.
7. Schema of the Protection Motivation Theory (PMT).
8. Information flow in the Protection Action Decision Model (PADM).
9. Abbreviated for of the PADM applied to the Hurricane Ike evacuation study.
10. Conceptual model of the proposed study using an adapted PADM.
11. Overall summary of the missing values from the variables selected for data analysis.
12. Information sources used for wildfire information by age group.
13. Comparison by age group of information sources “greatly relied on” for wildfire and evacuation information during the Fort McMurray wildfire in 2016.
14. Respondents who selected “Extremely Likely” for the threat of wildfire impacting them personally by age group.
15. Respondents who selected “Extremely Likely” for the threat of the smoke impacting them personally by age group.
16. Respondents who selected “Extremely Likely” for the threat of the after effects impacting them personally by age group.
17. Respondents who selected “Extremely Likely” for the threat of wildfire impacting them personally by age gender.
18. Respondents who selected “Extremely Likely” for the threat of the smoke impacting them personally by gender.

19. Respondents who selected “Extremely Likely” for the threat of the after effects impacting them personally by gender.
20. Information sources “greatly relied on” by 18 to 24 year olds.
21. Information sources “greatly relied on” by 18 to 24 year olds, gender comparison.
22. Social media, by platform, selected as “most used” comparison between 18 to 24 year olds and 25 and older.
23. Social media, by platform, selected as “most used” comparison between 18 to 24 year olds and 25 and older and by gender.
24. Mode of transportation for evacuation by all participants.
25. Locations where participants evacuated to.
26. Where evacuees stayed by age group.
27. Where evacuees stayed by gender.
28. Respondents by gender and age group.
29. Pie chart indicating marital status of the survey participants.
30. Type of dwelling lived in by participants compared by age group.
31. Word cloud created from participants’ comments in question 22 of the survey.
32. Young adults (18 to 24 years) living with their parents, taken from the survey results; compared with young adults (20 to 24) living with their parents, taken from a Statistics Canada Report; compared with the results, from the survey of 18 to 24 year olds who evacuated with their immediate family.

LIST OF TABLES

1. Census Information – 15 to 24 Year Olds, Regional Municipality of Wood Buffalo
2. Census Information – 18 to 24 Year Olds, Regional Municipality of Wood Buffalo
3. Cronbach’s Alpha Test on 5 New Variables
4. Factor Analysis – Correlation of Dependent Variables
5. Paired t Tests with Dependent Variables
6. Regression Analysis – Risk Perception and Independent Variables
7. Paired t Tests – Environmental Cues and Perceived Risk
8. Intercorrelations Among Variables
9. Paired t Tests – Social cues and Perceived Risk
10. Regression Analysis – Risk Perception and Independent Variables, 18 to 24 Year Olds
11. Independent t Tests – Information Source Variables by Age Group
12. Independent t Tests – Risk Perceptions and Age
13. Independent t Tests – Information Sources, 18 to 24 Year Olds and Gender
14. The Date that Participants Evacuated
15. The Time of day that Participants Evacuated
16. Date of Evacuation – Age Group Comparison
17. Date of Evacuation – Gender Comparison
18. The Time of Day that Participants Evacuated, by Age Group
19. The time of Day that Participants Evacuated by Gender
20. Who did Participants Evacuate With – Comparison by Age and by Gender

- 21. Locations, by Province and Territory, That Evacuees Went
- 22. Locations Where Participants Travelled To – By Age Group
- 23. Locations Where Participants Travelled To – By Gender
- 24. Occupational / Student Status of All Participants
- A1. Population by Age and Gender in the Regional Municipality of Wood Buffalo in 2015
- A2. Population by Age Groups and Gender in the Regional Municipality of Wood Buffalo in 2015
- A3. Canada Census Data Population of Wood Buffalo in 2011
- A4. Canada Census Data Population by Age Groups of Wood Buffalo in 2011
- F1. Communities and Locations Where the Participants Evacuated
- G1. Demographic Details of the Participants

I - Introduction

Wildfires consume an average of 2.83 million hectares of land in the United States (National Interagency Coordination Center, 2015) and 2.4 million hectares of land in Canada (Canadian Interagency Forest Fire Centre Inc., 2015) every year. These events trigger evacuations, causing people to flee from their homes and communities to seek refuge. A study of Canadian wildfire evacuations, between 1980 and 2007, revealed that the average annual number of evacuees, due to wildfires, was 7,469 people (Beverly & Bothwell, 2011). A large wildfire in May 2016, in the Fort McMurray area of Alberta, Canada, resulted in the evacuation of 88,000 people (KPMG, 2017).

Problem Statement

Wildfire evacuations are a regular occurrence in different parts of the world, including Canada. The main predictors of risk perception need to be understood in order to determine how to best communicate during wildfire situations. The source and type of information, concerning wildfires and evacuations, could influence risk perceptions. It is unclear whether the risk perceptions, influencing evacuation decision making and behaviours, differ between young adults and older adults.

The differences in evacuation behaviours among young adults and older adults, and by genders should be examined to determine the trends between them. This information could be used by emergency management professionals to better plan their communication strategies during wildfires and, potentially, other disaster events.

Purpose of the Study

The purpose of the research was to examine wildfire risk perceptions and evacuation behaviours of a younger population, 18 to 24 year olds, in comparison to an older age group, 25 years and older. The goal was to determine whether emergency managers need to utilize different communication methods and take special considerations when trying to disseminate information and evacuate young adults from areas threatened by wildfires. The study also took advantage of the opportunity to run similar evacuation behaviour comparisons on the data between the two gender groups, male and female.

Research Questions

The primary research questions were: (1) Do young adults, 18 to 24 years, and older adults, 25 and older, differ in their risk perceptions in a wildfire situation. (2) What are the sources of disaster and evacuation information that young people rely on? From a descriptive statistics standpoint, what are the evacuation behaviours of young adults versus older adults? What are the differences in evacuation behaviours between genders?

Significance

The research is important because emergency managers may have to change their methods of communication, during catastrophic incidents, in order to reach out to the young adult population. The study will contribute to the body of knowledge since little research has been done, so far, focusing on the younger adult population during wildfire situations in Canada. Furthermore, to date, there has been no published academic focused research on the Fort McMurray wildfire with the exception of two government sponsored reports on the incident.

Study Area

The study investigated the experiences and perceptions of residents of the Fort McMurray area during the wildfire in 2016. The total population of the Regional Municipality of Wood Buffalo (also known as Fort McMurray) was 73,252, in 2015 (Regional Municipality of Wood Buffalo, 2015). Fort McMurray is located in Northern Alberta, Canada, 270 miles from Edmonton, the capital city of Alberta (see Figure 1).



Figure 1. Map of the Province of Alberta, with the red arrow pointing at Fort McMurray. Map retrieved from Portable Atlas [PAT], (2013), *Public Domain Maps of Alberta*. At http://ian.mackay.net/pat/map/ca/ab/ab_blu.gif

Assumptions

This quantitative study surveyed students and staff from Keyano College, in Fort McMurray, to understand their wildfire perceptions and evacuation experiences. In conducting this research study, it was assumed that the participants would adequately recall the circumstances and would truthfully answer the survey questions. It was also assumed that there were no underlying causes or circumstances that would create a bias in the answers provided. A limitation of this survey was that the subjects were all from Keyano College; therefore, the participants may not have adequately reflected all of the adults in the Fort McMurray area, but rather reflected the staff and student population at Keyano College. Although the results are still relevant for the purpose of the study, this limitation must be considered when attempting to generalize to a broader population of 18 to 24 year olds and 25 and older adults.

Introduction to the incident

In May of 2016, a wildfire ripped through the Northern Alberta community of Fort McMurray. The fire, the costliest natural disaster in Canadian history (Insurance Bureau of Canada, 2016), lasted for more than a month and burned 589,552 hectares (Government of Alberta, 2017) – approximately the same land area as the entire state of Delaware. The wildfire resulted in an evacuation of the entire region surrounding Fort McMurray, Alberta.

The purpose of this study was to examine and compare the risk perceptions and evacuation experiences of 18-24 year olds and older adults, during the Fort McMurray wildfire of 2016. The Government of Alberta has just recently completed a full review of the emergency response, which included discussion about the evacuation of the

communities affected (KPMG, 2017). The breakdown of the government review like other reviews i.e. the Slave Lake fire review (KPMG, 2012) and the 2013 Floods in Alberta review (MNP, 2015), did not specifically focus on young adults as their own categorical age range. This study sought to determine whether the evacuation of this age group of adults was different than older adults.

A survey of staff and students, from Keyano College, who were living in the Fort McMurray area at the time of the wildfire, was conducted to learn of their experiences. The questionnaire was administered via an internet based survey.

Background

Fort McMurray is actually an unincorporated city located in the Regional Municipality of Wood Buffalo (RMWB). The RMWB was established in 1995 when the City of Fort McMurray amalgamated with the local Improvement District No. 143 (Fort McMurray Tourism, 2017). The entire community, encompassing 68,454 square kilometers, is one of the largest municipalities in North America (Fort McMurray Tourism, 2017).

The wildfire event started as a small, two-hectare blaze, southwest of Fort McMurray on Sunday May 1, 2016. At 9:57 p.m. the mayor of the Regional Municipality of Wood Buffalo, Melissa Blake, declared a state of local emergency and issued an evacuation order for one neighbourhood (Regional Municipality of Wood Buffalo [RMWB], 2016a). By Tuesday May 3 the fire had grown significantly, threatening the entire region, and eliciting a mandatory evacuation order from the mayor's office (French, 2016). It is estimated that 88,000 people fled from their homes during the disaster (KPMG, 2017).

On May 4, 2016, the lieutenant governor of the Province of Alberta issued an order in council declaring a provincial state of emergency in the Regional Municipality of Wood Buffalo (Order in Council, 2016). By Thursday May 12, the wildfire had destroyed more than 2,400 buildings and damaged in excess of 500 structures (French, 2016).

The wildfire was dubbed the Horse River Fire by the Alberta Government's Environment and Sustainable Resource Development (ESRD) – part of Alberta Agriculture and Forestry, as the blaze originated in the bush near the Horse River. The fire eventually passed through the Fort McMurray area and continued east to the Alberta/Saskatchewan border. At the peak of the firefighting, there were 2,161 firefighters and support staff, 80 helicopters, and 217 pieces of heavy equipment attempting to staunch the blaze (Government of Alberta, 2016a). The province had assistance from firefighters from almost every province and territory in Canada, from the United States, and from as far away as South Africa (Government of Alberta, 2016a). The firefighters, with heavy equipment, managed to build a perimeter guard around the fire of approximately 442 km (Government of Alberta, 2016a). By July 4, officials declared the Horse River fire under control after burning for 65 days (Government of Alberta, 2016b).

The re-entry of the residents to the Regional Municipality of Wood Buffalo started on June 1. The community was divided into five different zones and residents were allowed to return on a scheduled per zone entry, over a four-day period (RMWB, 2016c). The provincial state of emergency was rescinded on June 30 (Alberta Emergency Management Agency [AEMA], 2016). The municipal state of local

emergency was finally lifted on November 10, 2016 (RMWB, 2016b). The extensions to the state of local emergency were in the interests of public safety while hazardous materials were being removed from the neighbourhoods impacted by the fires (RMWB, 2016b).

The Insurance Bureau of Canada placed the Fort McMurray wildfire as the costliest insured natural disaster in Canadian history, with an estimate of \$3.58 billion in insured losses (Insurance Bureau of Canada, 2016). This is almost twice the amount of the previous costliest disaster on record, the 2013 southern Alberta floods, which rang in at \$1.7 billion (Insurance Bureau of Canada, 2016). The Conference Board of Canada estimated that the rebuilding effort will inject \$5.3 billion into Alberta's economy (Antunes, Bernard, & Owusu, 2016). The oil and gas industry is the region's largest economic contributor; the Conference Board of Canada's report indicates that, "Production valued at over 47 million barrels and \$1.4 billion in revenues will be lost to producers and the province in 2016" (Antunes et al., 2016, p. 9). A more recent report from MacEwan University suggests that the original estimates of losses, are a little shy of the actual losses of \$8.86 billion (Quantifying Disasters, 2017). This amount includes both direct and indirect costs according to the researchers. Things such as mental health, environmental losses, and other physical and psychological impacts contribute to the overall economic losses in the area (Quantifying Disasters, 2017). Despite all of these economic losses the rebuilding effort will generate a lot of economic benefits. It is estimated that 2,574 new homes will be built and the recovery will generate 8,968 jobs in 2017 (Antunes et al., 2016).

Despite the devastation and the tragedy, the Fort McMurray wildfire situation only claimed two lives, but not from the fire itself. Two young people were evacuating from the region, when their vehicle collided with a transport truck (Lamoureux, 2016). The pair unfortunately died at the scene of the accident (Lamoureux, 2016).

Demographics

The latest federal census data available, of the Fort McMurray area, is from the 2011 census. The Regional Municipality of Wood Buffalo conducted a municipal census in 2015. The data between the two surveys does not exactly line up. The federal census survey puts age in narrower categories than the RMWB survey. The concern, is in the specific age range, between 18 to 24 years. The federal survey individualizes 18 year olds, 19 year olds and 20 to 24 year olds as their own categories. The RMWB survey categorizes 15 to 19 year olds and 20 to 24 year olds in two separate categories. The RMWB survey has the more recent data, and is therefore a little more applicable to the research; however, their age range data does not align with the target age range. The 2011 federal census data indicates that there were 7,985 people aged 18 to 24 in the Fort McMurray area (Statistics Canada, 2011a). The same data set indicates that there were 10,195 people 15 to 24 years of age (Statistics Canada, 2011a). The difference, 2,100 people, indicates those persons aged 15 to 17. The RMWB survey indicates that there were 8,579 people aged 15 to 24 (RMWB, 2015). As compared to the 2011 federal census data, this represents a 16 percent decrease for this age group. Specifically, comparing the numbers between the two surveys for 15 to 24 year olds, there is a 13 percent decrease for males and a 19 percent decrease for females (see Table 1).

Table 1

Census Information – 15 to 24 Year Olds, Regional Municipality of Wood Buffalo

	2011 Federal Census	2015 RMWB Census	Difference (%)
Males	5,330	4,619	13%
Females	4,865	3,960	19%
Total	10,195	8,579	16%

Note: Data values are from the 2011 Federal Census (Statistics Canada, 2011a) and from the 2015 RMWB Census (RMWB, 2015).

If it is assumed that the same percentage decrease would hold true for 18 to 24 year olds, then based on the 2011 federal survey numbers, the 2015 numbers would be 3,631 males and 3,089 females (see Table 2). This projection provides a total of 6,719 18 to 24 year olds in the Fort McMurray area in 2015.

Table 2

Census Information – 18 to 24 Year Olds, Regional Municipality of Wood Buffalo

	2011 Federal Census	Decrease (%)	Estimation of the 2015 RMWB Census Results
Males	4,190	13%	3,631
Females	3,795	19%	3,089
Total	7,985	16%	6,719

Note: Data values are from the 2011 Federal Census (Statistics Canada, 2011a).

The total population of the Regional Municipality of Wood Buffalo, according to the 2015 municipal census was 73,252 people (RMWB, 2015). Given the estimated

number of 18 to 24 year olds, 6,719, it represents just under ten percent of the total population of the region, at 9.17 percent.

The 2011 census data indicates that there were 2,245 people living with relatives, 7,040 people living with non-relatives and an additional 4,125 people living alone (Statistics Canada, 2011a); this represents 3 percent, 11 percent, and 6 percent of the total population, respectively, for a total of 20 percent of the population not living in a family situation. Of these, the census data indicates that 2,500 people were 18 to 24 year olds (Statistics Canada, 2011b). This reveals that one third of all 18 to 24 year olds in the Regional Municipality of Wood Buffalo (in 2011) were not residing in family situations.

The total population of the Wood Buffalo area in 2011 was 66,896 people (Statistics Canada, 2011a). The total population in 2015, as mentioned above, was 73,252 (RMWB, 2015); therefore, the increase in population was 9.5 percent from 2011 to 2015. The total number of occupied private dwellings in the Fort McMurray region, according to the 2011 census was 23,544 (Statistics Canada, 2011a). If homes increased by a similar percentage to population growth, the number of occupied private dwellings in the Fort McMurray region would be approximately 25,780. The Government of Alberta reported that there were 1,929 homes destroyed in the fire (AEMA, 2016). Therefore, it is safe to assume that about 7.5 percent of the community's homes were destroyed by fire. See Appendix A for detailed census information.

Organization of the Study

The following chapter provides a comprehensive literature review of the relevant research. Chapter 3 breaks down the methodology for the research including the theoretical and conceptual frameworks. This chapter also outlines the research questions,

the hypotheses, the data collection methods and the ethical considerations. Chapter 4 provides the results of the research. Each of the hypotheses is examined relative to the data collected. This section also reviews the descriptive statistical data. The last chapter is a discussion about the results. This chapter concludes with a look at the limitations of the study and the opportunities for additional research.

II – Literature Review

There is a lot of literature available concerning the impacts of disasters (Neria, Nandi, & Galea, 2007; Norris et al., 2002); however, this study was aimed at looking specifically at a small segment of disaster research – risk perceptions and evacuation behaviours in wildfire settings. Risk perception is associated with disaster preparedness and evacuation (Baker, 1991; Dash & Gladwin, 2007; Gladwin, Gladwin, & Peacock, 2001; Huang et al., 2012) and in many cases, it is the risk perception that people hold, that leads them to evacuation decisions (Hasan, Ukkusuri, Gladwin, & Murray-Tuite, 2011; Lindell, Lu, & Prater, 2005; National Research Council [NRC], 2006). This section starts with an overview of the literature related to evacuation during disasters generally, then it delves more deeply into the individual characteristics that may relate to risk perceptions and behaviours, and then wraps up with a review of wildfire specific literature.

Evacuation During Disasters

Many different types of disasters trigger evacuations. Some of these include, wildfires, hurricanes, tornados, tsunamis, humanitarian emergencies, nuclear events and others. This research project, as stated, was primarily focused on a comparison of risk perceptions and evacuation behaviours of younger and older adults, and gender, during an evacuation due to a wildfire in a northern Canadian community. Prior to that discussion, it will be beneficial to get a grasp on the literature related to risk and evacuation generally, and then expressly related to wildfires.

Lim and Rungta (2013) define evacuation as involving, “...the mass movement of a population in the wake of an impending danger from an impacted geographical region

toward safer destinations” (p. 98). Michael Lindell (2013) refers to evacuation as, “...a process intended to temporarily move people from a hazardous location to a place of greater safety” (p. 122). Fitzpatrick and Mileti (1991) state that, “Evacuation is largely a function of people coming to define themselves as being in danger and perceiving that leaving their immediate environment is an appropriate action” (p. 137). Alternatively, Bateman and Edwards (2002), indicate that, “The primary utility of evacuating a threatened population before the impact of a disaster is to protect property, prevent injury, and sustain life” (p. 107). There are other definitions, of course, but, the overarching theme of evacuation is movement from danger to a place of safety.

In the United States, evacuations, involving at least 100 people, occur more than once a week; evacuations, involving more than 1,000, people occur more than three times per month (Dotson & Jones, 2005). The numbers for Canada are presumed to be much less although no formal studies on overall evacuations in Canada have been conducted in recent times. That being said, a 2011 study of wildfire evacuations in Canada, between 1980 and 2007, revealed that an annual median of 3,590 people were evacuated due to wildfires in Canada (Beverly & Bothwell, 2011). Evacuations are not an uncommon occurrence – there is probably one happening somewhere in North America right now.

There has been a lot of research and study about evacuations. In 1987 John Sorensen, Barbara Vogt and Dennis Mileti authored a paper titled, *Evacuation: An Assessment of Planning and Research*. They reviewed over 300 documents pertaining to evacuations with the goal of assessing the current research (at the time) and identifying the knowledge gaps (Sorensen, Vogt, & Mileti, 1987). Like much of the research literature concerning evacuations, their study specifically identified behavioural findings

for earthquakes, floods, hurricanes, tsunamis, and volcanoes. Wildfires are not expressly covered; however, some of the generalities noted in the study can be applied to wildfire situations.

There were many findings in their assessment of the research; however, only a few of them will be noted here. The authors identify a lack of special evacuation planning information for fast moving events (Sorensen et al., 1987). When the amount of time, from detection of an impending event to the event's impact, is short, it necessitates a fast evacuation. There is not a lot of research identifying how to plan for these types of scenarios (Sorensen et al., 1987). The researchers also questioned the prior research on human behaviour in evacuations, stating that, "Knowledge about public evacuation behavior is broad; however, it is the result of a piecemeal effort that pulled together the findings of divergent pieces of research involving varied hazards and using somewhat different research designs, methods, approaches and models" (Sorensen et al., 1987, p. xii). They go on to suggest that there is no evidence that differences in hazards results in differences in public responses (Sorensen et al., 1987). Another finding, is about special populations, which includes people in institutions (prisons, hospitals, nursing homes, schools, etc.) or dispersed throughout the community including the deaf, disabled, mentally challenged, and foreigners (Sorensen et al., 1987). They indicate that although some research has been done concerning these special groups, the information may not be readily available to evacuation planners at the local level (Sorensen et al., 1987). This finding may be relevant to the current study, as one of the target comparator age groups of the research is 18 to 24 year olds. Although not traditionally considered a special

population, in this case, they may meet some similar challenges as the groups identified in the Sorensen, Vogt and Mileti (1987) assessment.

The document discussed above is a synthesized version of a more complete annotated guide to evacuation literature, written by Vogt and Sorensen in 1987. Their findings are more detailed and document 10 years (1975 to 1985) of evacuation research. As noted previously, wildfires, are not one of the specific disaster types discussed; and there is no research reviewed by the authors that involves wildfires. That being said, some of the findings relevant to this paper are as follows:

- Warning, confirmation and evacuation are highly interrelated (Drabek, 1969, as cited in Vogt & Sorensen, 1987).
- Flood evacuees will seek refuge with family and friends rather than emergency shelters (Drabek & Boggs, 1968 and Michael, 1954, as cited in Vogt & Sorensen, 1987).
- People evacuate as family units, not as isolated individuals (Drabek & Stephenson III, 1971, and Moore, Bates, Layman, & Parenton, 1963, as cited in Vogt & Sorensen, 1987).
- Personality, age, gender and socioeconomic status are factors affecting evacuation response (Gruntfest, Downing, & White, 1978, as cited in Vogt & Sorensen, 1987).
- In pre-disaster settings, time is of central importance for explaining evacuation behaviour due to warnings (Mileti and Beck, 1975, as cited in Vogt & Sorensen, 1987).

- Once decided, the majority of respondents would be ready to evacuate within four hours (Louisiana Dept. of Public Safety, 1984, as cited in Vogt & Sorensen, 1987).

Clearly there were a lot of findings in this 10-year study. Vogt and Sorensen (1987) reviewed hundreds of documents pertaining to multiple disasters and different types of incidents. Many of the conclusions from the research they have noted seems to contradict conclusions made from other research. This potentially is because of the different types of disasters. It would appear that people take more seriously the threat of a rail car accident carrying hazardous materials, that just occurred, versus an oncoming hurricane that will arrive in two days. Therefore, timing appears to play a role in evacuation behaviour and risk perceptions. Location of the disaster and experience with disasters are also important, but, sometimes have conflicting results. Coastal residents who have suffered losses in the past, due to a hurricane, may be very motivated to leave when they hear another hurricane is approaching; however, ranchers who have lived through flooding dozens of times before, may be less inclined to leave when faced with another flood. Both individuals have experience with disasters; but, their risk perceptions of the danger may be different.

Sorensen and Vogt's (1987) study is a thorough compendium of the research at the time. There were a lot of other findings, in addition to the ones that have been noted; however, the conclusions indicated are either foundational or applicable to the topic that will be examined. The study, admittedly, is dated, but many of the sociological characteristics discussed, i.e. age, gender, warnings by family and friends, etc. are still relevant today. Many of the specifics concerning warning types, etc., are not as relevant,

due to the changes in technology and the different methods of warning that are currently available.

Earl Baker (1991), conducted studies on hurricane evacuations. He reviewed almost 30 years' worth of empirical research related to over 12 different hurricanes. Baker (1991) found that there were no consistent relationships between previous hurricane experience and evacuation. He also noted that there was no consistent evidence to suggest that length of time lived in an area has an effect on evacuation response (Baker, 1991). For hurricanes, Baker (1991) suggests that neighbourhood conformity may not be as strong as it is claimed. The thought is, that if the neighbours are evacuating it would positively influence someone's decision to evacuate; however, Baker (1991) indicates that this may not be the case. He explains that there can be some confusion with this because people may be evacuating because they are in the designated risk area, or because public officials have instructed them to do so; it may be unrelated to what the neighbours are doing (Baker, 1991). Baker (1991) identifies five variables: "risk level (hazardousness) of the area, action by public authorities, housing, prior perception of personal risk, and storm-specific threat factors" (p. 308) as the key factors influencing evacuation behaviour. Baker further notes, that many demographic factors such as age, education, gender and family status are, "...rarely, weakly, inconsistently, or never related to evacuation" (Baker, 1991, p. 308). Baker (1991) sums up his findings suggesting that the ideal would be to produce an evacuation model that can be used for any hazard to predict the public's behaviour. He comments that there is probably enough data to do this for hurricanes; however, until the databases for other hazard types are

more fully developed it will be difficult to generalize for all hazard evacuation response (Baker, 1991).

Decision to Evacuate

The decision to evacuate in the face of an impending disaster is complicated. Research has proven that there are many considerations taken into account prior to making the decision (Baker, 1991; Fitzpatrick & Mileti, 1991; Gladwin & Peacock, 2000; Vogt & Sorensen, 1987; and others).

While researching the evacuation that occurred during Hurricane Andrew, Gladwin and Peacock (2000) noted that there are many factors relevant to evacuation decision making. First and foremost is being located in an evacuation zone. Size of the household, having elders and/or children, and residing in a single-family dwelling, were the other mentioned factors of importance (Gladwin & Peacock, 2000). Their findings indicated that, "...being located in an evacuation zone increased the odds of evacuation by over eight times" (Gladwin & Peacock, 2000, p. 67). This would seem to make sense, in that if a person's home is located within a zone declared to be at risk, then the residents would be more inclined to leave, compared to others not in the area declared to be at risk. In their study, 91 percent of people who did not evacuate stated that they believed their homes were safe; they perceived no personal risk (Gladwin & Peacock, 2000). Their findings also concluded that having children present increased the likelihood of evacuation by seven times; however, having elderly persons present decreased the likelihood of evacuation by approximately 25 percent (Gladwin & Peacock, 2000). People are generally protective of their children; therefore, it would be logical that having young children in the home would trigger a sense of protection and thus cause people to

leave (Carter, Kendall, & Clark, 1983; Gladwin & Peacock, 2000; Hasan et al., 2011). Conversely, evacuating elderly household members can be challenging – particularly if there are mobility or other health related issues complicating movement (Gladwin & Peacock, 2000; Hasan et al., 2011). The research further indicated that people living in single family households are about 33 percent less likely to evacuate (Gladwin & Peacock, 2000). The researchers suggest that homeowners may be concerned about the security of their home in the event of an evacuation; hence part of the resistance to leave (Gladwin & Peacock, 2000). This was consistent with a study by Lazo, Waldman, Morrow and Thacher (2010), who found that concern about leaving property unprotected was a barrier to evacuation.

In a similar study, Gladwin, Gladwin and Peacock (2001), trialed a decision tree model. They surveyed a sample of residents of South Florida who had been present during both Hurricane Andrew in 1992 and Hurricane Erin in 1995. The researchers arrived at a model of “if then” results that could be trialed using the real data from the surveys. The researchers found that their model demonstrated the reality of, “the complexity and messiness of real-life decision-making” (Gladwin et al., 2001, p. 136). Messiness is great word to describe decision making during disasters. People do not all behave and react the same way as others; or, as emergency managers may expect (Dash & Gladwin, 2007). In this particular study, the authors noted that people’s perceptions of the hurricane, the safety features of their homes, the amount of time prior to the hurricane’s arrival, their age, and the influence of family members who were also determining whether to evacuate or not, all played a role in the decision making process (Gladwin et al., 2001). The importance of this study is that it highlights people’s

independence when it comes to deciding to evacuate or not. Despite evacuation orders given by emergency managers, 60 percent of people move on to weigh the riskiness of the hurricane for themselves prior to leaving, simply because an order has been issued (Gladwin et al., 2001). As a result of this, the researchers caution policy makers that the decision process and the weighing of the risks may occur past the timeline for evacuation; therefore, there could be substantial delays in the overall evacuation (Gladwin et al., 2001).

Many previous sociological evacuation behaviour based studies have indicated that families act as a unit during times of crisis (Quarantelli et al., 1980). Quarantelli, Baisden, and Bourdesh (1980), state, “The vast majority of the literature either explicitly or implicitly indicates that instead of responding as separate individuals, family members act as collective units at times of evacuation. Household members will try to respond to warnings together, to withdraw together, and to find shelter together” (p. 46).

Gladwin, Gladwin, and Peacock (2001), found the same to be true in a study of South Florida residents, present during Hurricane Andrew in 1992 and Hurricane Erin in 1995. They found that, of their survey group, there was a strong desire amongst respondents to evacuate as a family, and, in fact, a number of informants commented that they had been ready to leave; however, because other family members were not, they stayed and did not evacuate (Gladwin et al., 2001).

When it comes to age being a variable in evacuation behaviour and risk analysis, it should be noted that in almost all of the research concerning evacuations that the author found, age was referring to either the elderly, 65 years plus; or children, 18 years of age or younger. Those between the ages of 18 and 65 were not referred to in relation to their

age. This is further demonstrated in the 2014 publication from the National Governors Association, *Governor's Guide to Mass Evacuation*, where there are sections dedicated to the evacuation of senior citizens and children. The guide indicates that seniors are more likely to stay home rather than evacuate; however, they are more likely to evacuate if they are able to share transportation with family, close friends, or neighbours (MacLellan, Powell, & Saporito, 2014). The guide also highlights that children should be educated about natural disasters and what to expect during an evacuation (MacLellan et al., 2014). Overall, age is referring either to the elderly or to children. There is limited evacuation research specific to 18 to 24 year olds.

In another hurricane evacuation study, conducted by Hasan, Ukkusuri, Gladwin and Murray-Tuite (2011), the researchers concluded that there were several factors that could influence a household's evacuation behaviour. The findings are similar to the study by Gladwin and Peacock (2000) and other studies. They summarized, the "...factors include the household's location, source of the news of evacuation notice, mandatory work requirement during the evacuation, number of children, type of house (e.g., living in a mobile house), house ownership status, type of evacuation notice (mandatory or optional) received, previous hurricane experience, and income or educational attainment (e.g., high income or postgraduate)" (Hasan et al., 2011, p. 347).

All of these key evacuation themes have been researched and written about previously. The presence of children or elderly in the household influences decisions positively and negatively respectively (Carter et al., 1983; Gladwin & Peacock, 2000; Hasan, et al., 2011); females are more likely to evacuate than men (Bateman & Edwards, 2002; Fothergill, 1996); persons with disabilities face unique challenges during

evacuations (Kearns & Lowe, 2007; Van Willigen, Edwards, Edwards, & Hessee, 2002); race and ethnicity play a factor in emergency decision making (Perry, Lindell, & Greene, 1982); and finally, income plays a role when determining course of action (Sorensen et al., 1987).

In an assessment of evacuation planning and research, Sorensen, Vogt and Mileti (1987), identify seven individual or family level decisions that must be made concerning evacuation. They are:

- whether to evacuate,
- when to evacuate,
- what to take,
- how to travel,
- route to travel,
- where to go, and
- when to return (Sorensen et al., 1987, p. 8).

The authors, in listing these decisions, highlight that deciding to evacuate is a complex social process requiring “considerable communication and social interactions” (Sorensen et al., 1987, p. 8) to occur. Therefore, it is not easy to perfectly predict the responses that people will make when faced with these decisions.

Specific thoughts about how to evacuate, who to evacuate with, where to go, when to go, are all worthwhile considerations when an individual is deliberating evacuation. Lindell (2000) comments that household resources such as having cash, having access to a credit card, the ability to travel to and stay at friend’s or relative’s homes, all are taken into account when deciding about evacuation. He comments that

although Red Cross shelters (and similar shelters) are excellent options, people would prefer to avoid them. Lindell (2000) states, “Consequently, the inconvenience of evacuating is something that people tend to balance against the perceived risk” (p. 124).

Warnings

When speaking of evacuation, one should also consider the warnings. Warnings are often the initial triggers for evacuation decision making. Warnings are the sources of information that provide people with the data to form the perceptions about the risk they are facing. It is these perceptions of the risk that will influence the subsequent actions that the people will take as a result (Fitzpatrick & Mileti, 1991). Recognizing that there are a variety of sources involved in warning of a disaster and multiple factors that must be considered, will help us understand the impact they all have on resultant behaviours.

For an evacuation order to be heeded it needs to be communicated in such a way that the message is heard, received, and believed. Mileti and O’Brien (1992) summarize the process: First, someone needs to hear the risk information that is communicated; second, people will typically attempt to verify the warning; third, people will form an understanding of the risk; fourth, people will develop a belief that the risk information is relevant and accurate; lastly, people will decide what to do and then act on it. Individual meaning must be associated to the information heard prior to an individual being able to act – the warning must be personalized (Mileti & O’Brien, 1992). It goes without saying, that the warning must be believable. Dash and Gladwin (2007) state, “If individuals do not believe warnings are valid or the risk real, then the likelihood of response is decreased” (p. 70). Tierney, Lindell and Perry (2001) state that the processing of the information results in two types of psychological effects, “cognitive reactions such as

perceptions of threat and of alternative protective actions, and affective responses such as fear” (p. 85). They continue to state that these reactions then lead to behaviours applicable to their interpretations, such as continuation of normal activities to pursuing personal and property protective measures (Tierney et al., 2001).

As for content of the messaging, Mileti and Sorensen (1990) outline the necessary message components, “(1) information about the location(s) at risk and not at risk; (2) information about the character of risk, for example, the depth of expected flood waters; (3) information about guidance, or what people should do to protect themselves; and (4) information about how much time there is before impact or before a protective action should be initiated or completed” (p. 5-4).

The source of the evacuation warning has significant impact as well. Receiving an evacuation notice from friends and relatives, prior to hearing about it from other sources (i.e. television, radio, or internet), increases the probability of evacuation (Hasan et al., 2011; Lindell et al., 2005). Tierney, Lindell and Perry (2001), observe that in the United States, warnings by a uniformed officer, face to face, tend to be most credible source of information for much of the population; however, it is obviously a slow and labour intensive method. Drabek (2013) echoes this same thought, that, “...a police officer at your door, for example, is more likely to produce a high degree of concern than any other message source” (p. 80). Kuligowski (2011), in a study of the evacuation of The World Trade Center during 9/11 concurred, that an in-person direction increased the observers’ perceptions of risk and positively influenced their evacuation response. Fitzpatrick and Mileti (1991) describe several information factors that must be considered when sending out a warning. These are: the source of the information, the consistency of

the message, the accuracy of the information, the clarity, the certainty the message is communicated with, the sufficiency of the information provided, the guidance given, the frequency of the messaging, the specificity of the locations involved, and the channels that the message is communicated through (Fitzpatrick & Mileti, 1991).

Vogt and Sorensen (1987), in their review of evacuation literature, concur that simply giving a warning is not enough incentive to instigate an evacuation. Instead, people's initial reaction is one of disbelief, followed up with an attempt to confirm the threat from a different source (Vogt & Sorensen, 1987). They provided the example, "...if neighbors were seen leaving, the tendency to evacuate was found enhanced" (Vogt & Sorensen, 1987, p. 3). That being said, Carter et al. (1983) observed that single residents, once having considered evacuation, tend to do so with little effect from sources of input; whereas, couples with children seek out additional confirmations and information prior to deciding whether to evacuate or not. This indicates that although disbelief and confirmation are important in risk evaluation and evacuation decision making, it may not be of primary importance for those who are single or live alone.

Sources of Information

As noted above, the source that one obtains disaster information from will have an impact on the believability of the information received and of the actions taken. Previous studies have indicated that the mass media, broadcast media particularly, have been the primary and most effective source of hearing warnings among all of the available types (Lindell et al., 2005; Mileti & Sorensen, 1990). With the proliferation of internet usage and social media, this finding may no longer be true. Regardless of the source, prior studies allege that the more that different sources are used, the more that people become

aware and remember that they have heard a warning (Mileti & Sorensen, 1990) and the increased likelihood that they will take action.

Dow and Cutter (1998) conducted an interesting study on two specific hurricane evacuations and concluded that evacuation decision making was based on multiple sources of risk information. Confirmation of the risk was more inclined to be done from electronic sources, such as the Weather Channel, rather than seeking confirmation from emergency management officials (Dow & Cutter, 1998).

In a study, specific to wildfire evacuations during the Colorado wildfires in 2002, researchers determined that over 75 percent of people used a combination of sources for fire information, including, television, phone, newspaper and the internet (Benight, Gruntfest, & Sparks, 2004). The same study indicated that 50 percent of people used three or more sources and just over 35 percent of people used four or more sources to obtain fire information (Benight et al., 2004). That being said, when it came to evacuation information, 76 percent of those surveyed only used one source of information with 50 percent of that group using the telephone as their source (Benight et al., 2004). Just over 15 percent of people used the television for their evacuation information (Benight et al., 2004); which is interesting, given that the study is a little dated and the internet was not as prevalent back then as it is today. In a separate study specific to wildfires, Steelman, McCaffrey, Knox Velez and Briefel (2015), found that television and radio were used less frequently than family, friends and neighbours as important information sources.

The use of social media during times of crisis is continuously evolving as the technology evolves. Veil, Buehner, and Palenchar (2011) have put together what they

refer to as a “work-in-process literature review” (p. 110) of social media in risk and crisis communication. The study suggests that, “the news of a crisis can be shared and reshared, reaching millions of people without the intervening presence of journalists” (Veil, Buehner, & Palenchar, 2011, p. 111). They are indicating that social media has the potential to bypass traditional media and inform the masses without organized journalism required. They recommend that crisis managers embrace the use of social media because if they do not, the conversation will ensue on social media regardless (Veil et al., 2011). They conclude their study indicating that crisis managers must be proficient in both traditional media and social media to effectively reach the public (Veil et al., 2011).

A social media and crisis study, conducted by Jin, Liu and Austin (2014), found that the form and source of the crisis information provided impacted the public acceptance of the crisis message and impacted their emotional response to the crisis. Although the study was predominantly focused on organizational types of crises rather than natural disasters, the study utilized participants from a large East Coast university. Their sample size was 338 participants. The researchers chose to use young adults as their subjects because they are more frequent users of social media (Jin, Liu, & Austin, 2014). Their study indicated that the majority of their participants used Facebook more frequently than online videos, blogs and twitter (Jin et al., 2014).

The Pew Research Center regularly conducts studies on internet and social media usage. In a recent study, released in May 2016, the researchers found that 62 percent of U.S. adults receive news on social media (Gottfried & Shearer, 2016). They further discovered that, for news, on social media, Facebook is the most popular, with 67 percent of U.S. adults utilizing Facebook, and 44 percent obtaining news from Facebook

(Gottfried & Shearer, 2016). Figure 2 provides the breakdown of social media type and news obtained from those sources.

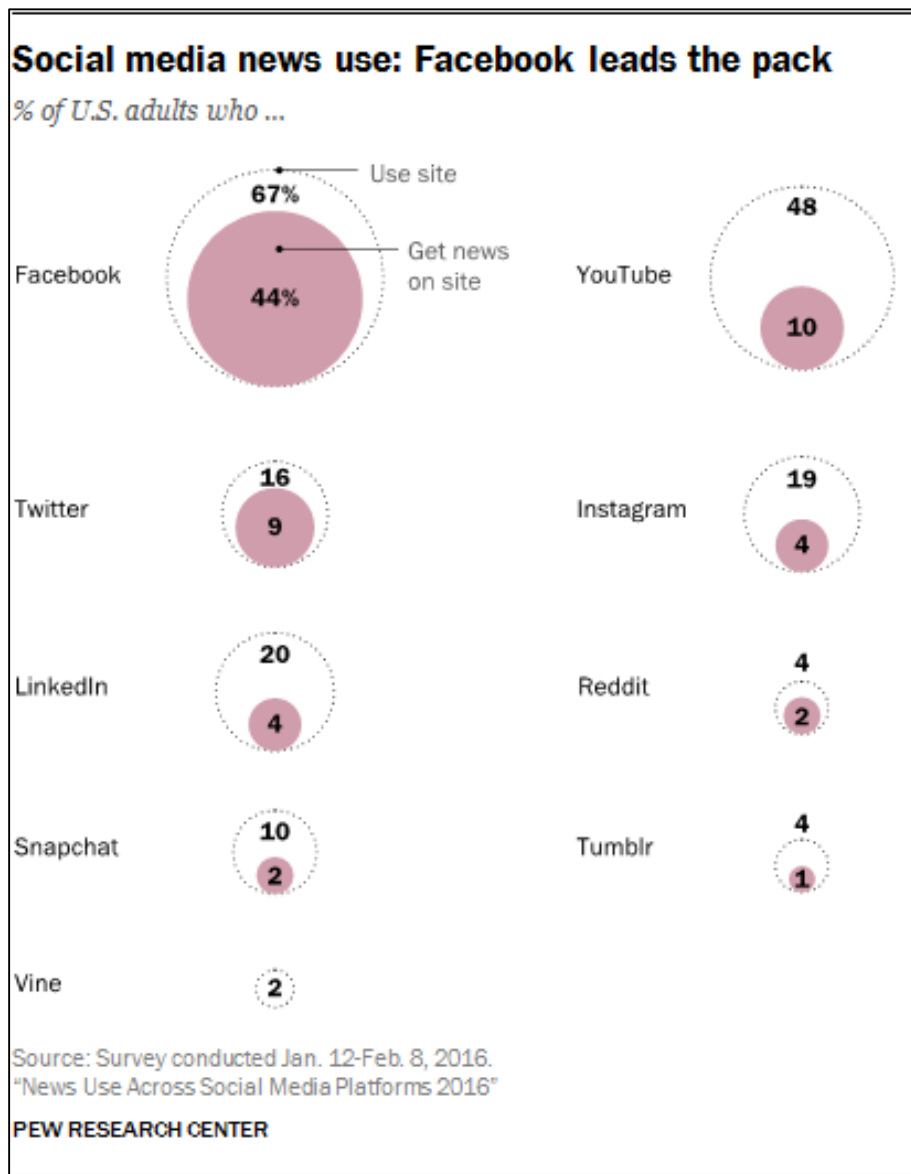


Figure 2. Visual depiction of the social media sources that U.S. adults receive news. Taken from “News Use Across Social Media Platforms 2016” by J. Gottfried and E. Shearer, 2016. Pew Research Center. p. 4.

The Pew Research Center also reports, that as of 2016, 86 percent of U.S. 18 to 29 year olds use at least one social media site regularly (Pew Research Centre, 2017a). See Figure 3 for a complete age breakdown of social media usage over the last decade.

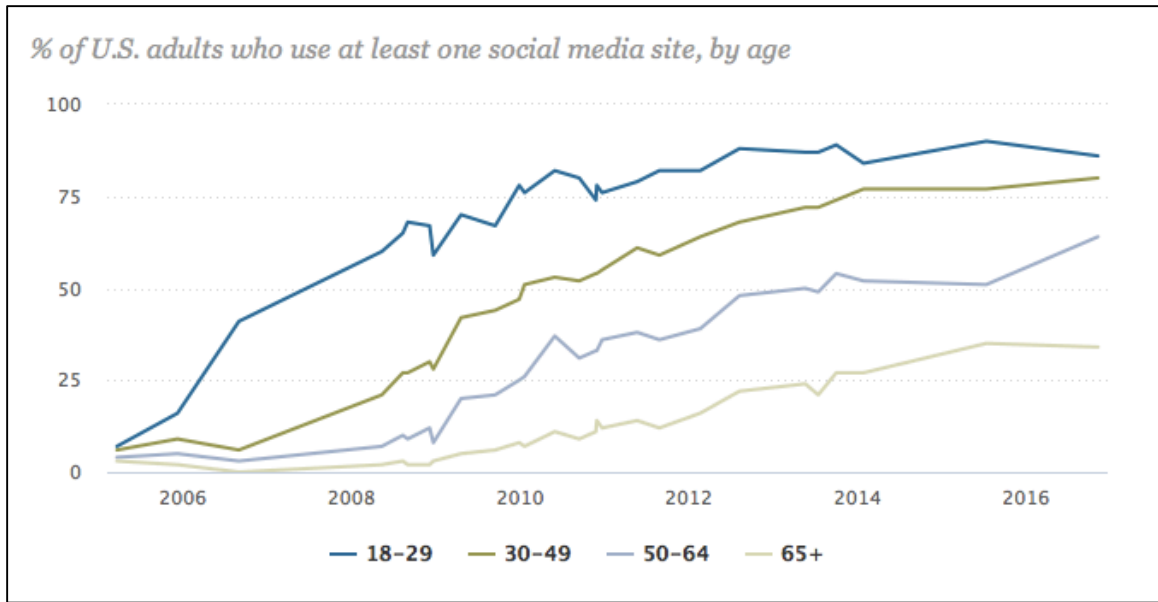


Figure 3. Visual depiction of social media use by age by U.S. adults. Taken from “Social Media Use by Age”, 2017a. Pew Research Center. (<http://www.pewinternet.org/chart/social-media-use-by-age/>)

In a separate chart, they indicate that of all Americans utilizing social media, 76 percent use Facebook daily with Instagram next, at 51 percent using it daily (Pew Research Centre, 2017b). See figure 4 for a full summary of their findings.

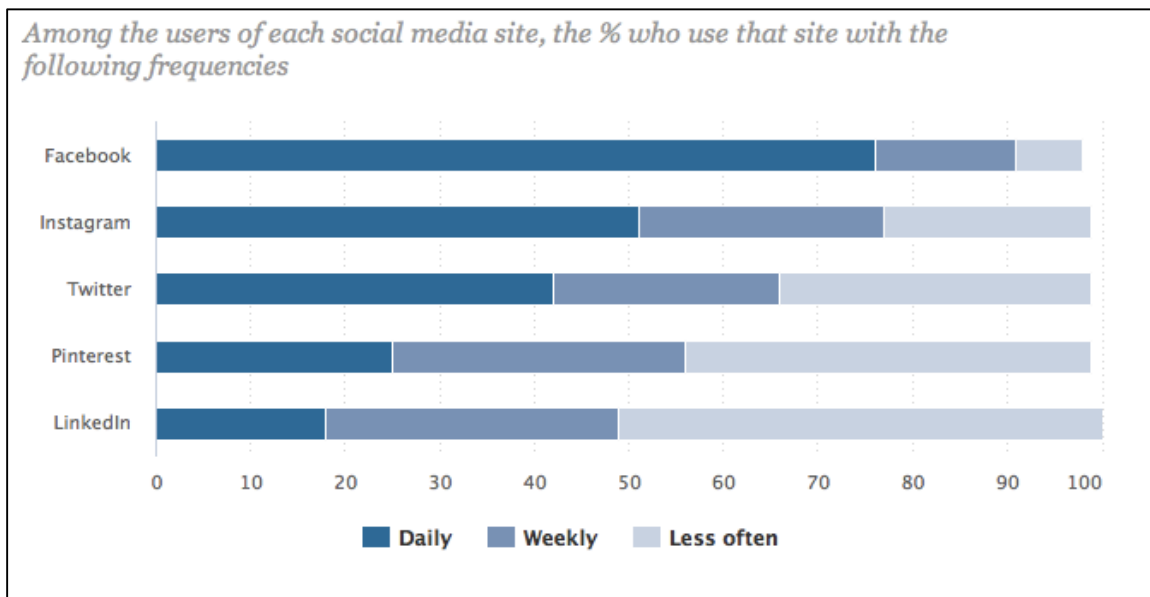


Figure 3. Visual depiction of frequency of social media use by Americans. Taken from “How often Americans are using social media”, 2017b. Pew Research Center. (<http://www.pewinternet.org/chart/how-often-americans-are-using-social-media/>)

Insights West, a market research company, conducted a survey of Canadian social media use in March of 2016. Their results were a little lower than the American results, found above. Seventy-one per cent of Canadians use Facebook on a weekly basis; where 54 percent of Canadians use Facebook daily (Insights West, 2016); see Figure 5. YouTube and Twitter are next with 49 percent and 27 percent respectively for weekly use (Insights West, 2016). Of 18 to 34 year olds, only 10 percent have never tried Facebook; with only 4 percent having never tried You Tube (Insights West, 2016).

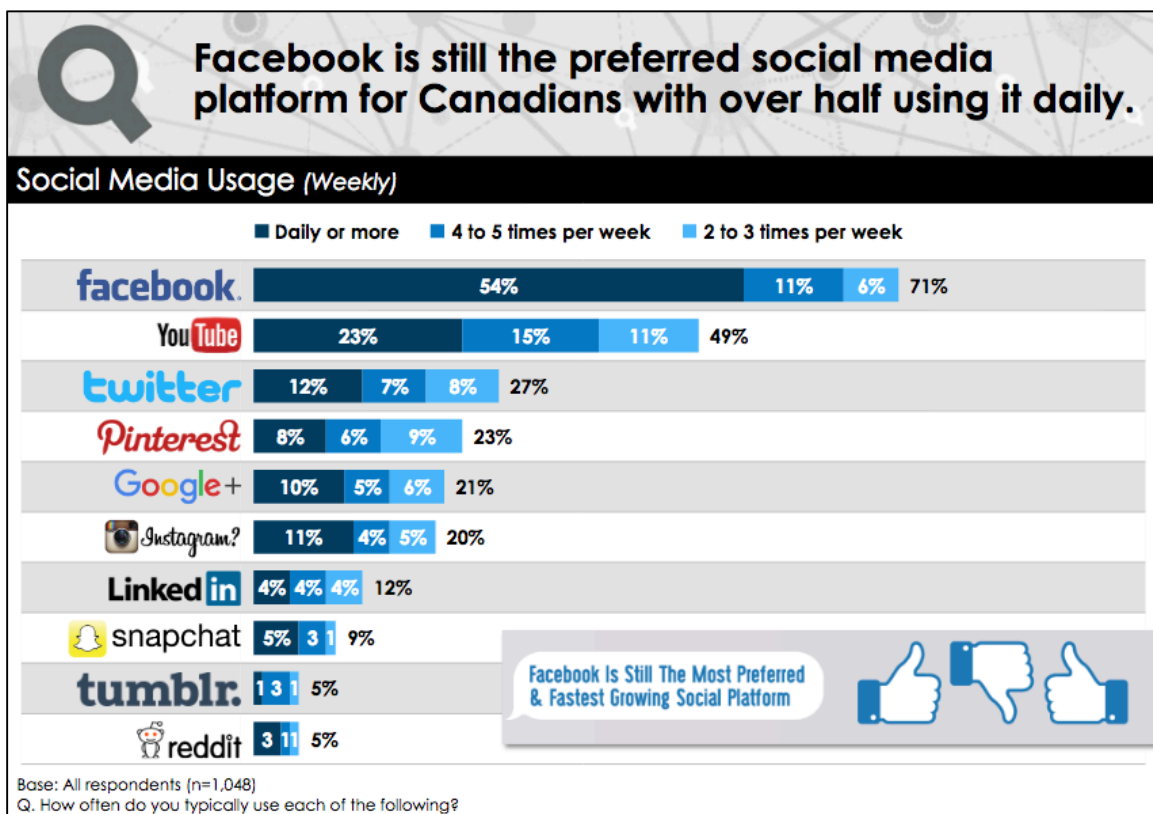


Figure 5. 2016 Survey of Canadian social media Use. Taken from “2016 Canadian Social Media Monitor”, 2016, Insights West (http://www.insightswest.com/wp-content/uploads/2016/05/Rep_InsightsWest_CDNSocialMediaMonitor_2016.pdf)

Both the American and the Canadian surveys indicate that Facebook is the most popular social media site; and that its use has continued to grow year over year. This trend would validate Veil, Buehner and Palenchar’s (2011) recommendation that

emergency managers must become proficient in both traditional and social media platforms.

Risk Perception

Having looked at evacuation and warnings generally, this brings us to risk perception, one of the key purposes behind this study. Disaster decision making is inextricably intertwined with warnings and risk perception. Mileti and Peek (2000) discuss risk perception in terms of expected personal impacts following or in advance of a disaster event. Risk perception has been measured in a variety of different ways by different researchers. Tierney, Lindell and Perry (2001), describe them as, "...the perceived likelihood of a particular type of event, such as an earthquake; as the perceived magnitude of an event; as expectations about the severity of its impacts on the community; and as expectations about the personal threat posed by the hazard" (p. 89). Eiser et al. (2012) suggest that risk is, "...a function of (a) the likelihood and (b) the value of some possible future event or events" (p. 7). They go on to state, "More importantly, however, risk arises not just from how some future can be described, but from the uncertainty, actual or perceived, surrounding that description" (Eiser et al., 2012, p. 7). Risk has different connotations to individuals. Perceived personal risk, depends on people's personal experience with hazards. Some research has found it to be related to the recency, frequency and intensity of personal experiences (Lindell & Prater, 2000; Weinstein, 1989). Weinstein (1989) postulates that if someone's experience with a hazard is minor, they, "...are not inclined to adopt additional preventive measures or to respond more quickly to future warnings" (p. 47); whereas, he states, "If the harm experienced is serious, people have increased motivation to reduce their risk" (p. 47).

When referring to personal experience, Lindell and Hwang (2008) indicate that this can be casualties or damage experienced by the person themselves, or by members of their immediate family, extended family, friends, neighbours, or coworkers. Mileti and O'Brien (1992) state, "perceived risk has a direct and positive impact on responding to warnings with protective actions" (p. 53). In other words, as stated earlier, if someone believes the threat of harm or loss is real then the likelihood of him or her responding to a warning, i.e. an evacuation warning, is greater (Dash & Gladwin, 2007). Further to this then, the individual must have an understanding and a belief of the risks if emergency managers expect them to respond to the warnings.

Mileti and Peek (2000) describe this in a little more detail, suggesting that risk perception includes: understanding the warning, having a belief in the risk information and its accuracy, and being able to personalize the risks. This leads to deciding what actions to take in light of the risk perceptions, and then executing those actions (Mileti & Peek, 2000).

One would think that timing of an evacuation would be linked to risk perception. Sorensen (1991) indicates that, "People appear to adjust the rapidity of their evacuation behavior in accordance with the severity and timing of the impending threat" (p. 155). Threats that are more imminent will elicit a faster response than a threat that is slow moving. Sorensen (1991) cites Burton (1981) while discussing the example of the Mississauga, Ontario hazardous material train derailment, where 90 percent of the first group of evacuees evacuated within 60 minutes, and of those, 60 percent left within 10 minutes or less. Yet, in a study of the Nanticoke, Pennsylvania hazardous materials fire, Sorensen (1991), found that there was no correlation between the perceived threat and the

amount of time it took people to evacuate. That being said, the personalization of the warning did have an impact on mobilization time – i.e. if the message was delivered by a friend or a relative, the evacuation response was quicker; if the message was delivered by a siren the evacuation response was slower (Sorensen, 1991).

Fitzpatrick and Mileti (1991), discuss the perceptions that motivate evacuation and note, as mentioned above, that understanding, belief and personalization are the necessary perceptual elements. Looking at each element, the researchers comment that the individual's interpretation of the meaning of the message may differ and thus affect their interpretation of the risks being communicated (Fitzpatrick & Mileti, 1991). They further comment that, "...understanding is connected to people's existing frames of knowledge and reference developed prior to the emergency situation" (Fitzpatrick & Mileti, 1991, p. 140). If a person has little prior knowledge of a hazard situation then it will be difficult for them to understand or contextualize the risks they could be facing. Mileti (1999) comments on this, stating, "the overwhelming scientific evidence is that people typically are unaware of the hazards they face, underestimate those of which they are aware, overestimate their ability to cope when disaster strikes..." (p. 136). As mentioned earlier, belief is critical in instigating a response. Part of developing belief is confirmation. People will typically try to confirm the information they have heard by seeking out alternative sources for the information (Fitzpatrick & Mileti, 1991; Mileti & Sorensen, 1990). Confirmation is therefore, an important part of the warning and believing process. While discussing the confirmation process, Mileti & Sorensen (1990) state, "It helps people better understand warnings, believe them, personalize the risk, and make response decisions" (p. 5-3). Speaking of personalization, this is when people

determine the amount of danger or risk that the hazard poses to them personally (Dash & Gladwin, 2007).

Much of the research on evacuation and evacuation risk perceptions, as mentioned previously, is focused on tornadoes, hurricanes, flooding (Sorensen et al., 1987) and to a lesser extent wildfires. This study, focused on a wildfire in a northern Canadian community, fills a gap in the current academic literature for both risk perceptions and evacuation behaviours, particularly in regards to age and gender.

Wildfire Evacuation

Jennifer Beverly and Peter Bothwell (2011) conducted an interesting study of wildfire evacuations in Canada between 1980 and 2007. Their research was challenging, as there is no central repository for this type of information. They derived their statistics from news media, individual agencies, etc., but in many cases the exact numbers of evacuees were estimates based on census data or numbers of people who registered at evacuation sites (Beverly & Bothwell, 2011). They found that between 1980 and 2007 there were 547 evacuation events, ranging from 1 to 53 with an average of 20 per year (Beverly & Bothwell, 2011). Beverly and Bothwell reported that 70 percent of the evacuations involved less than 300 people with a minimum of 40 people in 1984 and a maximum of 51,346 people in 2003. In the 28 year study a total of 497 homes were destroyed; an average of 18 homes per year (Beverly & Bothwell, 2011). The researchers noted that the majority of wildfire related evacuations were a result of an evacuation order due to a direct threat from wildfire; less than 3 percent of evacuations were voluntary (Beverly & Bothwell, 2011). As an aside, the researchers only found one

reference to a direct wildfire related death in the entire study period (Beverly & Bothwell, 2011).

Comparing these statistics with the United States, in 2015 wildfires destroyed 2,638 residences; with the State of California accounting for 1,892 of those homes (National Interagency Coordination Center, 2015). This is more than five times as many homes destroyed by wildfire, in the U.S., than all the homes destroyed by wildfire in Canada in the 28-year study conducted by Beverly and Bothwell (2011). Interestingly enough, total areas consumed by wildfire, for both the U.S. and Canada are very similar. The 68,151 wildfires in the U.S. in 2015, burned a little more than 4 million hectares (National Interagency Coordination Center, 2015). These numbers are a little higher than the typical U.S. average over the last 10 years, of 2.83 million hectares (National Interagency Coordination Center, 2015). Meanwhile, in Canada, the 2015 number is 3,903,277 hectares consumed; also, a little higher than the 10 year average for Canada, of 2.4 million hectares (Canadian Interagency Forest Fire Centre Inc., 2015). The summary of these statistics, is that Canada and the U.S. have, on average, a similar amount of land area consumed by wildfire each year. The United States, on the other hand, has a significantly higher annual average number of homes lost to wildfires. Beverly and Bothwell (2011) surmise that this is because two thirds of Canada's population live within a narrow stretch of land along the Canada/United States border. They state, "Overall, Canada's population density is 3.5 persons per km² or about one-tenth that of the United States, but in the most fire-prone regions of the country, population densities are much lower" (Beverly & Bothwell, 2011, p. 575). This is consistent with the findings of a 2002 study by Stocks et al., whereby they examined Canadian wildfires that occurred

between 1959 and 1997. Stocks et al. (2002) mention several times throughout their discussion, that Canadian wildfires occur predominantly in the northern forested areas where the population is sparse. They also note that almost half of the areas burned by fires were not suppressed to some degree unless they were threatening communities (Stocks et al., 2002). In other words, if the fires were not near homes, little effort was made to contain the fires.

Australia has also had its share of deadly bushfires over the years. Therefore, there has been a number of applicable studies conducted that could be relevant to the research in this study. In 1967 the Hobart Fires killed 62 civilians; the “Ash Wednesday” fires in 1983 killed 60 civilians; and in 2009, the “Black Saturday” fires killed 173 people and destroyed over 2,000 homes (Beatson & McLennan, 2011). In a report on the “Black Saturday” fatalities, Handmer, O’Neil and Killalea (2010), indicate a number of reasons why the fatalities occurred. Some of the reasons include, unawareness of the risk, misconceptions about bushfire safety, lack of official warning that plans should be activated, and waiting until the flames could be seen prior to taking action (Handmer et al., 2010).

It should be noted that Australia has a ‘prepare, stay and defend, or leave early’ policy, that allows residents the freedom to decide whether they will evacuate, presumably early, or stay and attempt to defend their property against the fire (Stephens et al., 2009). Stephens et al. (2009) suggest that this policy may actually be better than the U.S. practice of anticipating the fire spread, ordering mandatory evacuations, and having professional fire services move in to suppress the blaze. The caveat, of course, is having trained residents with the knowledge and capabilities to defend their property

(Stephen et al., 2009). Paveglio, Carroll and Jakes (2008), also did some research examining the “prepare, stay and defend, or leave early” response to wildfires and suggested the Australian policy would be worth considering. Both sets of researchers made these comments and suggestions prior to the Black Saturday fires that killed 173 civilians.

In a separate study, examining fatalities in Australian bushfires from 1900-2008, researchers found that the majority of deaths were the result of late evacuations, or, in the case of males, defending property outside (Haynes, Handmer, McAneney, Tibbits, & Coates, 2010). These researchers stated, “...while there is no zero risk option when confronted with a bushfire, staying and actively defending a dwelling appeared to be the safest option, and leaving at the last minute the most dangerous” (Haynes et al., 2010, p. 192). Again, these comments were made prior to the results of the Black Saturday fires being analyzed and the authors noted that their findings could change based on new data. Staying to defend property has obvious risks; but, evacuating too late has equally life-threatening consequences.

In the 2009 Victorian Bushfires Royal Commission (VBRC) (2010) final report on the Victorian Bushfires, known as the Black Saturday fires, it noted that, “The stay or go policy failed to allow for the variations in fire severity that can result from differing topography, fuel loads and weather conditions” (2009 Victorian Bushfires Royal Commission [VBRC], 2010, p. 5). The report indicated that evacuating early is still the safest option; however, staying to defend a home, in less severe fires, with the proper qualifications, may still be a sound option to consider (2009 VBRC, 2010). In fact, Gledhill (2003), presented a paper at the Third International Wildland Fire Summit, and

stated that, “Most Australian fire authorities, including Tasmania Fire Service, no longer support large-scale evacuation of people from areas threatened by bushfires” (p. 1).

Beatson and McLennan (2011) reviewed three different studies related to the Black Saturday fires and concluded that, “Few people in high bushfire risk communities personalized warnings of the dangers posed by extreme fire danger weather; few undertook thorough preparation of their homes to resist bushfire attack; few undertook the necessary planning and preparation to leave in a safe and timely manner; many were caught unawares by the rapid advance of the fires; and many residents expected authorities to issue a specific direction to them that it was time to leave” (p. 172).

Between the Beatson and McLennan (2011) reviews and the 2009 Victorian Bushfires Royal Commission (2010) report, it would appear that there were some deficiencies with the stay or go policy. It further appears that leaving early posed the best possible outcome in terms of survivability. The 2009 VBRC (2010) report had 67 recommendations covering everything from planning and building, land and fuel management, fireground response, and others. The very first grouping of recommendations concerned Victoria’s bushfire safety policy. Specifically, enhancing the role of warnings to include information about the predicted path of the fire and the actions people are to take; emphasizing that all fires are different and a certain level of awareness of fire conditions, local circumstances and personal capacity are important; and recognizing that on the worst days, heightened risk may necessitate a different response (2009 VBRC, 2010). Another recommendation was specific to evacuation, stipulating that the state encourage early evacuation, particularly for vulnerable people with consideration that the vulnerable may require assistance (2009 VBRC, 2010).

Doug Cote and Tara McGee (2014) did a small case study in the hamlet of Mt. Lorne, Yukon, Canada. The purpose of their research was to examine residents' perceptions of evacuation and the alternatives available; determine how residents planned to respond to a wildfire; and identify the influencing factors (Cote & McGee, 2014). The community they studied has a population of 410 people; their focus group consisted of 12 participants ages 28 to 64 (Cote & McGee, 2014). One of the lines of inquiry of their research, was to explore the stay and defend alternative to evacuation. All but one of their participants had heard of it and all of the participants concurred that they would prefer to stay and defend (Cote & McGee, 2014). That being said, a majority of their participants said that if conditions got extreme, they would evacuate. This is a problem, because as noted in the previous studies, fleeing at the last moment during a wildfire is exceptionally dangerous (2009 VBRC, 2010; Beatson & McLennan, 2011; Haynes et al., 2010; Stephens et al., 2009). The study highlighted that wildfire management agencies need to ensure that local residents understand the risks associated with wildfires and staying to defend their property (Cote & McGee, 2014). The people in the study had the best intentions for their properties, but the majority did not come across as knowledgeable, informed, or as prepared as they would need to be to stay and defend their properties during a wildfire incident (Cote & McGee, 2014). Finally, Cote and McGee (2014) suggest that, "Further study is needed to obtain an understanding of Canadians' wildfire evacuation intentions, and to identify factors that influence evacuation intentions" (p. 501).

In 2003 there was a wildfire in the area of Barriere, British Columbia, known as the McClure fire. Researchers from the University of Lethbridge conducted a survey

from the community seeking information about their evacuation experiences. Their study resulted in a number of interesting statistics relating to households and community.

Twenty nine percent of the survey group had previous experience with wildfires (Kulig et al., 2010). Of the group surveyed, 201 individuals, only one person thought that they would die as a result of the fire (Kulig et al., 2010). Ninety percent of the participants were evacuated, and of those, 37 percent were evacuated more than once (Kulig et al., 2010). A large portion of the study was devoted to inquiry about the aftermath of the fire and community resiliency. The majority of the survey participants felt that the community came together and helped one another through the experience (Kulig et al., 2010).

Taylor et al. (2007), conducted a “quick response” research study during the 2003 wildfires in the San Bernardino area of California. Quick response research is intended to, “...understand circumstances that exist only fleetingly and/or to document evidence created as a result of a damaging event that will not survive clean-up operations” (Michaels, 2003, p. 15). In this case, the researchers were studying how communities, threatened by wildfire, communicate and obtain information (Taylor et al., 2007). Their study revealed that the primary information the public was seeking, at the outset of the fire, was, ““Where exactly is the fire?” “How bad (how big) is it?” and “Which direction is it moving?”” (Taylor et al., 2007, p. 202). The answers to these questions would allow the community to determine whether their homes were at risk and whether they should or should not evacuate. In the study conducted by Taylor and his colleagues, residents reported requiring “real-time” information, regardless of whether it was obtained from official sources or not (Taylor et al., 2007). The official information disseminated often

spoke of number of fire fighters and amount of apparatus but it failed to provide the local specifics that the residents required for decision making (Taylor et al., 2007). Although the affected county had set up a hot line switchboard, where residents could call in to obtain information, the call in line was understaffed and didn't have updated information, causing frustration for callers (Taylor et al., 2007). Taylor and the other researchers noted, "That lack of up-to-date, site specific information from official sources was a consistent concern heard throughout this fire communication study" (Taylor et al., 2007, p. 204). Other sources of information were a little hit or miss, according to the study. San Bernardino is relatively close to Los Angeles. The large media outlets were targeting the masses in Los Angeles, rather than focusing on providing quality information to the residents of the San Bernardino area affected by the wildfires. As a result, the information broadcasted was often inaccurate, sensationalized, and not timely (Taylor et al., 2007). On the positive side, a small local radio station made a point of broadcasting relevant information as often as possible. Even when the radio station owner had to evacuate, he continued to provide updates on his radio station's web site (Taylor et al., 2007). The summary of the study is that people need timely and accurate information to help them cope with the threat facing them; if they are unable to get this information from official sources, they will likely turn to less formal information networks to obtain the necessary information (Taylor et al., 2007).

Slave Lake Fire

The Slave Lake fire of 2011, in northern Alberta, resulted in an evacuation of almost 15,000 people and the destruction of 730 homes (KPMG, 2012). At the time, the Insurance Bureau of Canada stated that the Slave Lake fire was the second costliest

disaster in Canadian history, estimated at over \$700 million (KPMG, 2012). This fire, is the most closely related disaster, both in terms of type and of the evacuation, to the Fort McMurray wildfire of 2016. Both communities are fairly isolated in Northern Alberta.

A group of Alberta researchers investigated the impacts of the Slave Lake wildfire on local area school children. Although the study is interesting and was seemingly relevant, because it is a specific age based survey relating to a Canadian wildfire incident, the study focused on examining the psychological effects on children in grades three to twelve (Townshend et al., 2015). As a result, the study is not applicable to the research being undertaken in this Fort McMurray research project.

A separate study concerning the Slave Lake fire (with some of the same researchers) focused on family functioning in the recovery phase after the fire. This study is also revealing in relation to the project that this paper is focused on, in that, it is family specific. Young people, aged 18-24, were not included in the Slave Lake study, as this age range was not part of any of the family units studied. Of the 19 families surveyed, adults were aged 29 to 48 years and the children were aged, 9 to 12 years (Pujadas Botey, & Kulig, 2014). This could potentially indicate that future research may need to be conducted on the recovery phase of young adults from wild fires. Another interesting note from the Pujadas Botey and Kulig (2014) study, was that families evacuated as family units. This sentiment, of needing to evacuate as a family unit, was also observed during Hurricane Katrina (Peek, Morrissey, & Marlatt, 2011). In the Hurricane Katrina study, like the Slave Lake study, young adults, aged 18 to 24, were not typically included in family units.

About Young People

The survey for this research project was conducted on a college campus. Students, staff and faculty were respondents. The research intended to focus on 18 to 24 year olds as compared to adults who are older. The Pew Research Center conducts research on a variety of social science, political, scientific, and demographic trends. They suggest that people born between 1981 and 1997 fall into the “Millennial” generation (Pew Research Center, 2015a). It can be noted that 18 to 24 year olds, at the time of the wildfire in Fort McMurray, would have been born between 1992 and 1998. Some of these young people would be at the very tail end of the millennial generation. Monster Worldwide Incorporated, is a company that focuses on connecting people to jobs (Monster Worldwide Inc., 2016a). In a 2016 survey they sponsored, they dubbed “Generation Z” as young people born between 1996 and 2001; they also referred to the Millennial Generation as “Generation Y” (Monster Worldwide Inc., 2016a). Needless to say, the young people in the Fort McMurray evacuation survey cross over between these two generations. Many of the adults, 25 and older, who participated in the survey fall within the “Millennial Generation” or, if older than 36 years of age at the time of the wildfire, they would fall into the “Generation X” category (as defined both by the Pew Research Center (2015a) and Monster Worldwide Inc. (2016a)). Adults older than 51 years of age, at the time of the wildfire, would be “Baby Boomers” (Pew Research Center, 2015a).

The generational differences may be important when examining information sources and differences in evacuation behaviours between the groups. Monster Worldwide Inc. (2016b) describes Generation Z as, “...the first generation that has grown

up with access to ubiquitous internet technology since birth” (p. 6). They further claim that for Generation Z, “there is no separation between online and offline worlds” (Monster Worldwide Inc., 2016b, p. 6). A Pew Research Center report suggests that Millennials are not much different, in that, “They are history’s first “always connected” generation” (Taylor & Keeter, 2010, p. 1). Millennials have been referred to as “digital natives” because they have not needed to adapt to technologies such as social media, the internet, mobile technology, etc. – they have grown up with it (Pew Research Center, 2014). Millennials tend to stay connected via social media sites more so than their older counterparts. In the same report cited above, Millennials, in 2013 had an average of 250 Facebook friends; where Generation X Facebook users had an average of 200; older generations peaked at 98 friends on average (Pew Research Center, 2014). In another survey of technology stakeholders and critics, conducted by the Pew Research Center, they described the life skills of young people in the year 2020 as: able to search for online information and be able to determine the quality and the veracity of the information found; able to synthesize information from a variety of sources; and able to differentiate between “noise” and the message actually being communicated (Anderson & Rainie, 2012). The online savviness of the younger generation (either Generation Y or Generation Z) is worth noting when considering methods of communication to this populace. This is highlighted in the previous section discussing social media usage; where it is mentioned that 86 percent of 18 to 29 year olds, in the United States, use at least one social media site regularly (Pew Research Center, 2017a).

Speaking of communications, in 2013, nearly all Millennials, 96 percent, and Generation Xers, 95 percent, reported having a cellular telephone (Pew Research Center,

2014). In a Canadian survey by Catalyst, a consumer research company, they found that 18 to 24 year olds had the largest growth of “at home” usage on their smart phones across six common activities, such as getting directions, finding restaurants, etc. (Catalyst, 2015). Refer to Figure 6 for the details.

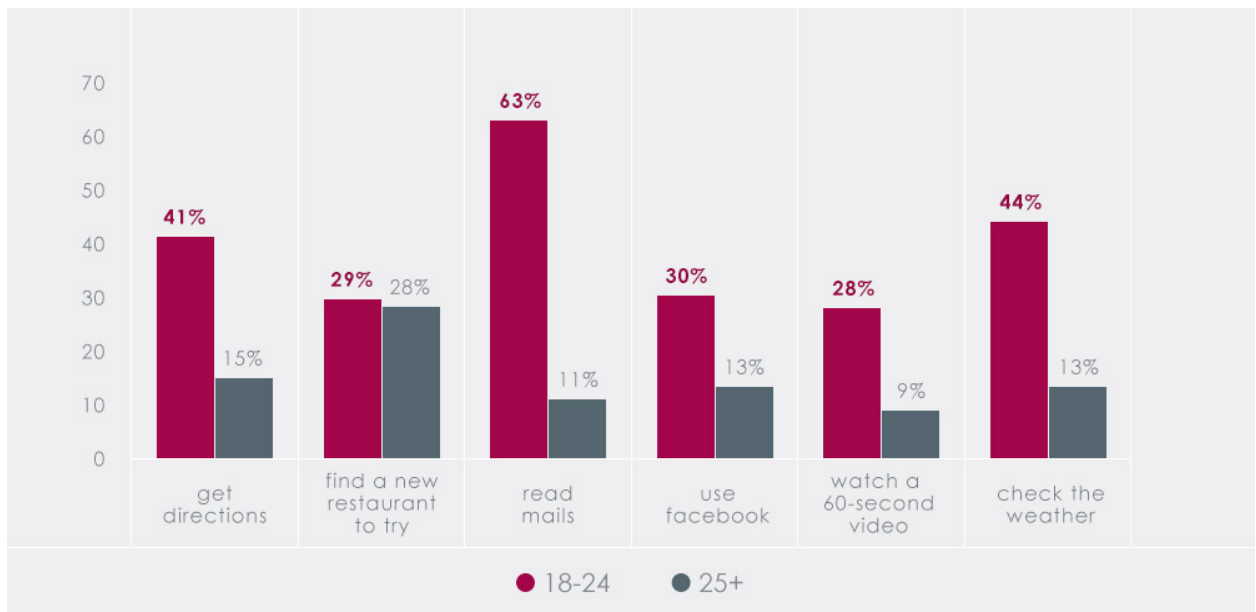


Figure 6. Growth in share of ‘at home’ users within respondents who use a smartphone as a primary device for activity. Taken from “With Growth Comes Change: The Evolving Mobile Landscape in 2015”, 2015. Catalyst. (<http://catalyst.ca/2015-canadian-smartphone-market/>)

In Canada 73 percent of the population owns smartphones (Canadian Radio-television and Telecommunications Commission [CRTC], 2016); with over 30 million wireless phone subscriptions throughout the country (Canadian Wireless Telecommunications Association [CWTA], 2017). The Catalyst survey states, “Smartphones are no longer merely prevalent in Canada, but virtually ubiquitous” (Catalyst, 2015, “Mobile is growing – and fast,” para. 5). In summary, a majority of the population has smartphones, and the younger generations are clearly excelling in their

use – to obtain news, to stay in touch, to check the weather, and to communicate to name a few.

When referring to sources of information, an additional study by the Pew Research Center (2015b) comments that, much of the news obtained by Millennials comes from Facebook and Google News. This study indicates that Millennials are almost opposite Baby Boomers, in that Baby Boomers obtain 39 percent of their political news from Facebook and 60 percent from local TV; whereas Millennials obtain 61 percent of their political news from Facebook and only 37 percent from local TV (Pew Research Center, 2015b). Generation Xers fall into the middle with 51 percent getting political news on Facebook and 46 percent from local TV (Pew Research Center, 2015b). Millennials and Generation Xers are more inclined than other generations to actually follow news organizations on their respective social networking sites (Pew Research Center, 2015b).

The other interesting fact about Millennials, and potentially Generation Z is their living arrangements. According to the Pew Research Center, Millennials are more likely to live at home than earlier generations (Fry, 2017). Their study indicates that 15 percent of 25 to 35 year olds (in 2016) were living in their parents' or a parent's home (Fry, 2017). The report suggests that success in the labor market (or lack thereof), the cost of living independently and the amount of debt one has, may all be influential in the propensity for Millennials to stay at home (Fry, 2017).

Students in Disasters

A 2005 journal article compares experiences from Hurricane Floyd between community members and university students. It is one of the few studies where students

are considered as a separate entity in disaster research. The authors found that, “...students occupy a unique position within university communities which buffers them from the effects of natural hazards” (Van Willigen, Edwards, Lormand, & Wilson, 2005, p. 180). In this research study, they found that students evacuated at higher rates than did other members of the community (Van Willigen et al., 2005). The authors suggest that the high rate of evacuation of students could be as a result of them being able to evacuate to their parents’ homes; 71 percent stayed with their parents after evacuating (Van Willigen et al., 2005). Conversely, of the community residents surveyed, 29 percent stayed with parents, 31 percent with other relatives, and 22 percent with friends (Van Willigen et al., 2005). Of the students, 2 percent stayed in hotels or motels and less than 1 percent stayed in community shelters; compared with the rest of the community where it was 14 percent and 4 percent respectively for hotels or motels and community shelters (Van Willigen et al., 2005). This study also examined risk perception in terms of expectation of flood as a predictor of evacuation. In the study, both populations, students and the rest of the community, had similar risk perceptions, “Community residents and off-campus students who perceived that their home was at risk of flooding evacuated in greater numbers than those who did not” (Van Willigen et al., 2005, p. 185).

Conclusion of the Literature Review

As noted, there has been a significant amount of research on evacuations, evacuation behaviour, warning systems, and risk perceptions. Evacuation behaviour is largely focused on whether people evacuated or not. There is some attention on where they went, who they went with, and other related information. Risk perceptions are influenced by the information received (Fitzpatrick & Mileti, 1991); therefore, it is

important to have a good understanding of the sources of information and the messages being communicated that affect risk perception. Fitzpatrick & Mileti (1991), state,

When information is repeatedly and consistently delivered and when it enters into the public's informal communication processes with one another, the message (e.g., evacuation warning) is provided its greatest opportunity to help an endangered public form a definition of the situation consistent with the risk it faces. In this way, by assisting and guiding the definition of the situation, the actual behavioral outcome can also be greatly enhanced (p. 147).

Dow and Cutter (1998) echo a similar sentiment stating, "In general, the stronger predictors of evacuation behavior are tied to personal risk perception" (p. 239). In the case of the Fort McMurray wildfire, the end result behaviour was evacuation, because, for the most part, everyone was forced to leave. Regardless of that, people still had personal perceptions of the risks they faced and their potential personal impacts. These perceptions were influenced by a variety of different factors, including, the source of the information, the environmental cues, social cues, etc. It is worthwhile to look at these factors and draw a correlation between them and their perceptions of risk. It is further interesting to examine the differences in these factors and their possible effects on risk perception between 18 to 24 year olds and older adults and between genders. Studies, focusing on risk perceptions and evacuation behaviours in Canada are fairly limited; therefore, this study aimed at contributing to the knowledge base for practitioners and academics to draw upon.

III – Methodology

This study was intended to survey adults about their experiences and risk perceptions during the evacuation from Fort McMurray during the wildfire in May of 2016. Ideally, important information about their risk perceptions and their expected personal impacts, while considering evacuation, will be beneficial for emergency managers. Understanding the differences between young adults and older adults in terms of their expected personal impacts and their evacuation behaviours is of interest as well. Examining these same differences from a gender perspective was decided upon after the fact.

Theoretical Framework

Protection motivation theory was first described by Ronald Rogers in 1975. The theory proposes that a fear appeal initiates a cognitive appraisal process that mediates an attitude change (Rogers, 1975). Rogers (1975) cites Atkinson's conceptualization of achievement motivation, Edwards' decision making theory, Lewin's decision making and field theory, Tolman's purposive behaviourism, and Rotter's social learning theory as examples of prior theories with similar expectancy and value concepts to explain behaviour in a choice situation. Rogers states, "For all of these researchers, the tendency to act in a particular fashion is said to be a function of the expectancy that the given act will be followed by some consequence and the value of the consequence" (Rogers, 1975, p. 96). Rogers (1975) develops this more specifically relating fear with cognitive appraisal and attitude change or response. The original model was developed to explain the effects of fear appeals on health attitudes and behaviours (Rogers, 1975). Figure 7 displays the original concept model, outlined by Rogers.

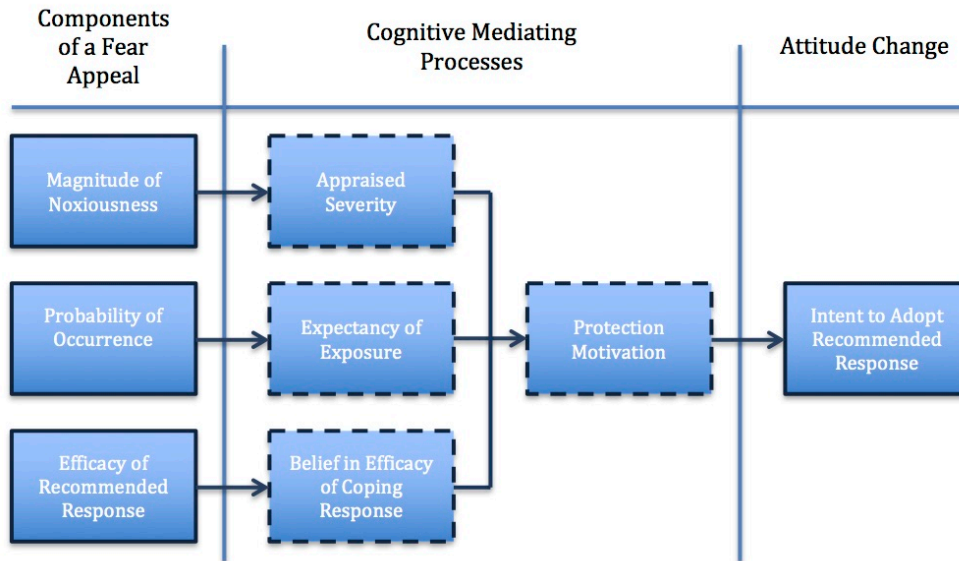


Figure 7. Schema of the Protection Motivation Theory. Adapted from “A Protection Theory of Fear Appeals and Attitude Change” by R. W. Rogers, 1975, *Journal of Psychology*, 91, p. 99.

Maddux and Rogers (1983) refined this model slightly to include self-efficacy as an additional cognitive mediating process. Self-efficacy theory, as described by Maddux and Rogers (1983) includes, “outcome expectancy, the belief that a given behavior will or will not lead to a given outcome; and a self-efficacy expectancy, the person’s belief that he or she is or is not capable of performing the requisite behavior” (p. 470).

In the early development of the model, like Roger’s first model, it was used primarily for health-related issues such as smoking cessation (Maddux & Rogers, 1983), breast cancer self-exams (Rippetoe & Rogers, 1987) and others (Floyd, Prentice-Dunn, & Rogers, 2000). As researchers continued to apply the model, it expanded to a wider variety of issues including injury prevention, politics, the environment, and the protection of others (Floyd et al., 2000). Therefore, instead of just health related issues and threats, “the protection motivation concept involves any threat for which there is an effective recommended response that can be carried out by the individual” (Floyd et al., 2000, p. 409).

The model outlined by Rogers and colleagues has similar elements to the model by Michael Lindell and Ronald Perry (2004; 2012), coined, The Protective Action Decision Model or PADM. They summarize the research by stating:

[S]ensory cues from the physical environment (especially sights and sounds) or socially transmitted information (e.g., disaster warnings) can each elicit a perception of threat that diverts the recipient's attention from normal activities. Depending on the perceived characteristics of the threat, those at risk will either resume normal activities, seek additional information, pursue problem-focused actions to protect people and property, or engage in emotion-focused actions to reduce their immediate psychological distress. Which way an individual chooses to respond to the threat depends on evaluations of both the threat and the available protective actions (Lindell & Perry, 2004, p. 46).

Disaster warnings and other hazard communications generally prompt people to reexamine their current situation and realize the potential threat that their environment poses. The process of reexamining the situation will ideally lead to options for action and finally a decision on an appropriate response to the threat (Lindell & Perry, 2004).

Figure 8 presents the protection action decision model as described by Lindell and Perry.

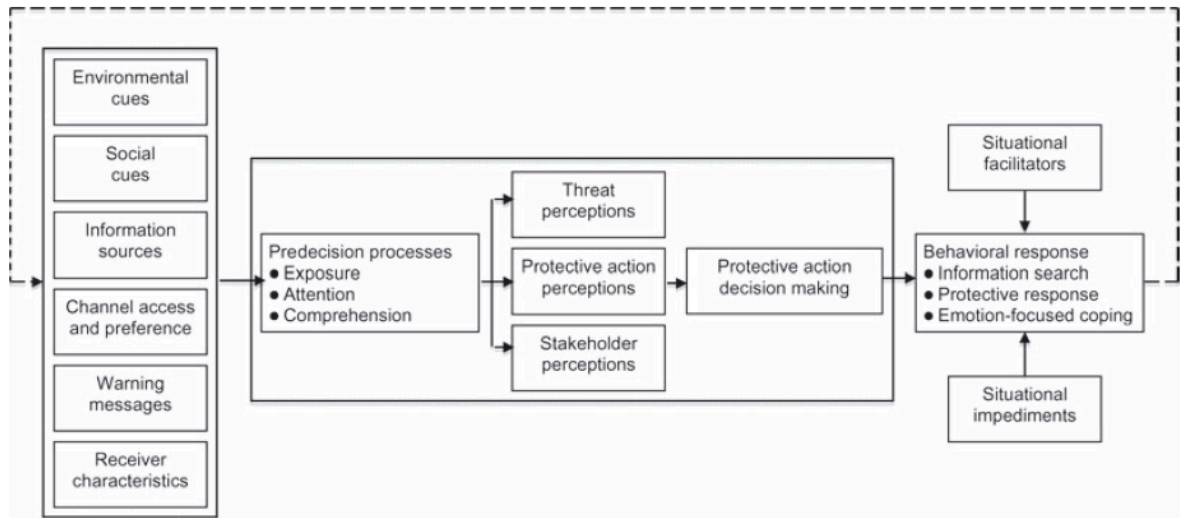


Figure 8. Information flow in the Protective Action Decision Model (PADM). Taken from “The Protective Action Decision Model: Theoretical Modifications and Additional Evidence” by M. K. Lindell & R. W. Perry, 2012, *Risk Analysis*, 32, p. 617.

Tierney et al. (2001) confirms that, “Evacuation decisions are affected by observable cues in the environment, such as wind and rain...” (p. 92), or in the context of this study, fire and smoke, “...as well as by message and warning system characteristics” (p. 92). The text continues suggesting, “Other influences include psychological, sociodemographic, and sociocultural characteristics and past experiences of the individuals and groups that receive disaster warning” (Tierney et al., 2001, p. 92). The PADM as indicated above contains many of the elements or variables that Tierney et al. (2001) describe.

Lindell and Perry’s PADM has been adapted for different studies depending on the type of event and whether the study was pre or post disaster. While examining household evacuation decision making in response to Hurricane Ike, researchers modified the PADM model (Huang et al., 2012) to look like the following, in Figure 9.

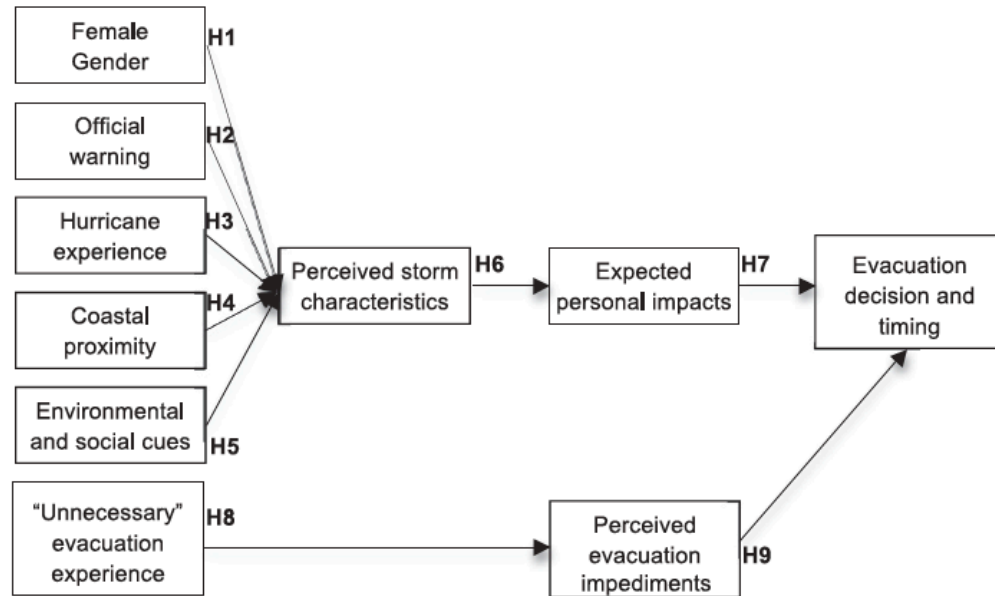


Figure 9. Abbreviated form of the PADM applied to the Hurricane Ike evacuation study. Taken from “Household Evacuation Decision Making in Response to Hurricane Ike” by S.-K. Huang, M. K. Lindell, C. W. Prater, H.-C. Wu and L. Siebeneck, 2012. *Natural Hazards Review*, 13. p. 286.

The researchers commented that in this case, their study required a modification of the PADM because the study was retrospective, or after the fact; therefore, some of the variables could not be reliably measured i.e. the pre-decision processes of exposure, attention and comprehension (Huang et al., 2012). In this model, like the prior version of the model by Lindell and Perry (2012), the behavioural response, or evacuation, is the outcome.

Conceptual Framework

For the study at hand, the evacuation of Fort McMurray, a similar modified version of the protective action decision model is proposed; however, the model is shortened, only looking at the factors influencing the risk perceptions. McLennan, Cowlshaw, Paton, Beatson, and Elliott (2014), in their investigations of theory of planned behaviour (TPB) and protection motivation theory (PMT), related to wildfires, surmise that utilizing a theoretical model to analyze social and behavior aspects of

communities during wildfire events, should be encouraged. In the hurricane evacuation study by Huang et al. (2012) hurricane threat was divided into two categories: perceptions of the storm's characteristics and the expected personal impacts. This research project combined risk perceptions as a measurement of expected personal impacts. The full protective action decision model, as outlined by Lindell and Perry (2012) leads to a behaviour. In the Fort McMurray study, almost all of the residents evacuated; thereby making the decision to evacuate (the behaviour), as a variable, immeasurable. What was being sought in this study was to understand some of the factors that affect risk perception and examine evacuation behaviours. When considering the PADM this leads to a modified, shortened version, of the model, looking solely at the variables affecting risk perception. Kuligowski (2011) states that, "...the PADM is based upon theories that link cues, cognitive processes, and subsequent protective action. Much of that research seeks to establish links between the perception of risk and the performance of protective action" (Kuligowski, 2011, p. 59). One group of researchers defined risk perception as, "...the subjective evaluation of the probability to be affected by an imminent undesirable event and the assessment of one's own perceived vulnerability" (Kinatader, Kuligowski, Reneke, & Peacock, 2015, p. 11). As risk identification and risk assessment are the first two steps in the PADM model (Lindell & Perry, 2012), it goes without saying that risk perception is an integral part of the PADM. As such, risk perception is inextricably linked to evacuation and evacuation behaviours. This study examined some of those risk perceptions in the Fort McMurray wildfire setting. Refer to the conceptual study model in Figure 10.

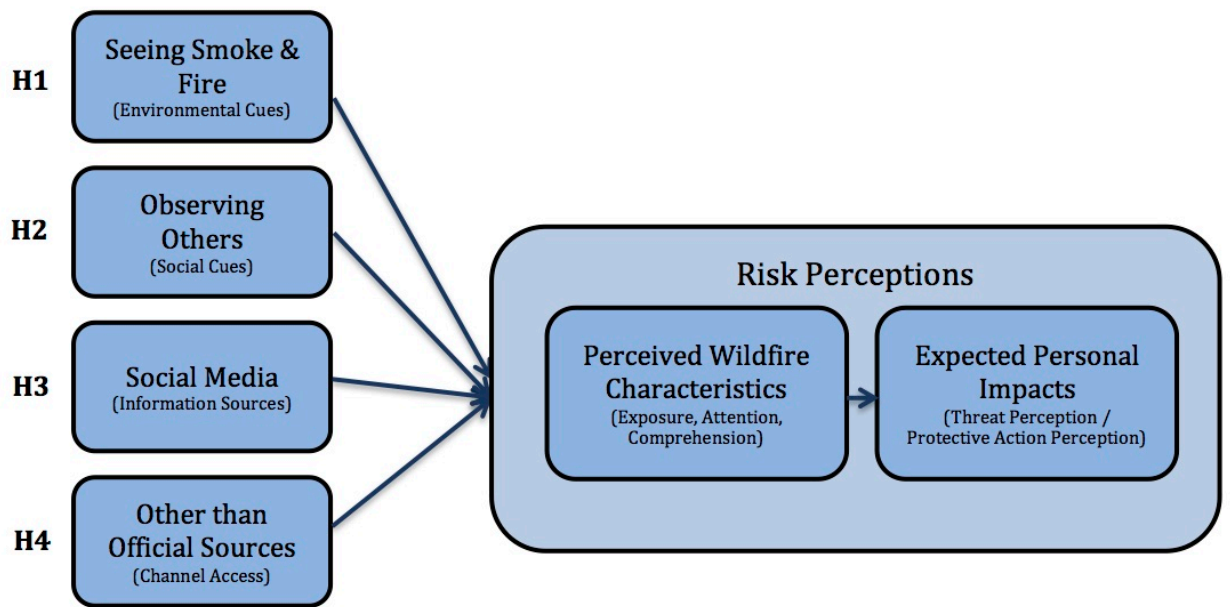


Figure 10. Conceptual model of the proposed study using an adapted Protective Action Decision Model.

Research Questions

The research questions that this study intended on answering were:

1. What are the risk perceptions of adults during a wildfire? Are there differences between younger adults, 18-24 year olds, and older adults, 25 and older? Are the perceptions the same for males and females?
2. How did young adults receive evacuation and disaster information?
 - a. Were the sources from traditional sources of information i.e. the radio, newspaper, television, or from more modern sources, i.e. websites and social media. If social media were used, which social media platform(s)?
3. What were the evacuation behaviours of young adults versus other adults?
 - a. At what point did they evacuate?
 - b. Who did they evacuate with?
 - c. By which means of transportation did they evacuate?

- d. Where did they go?
- e. Where did they stay?

Hypotheses

The hypotheses for this study intended to explore whether certain attributes impacted risk perceptions of wildfires.

H1: Seeing the smoke and the fire positively related to the risk perceptions (Environmental Cues).

H2: Observing what others were doing positively related to the risk perceptions (Social Cues).

H3: Young adults aged 18-24 years relied primarily on social media for their information about the wildfire positively relating to their risk perceptions (Information Sources).

H4: Young adults sought out confirming information from sources other than official sources which positively related to their risk perceptions (Channel Access and Preference).

The first hypothesis, environmental cues impacting risk perceptions, was attempting to confirm prior disaster research indicating similar results. Kinatader et al. (2015), albeit a study on evacuation from building fires, suggests that fire cues that are closer, unexpected, and more intense, lead to higher perceived risk. Other research in a variety of disaster situations has indicated similar risk perception findings (Dash & Gladwin, 2007; Drabek, 2013; Huang, 2014; Lindell & Perry, 1993; Van Willigen et al., 2005), i.e. seeing the hazard approaching, experiencing the flood waters rising, etc. increase perceptions of risk.

The second hypothesis, suggested that observing others evacuating and businesses closing would be positive indicators of risk perception. Baker (1991) commented that this may not be an indicator of risk perception, and that people may choose to evacuate for other reasons, aside from the neighbours leaving. Other studies; however, have indicated that social cues are correlated with perception of storm characteristics (Huang et al., 2012). This hypothesis tested whether witnessing others evacuating and businesses closing impacted risk perceptions.

The next hypothesis, was about whether social media played a primary role for young people to obtain information about the wildfire. Given the research about the younger generations and their extensive social media use (Catalyst, 2015; Pew Research Center, 2014; Taylor & Keeter, 2010), it appeared to be a logical hypothesis that social media tools would be a primary source of information for young people in Fort McMurray.

The last hypothesis carried over a little from the previous hypothesis, in that the assertion was that young people did not necessarily rely on traditional or official sources of information related to disasters, but rather, relied on information from other sources of information, such as the internet, friends, social media, etc. This is consistent with the Pew Research Center's indication, that younger generations rely on the internet and social media for news (Pew Research Center, 2017a; Pew Research Center, 2015b; Taylor & Keeter, 2010). The question was whether this held true when seeking information about disasters.

Data Collection

This study was conducted using convenience sampling of students and staff attending and working at Keyano College in Fort McMurray. Although, there are clear issues with convenience sampling, i.e. bias and lack of representativeness (Gravetter & Forzano, 2014), the study aimed at soliciting feedback from a broad spectrum of the students, staff and faculty at the college. The college graciously agreed to assist in the research by promoting survey participation in their classrooms, on bulletin boards, and through email. They also provided access to physically visit the college to directly encourage participation of the college population at their main campus. The opportunity to participate in the survey was available to all of the students and staff.

The survey was internet based, utilizing a website provider, specific to the purpose, Survey Monkey (www.surveymonkey.com). The website allowed the researcher to formulate his own questions and format. The survey was then made available, at a specified, and customized internet address for participants. The surveyor had access, through a special log on, to view and download the results. The internet address for this survey was: www.surveymonkey.com/r/FortMacEvac. The survey can be viewed in Appendix B.

The researcher and an assistant travelled to Fort McMurray April 4, 2017 and set up a table at Keyano College to invite students and staff to participate in the survey. The research team had two Android tablets available for participants to fill out the survey. If the individual was not able to fill out the survey at the time, they were provided with a business card with the web address of the survey printed on it, for them to participate at a later time. The research team had a large poster on the table to attract attention to the

survey. Participants were offered an incentive to take the survey - an opportunity to win, via a raffle, a pair of wireless headphones, valued at \$250. Participation in the raffle was completely optional with the disclaimer that their contact information would not be used for any purpose, other than the raffle. The survey and the raffle were set to close on June 1, 2017.

The initial response, while at the college, was a little dismal. It was very apparent that there were not as many students on campus as had been originally predicted. Despite that fact, upon leaving, after three days at the college, the researcher had elicited 151 responses to the survey. The college's marketing and media liaison was contacted, and she sent an email out to all staff and students of the college on April 18, encouraging them to take part in the survey (See Appendix C). By the close of the survey, 299 people had participated.

Ethical Considerations

The survey involved human subjects and therefore required approval from Jacksonville State University's Institutional Review Board (IRB). The application was completed and submitted on March 14, 2017. No special populations were involved in the study, therefore, an exemption was requested. Part of this process required the investigator to complete "Investigator Responsibilities & Informed Consent" training, through the Human Subject Assurance Training at the Office for Human Research Protections (OHRP) website. IRB approval was granted March 15 (See Appendix D).

As the study was being conducted at Keyano College, they too required an ethics review prior to allowing the survey on their campus. The application to the Keyano

College Research Ethics Board was submitted on March 20, and approved shortly thereafter (see Appendix E).

People have been known to suffer from psychological effects after wildfires (McDermott, Lee, Judd, & Gibbon, 2005; Townshend et al., 2015); therefore, it was important to include a commentary in the survey about the various psychological helps available to participants if they felt they required them. This information was mentioned at both the beginning of the survey and at the conclusion.

The Survey and Measurement

Each participant was asked to fill out the online survey comprised of 23 core questions. The questions queried about participant's information sources, risk perceptions, evacuation influences, evacuation behaviours, and demographics. The very first question addressed whether the participant was living in Fort McMurray or the surrounding area at the time of the wildfires in May 2016 (yes or no answer). If the respondent was not living in the area, they were directed to a, "Thanks for Participating!" page and that was the end of questions for that individual.

Information Sources

The next question offered a variety of different information sources (local authorities, local news media, national television news media, internet website sources, social media sources, and peers), with examples of each, and requested participants to score, on a scale of 1 to 5, how much they relied on each source for information about the wildfire and/or evacuation. A score of one (1) constituted, "Did not rely on"; and a score of five (5) was, "Greatly relied on". In many cases throughout the survey, a comment

field, addressed as “Other” was made available for participants to indicate their own answer to the question.

Social Media

The participants were asked to rank social media platforms that they were using in May of 2016 from “most used” (number 1) to “least used” (number 6). The social media platforms offered in the question were: Facebook, Twitter, Instagram, LinkedIn, Snapchat, and other.

Risk Perceptions and Thoughts on Evacuation

Determining the respondent’s perceptions of the risks associated with the wildfire and their thoughts about evacuating were goals of the study. As a result, the next five questions (questions four through eight) focused on these two matters. Four of the questions asked the participants to rate their expected personal impacts, on a scale of one (1) to five (5), of the threat characteristics listed, where one (1) was “extremely unlikely” and five (5) was “extremely likely”. The expected personal impacts were: damage or destruction of their home; personal harm or death to self, family or friends; impact on services such as electricity, water, etc.; and the ability to work and/or attend classes. The threat characteristics were: the wildfire itself, the smoke, the potential toxic emissions, the after effect of potential flooding and the after effect of potential landslides. The next question explored the impetus or the impediments to evacuation, asking participants to rate, on a scale of one (1) to five (5) whether a series of items were a consideration while they were contemplating evacuation. “Not at all considered” was scored as one (1); “It was a huge consideration” was scored as five (5) on the scale. The items included: seeing the wildfire approach; seeing or smelling smoke; wind direction changes; nearby

combustibles; local businesses closing; friends, relatives, etc. evacuating; hearing local authorities issue official evacuation orders; previous personal experience with wildfires; concerns about protecting home from fire; concern about evacuation expenses; concern about where to stay; other concerns such as pets, medical conditions, etc.; concern about getting stranded on the highway; and the possibility of rain slowing down or putting the fire out.

Evacuation

The next series of questions asked specific information about the participant's evacuation. They focused on: what day they evacuated, what approximate time they evacuated, who they evacuated with, their mode of transportation, where they stayed once they evacuated, and what community they evacuated to. The first question in this series inquired whether the participant evacuated or not using a "yes" or "no" response. Next was an inquiry as to what day the participant left their home. The wildfire started on Sunday May 1, 2016, with the first evacuation order given at 10:00 p.m. that day (KPMG, 2017). A mandatory evacuation order, for the entire region, was issued on Tuesday, May 3 (KPMG, 2017). The options for this question were, "before May 1" to "After May 5", with every date in between. The last option for this question was, "I did not leave". Question 11 queried what time of day the participant left, starting with "middle of the night (midnight to 3:00 a.m.)" to "late evening / night (9:00 p.m. to midnight)", with all of the options, in 3 hour increments, between those times. A question about who they evacuated with was asked; options included: immediate family, other relatives, friends / neighbours / room mates, by yourself, and other. Mode of transportation was the next question, which encompassed: personal vehicle, someone

else's personal vehicle, municipal transit bus, Greyhound or other similar commercial bus, train, plane or other. Question 14 inquired where the participant stayed after their evacuation: with friends; with relatives; in a hotel or motel; at an evacuation shelter; or other. This was followed with a final question in this section concerning which city or location they evacuated to. Options for this question were: stayed within the Fort McMurray area; north to an industry camp; Edmonton; Red Deer; Calgary; and other.

Demographics

The last pertinent questions in the survey were demographics. The participant's gender, age, occupational/student status, marital status, living arrangements, and type of dwelling were all polled. Gender was "male" or "female". Age was divided up into "17 or younger", "25 or older", with individual ages, "18", "19", etc. in between. The occupational or student status question allowed participants to select multiple answers. The selections were: working full time; working part time; full time student; part time student; and unemployed. Marital status had the usual options: single; married; common law; separated / divorced; and other. Question 20 inquired about living arrangements. The options were: living with spouse/common law partner; living with parents; living with relatives; living with friends/roommates; living by yourself; and other. The final demographic question inquired about type of dwelling lived in. Choices for this question were: a house/townhouse; an apartment/condo building; an apartment/suite in a house; a college residence; or other.

Qualitative Questions

The survey was predominantly intended to be a quantitative study exploring the stated hypotheses and the descriptive statistics noted. That being said, the opportunity

was present to solicit some further feedback, in the form of a few qualitative questions, about the participants' involvement with the Fort McMurray wildfire of 2016. Therefore, the final two questions of the survey asked for a positive outcome as a result of their experience, and any other comments that people wished to share concerning their evacuation or wildfire experiences. Comment boxes with unlimited text were provided for these last two questions.

Method of Analysis

All of the results of the survey were imported into an SPSS database. The data was cleaned, labeled and categorized in preparation for the statistical analysis.

The primary dependent variables were risk perceptions of the smoke, the fire, and the after effects, measured predominantly through expected personal impacts of those variables. The independent variables were the variables associated with information sources, the variables related to thoughts on evacuation, and demographics.

Multiple Response Sets

In order to perform analysis on some of the results of the questions, where the answers allowed the participant to select multiple answers, the responses needed to be consolidated in SPSS to a multiple response set. As an example, question 12, asked, "Who did you evacuate with (select multiple answers if necessary)?" the answers: Immediate family; Other relatives; Friends / neighbours / room mates; By yourself; and Other (please specify), were each coded as separate variables in SPSS. When the data was imported "Immediate family" was scored as a 1; "Other relatives" was scored as a 2, etc. Each of these was considered as a separate variable in SPSS and had its own column. Many respondents selected one or more of the provided variables. The ones

they did not select were left blank, presumably because the answers were not applicable to their situation. The blank responses were considered missing statistics for each variable. The question may have been answered, so the blanks were not truly representative of a “missing answer”, only that that particular response wasn’t selected. Keeping in mind, that all of the responses that were answered, i.e. scored a 1, 2, 3, 4, etc., were recorded in their own variable (column). All of the answers, for each separate variable were converted in SPSS, using the “Recode into same variable” function to a 1. All of the blank responses were converted to 0. As an example, if a participant had selected, “Other Family” for Question 12, the affirmative answers indicated a 1 whereas, if they didn’t evacuate with “Other Family” it indicated a 0 in that column.

Any of the questions where there was an “Other (please specify)” had to be treated differently as well. Like above, the “Other (please specify)” was in its own column. For these variables, a new variable was created to input a strictly numerical response. Aligning the columns, “Other (please specify)” with the new numerical response column, the researcher manually entered a “1” in the new column alongside any of the comments in the “Other (please specify)” column. Therefore, anywhere a respondent had entered data into the “Other (please specify)” column, a corresponding “1” was alongside in the adjacent new column that was created. Blank cells in the new column aligned with blank cells in the “Other (please specify)” column. These blanks, in the new column, were converted to zeros, consistent with the handling of the other variables for the question. The end result is either a 1 for an answer that was checked (or had a comment), or a 0 for an answer that wasn’t checked for each of the answers to the question, including the newly created “Other (please specify)” column. The regular

variables for the question (i.e. “Immediate family”, “Other relatives”, etc.) and the new “Other” variable that was created were then grouped together into a multiple response set, using the “Define multiple response set...” in SPSS. To put the data into a multiple response set SPSS requires a value to be counted; hence the requirement to have either a 0 or a 1 in all of the cells for each variable. The counted variable, 1, in this case, represents an answer that was selected by a respondent.

The questions and their associated answers that were grouped into individual multiple response sets were:

Q12. “Who did you evacuate with?”

Q14. “Where did you stay once you evacuated?”

Q15. “Where did you evacuate to?”

Q18. “What was your occupational / student status at the time of the wildfire?”

Question 17 inquired about the age of the respondent at the time of the wildfire. There were nine different responses: 17 or younger; 18; 19; 20; 21; 22; 23; 24; and, 25 or older, they were coded 1 through 9. For simplification, and to focus on a specific age grouping, it was decided to amalgamate this question into three responses: 17 or younger; 18 to 24; and 25 or older. The values were coded 1 through 3, where 1 was “17 or younger”, 2 was “18 to 24”, and 3 was “25 or older”.

Handling of Missing Variables

There were 299 responses in the Fort McMurray evacuation survey. Some of the respondents did not fully participate. Some were total nonresponse, also referred to as unit nonresponse, and some were item nonresponse. Total nonresponse occurs when none of the survey responses are available due to refusals, inability to participate and

other untraced elements (Kalton & Kasprzyk, 1986). Item nonresponse occurs when some but not all of the responses are available often due to item refusals, “don’t knows”, and omissions (Kalton & Kasprzyk, 1986). In the Fort McMurray survey, there were 20 participants, or 6.69 percent, who answered only the first question, “Were you living in Fort McMurray or the surrounding area during the wildfire in May 2016?”, in the affirmative and then skipped to the end of the survey and filled out the contact information relating to winning the prize for participating in the survey. They did not answer any of the other questions in the survey. These cases were treated as total nonresponse. There were an additional 10 respondents, 3.34 percent, who answered “no” to the first question, they were not living in Fort McMurray or area at the time of the Wildfire. These participants were not provided the opportunity to answer any additional survey questions. These cases were also treated as total nonresponse as they were ineligible to continue with the survey. Unit or total nonresponse must be dropped from analysis (Garson, 2015); therefore, these 30 cases, or 10 percent of the responses, were removed from the survey results. This left 269 cases for analysis, or 90 percent of the overall respondents.

This study was predominantly focused on risk perceptions; therefore, the questions in the survey specifically related to risk perceptions and demographics were initially examined; the rest of the questions were dropped for the moment. For reference, the survey can be found in Appendix B. The questions eliminated from the study, at this point, were questions: 3, 9, 10, 11, 12, 13, 14, 22 and 23. Any portion of an answer that included a string variable (text) was also eliminated (i.e. “Other (please specify)”) or converted to a numerical value. Keeping in mind that several questions in the survey had

multiple parts, therefore, after the noted questions were removed, the dataset had 51 variables remaining.

Some of these remaining 269 participants had occasional item nonresponse. The issue was whether the nonresponse items were missing completely at random (MCAR) or whether there was some systematic reasoning for the missing data. To determine this, Little's (1988) test was conducted using SPSS. The test was done utilizing all of the remaining variables noted.

After the missing variable analysis function was run in SPSS, the results, revealed a significance of 0.591 for Little's MCAR test ($\chi^2(1,121) = 1,109.529, p = 0.591$). The test is not significant, as p is greater than 0.05. Nonsignificant test results indicate that the missing variables are missing completely at random (Garson, 2015; Little, 1988). Garson (2015), recommends that in such circumstances listwise deletion of the cases with missing variables could be done, if the sample size is large enough not to cause bias, or Type II errors due to reducing the sample size. Garson (2015) indicates that there is no accepted consensus on what defines a "larger sample" however, he states that if the missing data is less than 5 percent of the sample, it is common to drop the cases from analysis. In this study of the 51 variables, only 8 variables had complete data. Of the cases, or the individual survey respondents, there were 225 complete cases. Looking at all of the values for all of the variables, there was only 1.115 percent missing data (see Figure 11 for further details concerning missing values). In this study, the sample size of 269 cases is relatively small, and any further reduction of the sample size to 225 cases, through listwise deletion, could introduce bias. Therefore, in this situation, imputation was the preferred methodology of handling the missing data.

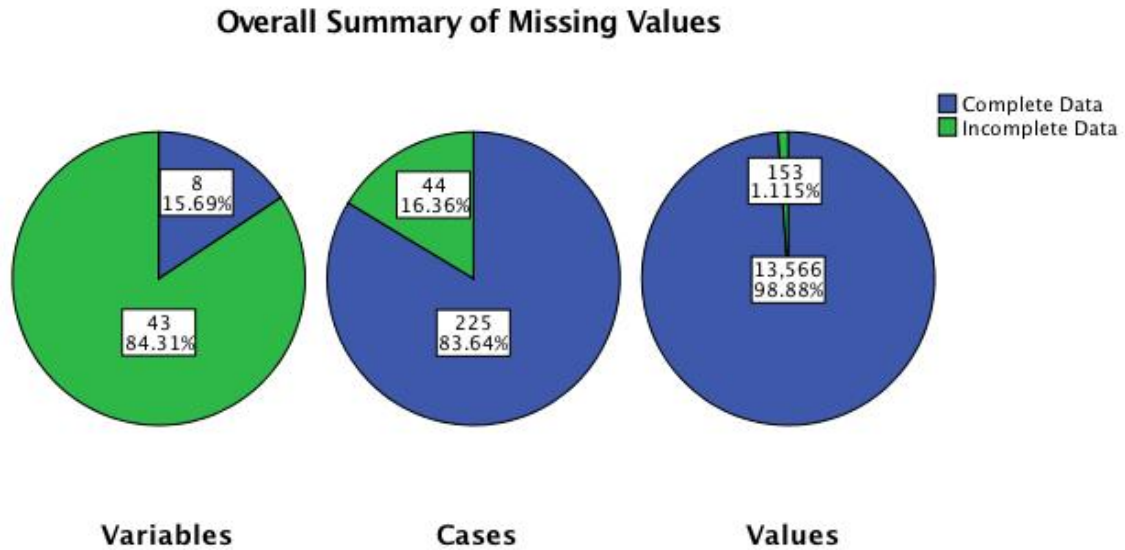


Figure 11. Overall summary of the missing values from the variables selected for data analysis from the Fort McMurray Evacuation Survey. Image produced using SPSS.

There are many methods of imputation. Both multiple imputation (MI) methods and expectation maximization (EM) methods were considered. EM is a single imputation method and can be used under the following circumstances: when less than 10 percent of the data is missing, when examining the means; and it can be used when less than 5 percent of the data is missing, when examining the variance structures in the data (Scheffer, 2002).

Expectation maximization is a valid method of data imputation, provided that the missing data are either missing at random or missing completely at random and the percentage of data missing is not too great, i.e. more than 5 percent (Scheffer, 2002). As noted above, the missing data in this study is much less than this; therefore, expectation maximization was utilized to fill in the data for the missing values. In the process, a duplicate variable was created for each of the variables where data was to be replaced. The newly formed duplicate had the old values plus the missing values replaced, whereas

the old variable still had the occasional missing data. A paired t test was done to compare the means, the standard deviations and the standard error means of each of the pairs of variables (with the missing and not with the missing). Fifty-one pairs of variables were examined. The means, the standard deviations and the standard error means were the exact same within the paired groups. This indicates that the imputing of values did not change these statistics.

The Dependent Variables

One of the primary focuses of the study was risk perceptions. Several of the questions were seeking risk perception information from respondents in terms of the threats that the respondents believed certain attributes posed. These are the dependent variables. The specific attributes were: the wildfire itself; the smoke; the potential toxic emissions; the after effect of potential flooding; and the after effect of potential landslides. The responses, ranging from “Extremely Unlikely” up to “Extremely Likely” (on a scale of 1 to 5), were sought for each of the attributes listed for Questions 4 through 7. The responses for Questions 4 through 7 were averaged for each attribute, into a new variable. Ending up with a numerical value, on a scale of 1 to 5, for “The wildfire itself”, “The smoke”, “The potential toxic emissions”, etc. (all based on answers from questions 4 through 7). This was done using the “compute variable” function in SPSS; where the average was taken for each row of the 269 participants for each attribute for each question noted.

Cronbach’s Alpha was checked on each of the sets of the variables to check for internal consistency between the sets. The lowest value on the test was $\alpha = 0.797$. All of the others exceeded $\alpha = 0.8$. This indicates a high degree of reliability (Gravetter &

Forzano, 2014) between the variables in each grouping. See Table 3 for the specific values for each.

Table 3

Cronbach's Alpha Test on 5 New Variables

Variables	Cronbach's Alpha
The Wildfire	0.824
The Smoke	0.797
The Toxic Emissions	0.843
The Potential Flooding	0.866
The Potential Landslides	0.899

A factor analysis, through SPSS, was done to examine each of these of these five variables (The Wildfire, The Smoke, The Toxic Emissions, The Potential Flooding, and The Potential Landslides) against each other. It was determined that the correlation between the smoke and the toxic emissions was sufficient (Pearson $r = 0.646$) enough to group the two variables together into one variable. Likewise, flooding and landslides were similarly correlated (Pearson $r = 0.845$) indicating that they also could be combined together into one variable. Using the same method described above for combining variables in SPSS, the smoke and toxic emissions were combined, as were the flooding and the landslide variables. This reduces the five dependent variables down to three. They are: the fire; the smoke (which includes the toxic emissions); and the after effects (including both flooding and landslides). See Table 4 for the correlation analysis. Cronbach's Alpha was checked again, for internal consistency between the variables in each of the groups that were combined. As expected, the reliability was high, $\alpha = 0.939$ for "the smoke" variables, and $\alpha = 0.930$ for "the after effects" variables.

Table 4

Factor Analysis – Correlation of Dependent Variables

Variable	Wildfire Itself	Smoke	Toxic Emissions	Flooding	Landslides
Wildfire Itself	1.000	0.646	0.466	0.226	0.214
Smoke	0.646	1.000	0.697	0.335	0.305
Toxic Emissions	0.466	0.697	1.000	0.465	0.422
Flooding	0.226	0.335	0.465	1.000	0.845
Landslides	0.214	0.305	0.422	0.845	1.000

The Independent Variables

Using a similar methodology to the above, some of the other variables were grouped to form new independent variables. Question 8 had a number of sections to it. The first four elements all had to do with environmental cues: seeing the wildfire approaching; seeing or smelling smoke; feeling a change in the wind intensity or direction; and seeing combustibles nearby (i.e. gas, propane, brush, etc.). These were all combined into one variable, “environmental cues”. Another two variables, “Seeing local businesses closing” and “seeing friends, relatives, neighbours and coworkers evacuating” were combined into one variable titled, “social cues”. Still in Question 8, there were a number of variables about evacuation concerns: concern about evacuation expenses; concern about where to stay; concern about other special considerations (pets, medical needs, etc.); and concern about getting stranded on the highway. These were all combined into a variable titled, “evacuation concerns”. Cronbach’s Alpha was run for each of the newly created variables resulting in internal consistency (environmental cues $\alpha = 0.844$; social cues $\alpha = 0.877$; and evacuation concerns $\alpha = 0.891$).

When considering risk perceptions and demographics, the independent variables related to demographics were also slightly adjusted for ease of analysis. Question 16, gender, was left as it was with “Male” = 1 and “Female” = 2. Question 17, age, was

modified from 9 groups to 3 groups; group 1 (coded as 1) was “17 or younger”; group 2 (coded as 2) was “18 to 24”; and group 3 (coded as 3) was “25 or older”.

As an afterthought, group 1, “17 or younger” was eliminated from the data analysis, 23 cases, as much of the study was attempting to draw comparisons between younger adults and older adults. The 17 or younger category was not included for that reason. This left the sample size, without the 17 or younger participants, at $n = 246$.

Question 19, marital status, was modified to “Married” = 1, and “Not Married” = 0. The same modification was done with question 20, living arrangements, “Living by self” = 1, “Living with Others” = 0.

Preparing the data was a necessary evil of conducting statistical analysis. Once fine-tuned it could be analyzed.

Data Analysis

As mentioned earlier, three key dependent variables for analysis of risk perception are, “The Fire”, “The Smoke”, and “The After Effects”. These variables were looked at alongside each other without the influence of the independent variables. Wilk’s Lambda test results in $\lambda = 0.034$, a significant result. A significant result indicates that the dependent variables are not equal therefore we can examine them individually against the independent variables.

Next paired t tests were conducted to compare the difference between each of the three dependent variables. The paired t tests indicated that each of the pairs was statistically significant at the 0.001 level, indicating that they were each different (See Table 5).

Table 5

Paired t Tests with Dependent Variables

		Mean	Std. Deviation	<i>t</i>	df	Sig.
Pair 1	The Wildfire	0.46138	0.75161	10.068	268	.000
	The Smoke					
Pair 2	The Wildfire	1.25855	0.84151	24.5269	268	.000
	The After Effects					
Pair 3	The Smoke	0.79717	0.51878	25.203	268	.000
	The After Effects					

A number of new datasets were created. The first, as mentioned earlier, excluded participants who had selected “17 or younger”. Another dataset was created that was only participants who identified as being “18 to 24 years” of age. The next dataset created was for participants who identified as “25 and older”. Two additional datasets were created, one for males and one for females.

An intercorrelation matrix was constructed between all the variables, for the different datasets. As well, a regression analysis was run for each of the three dependent variables, with the other variables as independent variables. A number of frequency distribution analyses were conducted and, when deemed necessary, independent *t* tests were examined. For some of the nominal data, Chi Square tests of independence were conducted when analyzing against other variables. The results of these different analyses are discussed in the next chapter.

IV - Results

This chapter presents the results of the study about the evacuation of Fort McMurray during the 2016 wildfire. The subjects in the study were predominantly students and staff from Keyano College in Fort McMurray. They were surveyed in an effort to gain a greater understanding of their risk perceptions in relation to the fire and their specific evacuation behaviours. The research questions, the hypotheses and the descriptive statistics attempted to gain some broad knowledge applicable to both younger and older adults, but also specific differences between the two groups and between genders. The results of the different analyzes are documented in the following paragraphs.

As a reminder, the hypotheses dealing with risk perceptions utilized the dependent variables: the wildfire, the smoke (which comprised the smoke and the toxic emissions), and the after effects (which were flooding and landslides). These variables were derived from a number of questions in the survey that queried participants' thoughts on the likelihood of an impact as a result of the mentioned variables. Their answers were measured on a scale of 1 to 5 where 1 was "extremely unlikely" and 5 was "extremely likely".

A regression analysis was run to determine which of the independent variables were predictors of risk perception. The results of Table 6 are for all of the cases with the exception of participants who indicated they were 17 years old or less as of May 2016.

Table 6

Regression Analysis – Risk Perception and Independent Variables (Section 1)

		FIRE	Smoke	After Effects
		All Variables	All Variables	All Variables
Gender	B (Logistic Regression Coefficient)	0.220	0.104	-0.026
	Standardized Regression Coefficient)	0.114	0.114	0.105
	Exp(B)	0.125	0.058	-0.015
	Significance	0.054	0.362	0.805
Age	B (Logistic Regression Coefficient)	0.014	0.048	-0.030
	Standardized Regression Coefficient)	0.141	0.142	0.130
	Exp(B)	0.009	0.029	-0.019
	Significance	0.921	0.735	0.817
Full Time Student	B (Logistic Regression Coefficient)	0.025	0.050	0.111
	Standardized Regression Coefficient)	0.133	0.134	0.123
	Exp(B)	0.015	0.029	0.067
	Significance	0.849	0.708	0.367
Work Full Time	B (Logistic Regression Coefficient)	0.128	0.050	0.078
	Standardized Regression Coefficient)	0.129	0.129	0.118
	Exp(B)	0.078	0.029	0.049
	Significance	0.320	0.701	0.511
Married	B (Logistic Regression Coefficient)	0.007	0.057	0.110
	Standardized Regression Coefficient)	0.140	0.140	0.129
	Exp(B)	0.004	0.030	0.061
	Significance	0.958	0.684	0.392
Living with Parents	B (Logistic Regression Coefficient)	-0.042	0.053	0.027
	Standardized Regression Coefficient)	0.145	0.146	0.134
	Exp(B)	-0.025	0.030	0.016
	Significance	0.770	0.717	0.842
Living in a House/Townhouse	B (Logistic Regression Coefficient)	0.293	-0.061	-0.069
	Standardized Regression Coefficient)	0.118	0.119	0.109
	Exp(B)	0.165	-0.034	-0.040
	Significance	0.014	0.608	0.526
Social Cues	B (Logistic Regression Coefficient)	0.066	0.076	0.085
	Standardized Regression Coefficient)	0.057	0.057	0.053
	Exp(B)	0.085	0.096	0.112
	Significance	0.249	0.186	0.109
Environmental Cues	B (Logistic Regression Coefficient)	0.191	0.230	0.189
	Standardized Regression Coefficient)	0.063	0.063	0.058
	Exp(B)	0.227	0.266	0.231
	Significance	0.003	0.000	0.001

Note. Highlighted yellow is significant at $p < .05$

Table 6 Continued

Regression Analysis – Risk Perception and Independent Variables (Section 2)

		FIRE	Smoke	After Effects
		All Variables	All Variables	All Variables
Prior Experience	B (Logistic Regression Coefficient)	0.005	-0.058	0.022
	Standardized Regression Coefficient)	0.038	0.038	0.035
	Exp(B)	0.009	-0.103	0.040
	Significance	0.896	0.131	0.540
Evac Impediments	B (Logistic Regression Coefficient)	-0.033	0.049	0.110
	Standardized Regression Coefficient)	0.046	0.046	0.042
	Exp(B)	-0.052	0.075	0.178
	Significance	0.467	0.287	0.009
Local Authorities	B (Logistic Regression Coefficient)	-0.002	-0.028	0.018
	Standardized Regression Coefficient)	0.043	0.043	0.039
	Exp(B)	-0.003	-0.042	0.028
	Significance	0.967	0.514	0.656
Local News Media	B (Logistic Regression Coefficient)	-0.018	-0.003	0.013
	Standardized Regression Coefficient)	0.045	0.045	0.041
	Exp(B)	-0.028	-0.004	0.021
	Significance	0.683	0.949	0.752
National Television News	B (Logistic Regression Coefficient)	-0.071	-0.001	0.017
	Standardized Regression Coefficient)	0.042	0.042	0.039
	Exp(B)	-0.122	-0.001	0.030
	Significance	0.091	0.989	0.657
Internet Web Sources	B (Logistic Regression Coefficient)	0.018	0.007	-0.027
	Standardized Regression Coefficient)	0.049	0.049	0.045
	Exp(B)	0.027	0.009	-0.041
	Significance	0.716	0.895	0.556
Social Media Sources	B (Logistic Regression Coefficient)	0.087	0.127	0.104
	Standardized Regression Coefficient)	0.044	0.044	0.040
	Exp(B)	0.136	0.192	0.167
	Significance	0.048	0.004	0.011
Peers, friends, relatives, etc.	B (Logistic Regression Coefficient)	0.000	0.034	-0.017
	Standardized Regression Coefficient)	0.053	0.053	0.049
	Exp(B)	0.001	0.042	-0.022
	Significance	0.993	0.523	0.732

Note. Highlighted yellow is significant at $p < .05$

Hypotheses

Hypothesis 1

The first hypothesis stated that observing the smoke and fire positively related to the risk perceptions. Observing the smoke and the fire was an environmental cue. As noted earlier, feeling a change in the wind intensity or direction and seeing combustibles nearby were two variables that were included in the “environmental cues” variable. The

standardized regression coefficient for environmental cues was small, for each of the listed perceived risks (Wildfire $\beta = 0.063$, Smoke $\beta = 0.063$, and the After Effects $\beta = 0.058$); however, all were statistically significant at the 0.01 level.

A paired t test between the individual environmental cues, seeing the fire (question 8.1) and seeing or smelling the smoke (question 8.2) and the perceived risks was also conducted, see Table 7.

Table 7

Paired t Tests - Environmental Cues and Perceived Risk

		Mean	n	Std. Dev.	t	df	Significance
Pair 1	Seeing the wildfire approaching	4.550	246	0.9710	5.477	245	0.000
	Wildfire Risk	4.187		0.8223			
Pair 2	Seeing the wildfire approaching	4.550	246	0.9710	11.329	245	0.000
	The Smoke Risk	3.690		0.8427			
Pair 3	Seeing the wildfire approaching	4.550	246	0.9710	21.976	245	0.000
	The After Effects Risk	2.898		0.7968			
Pair 4	Seeing or smelling smoke	4.110	246	1.2260	-0.863	245	0.389
	Wildfire Risk	4.187		0.8223			
Pair 5	Seeing or smelling smoke	4.110	246	1.2260	4.831	245	0.000
	The Smoke Risk	3.690		0.8427			
Pair 6	Seeing or smelling smoke	4.110	246	1.2260	14.151	245	0.000
	The After Effects Risk	2.898		0.7968			

The results indicated that with the exception of pair 4, seeing or smelling smoke and perceived wildfire risk, the environmental cues are related to perceptions of risk and were statistically significant at the .001 level.

This finding was further confirmed in an examination of the intercorrelations among the variables (See Table 8). Environmental cues were correlated with risk perceptions and the findings indicated a weak but direct relationship (Wildfire Pearson $r = 0.233$, Smoke Pearson $r = 0.318$, and After Effects Pearson $r = 0.364$), all at the 0.01 significance level.

Table 8

Intercorrelations Among Variables

	Variables																			
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Wildfire	0.579																			
2 Smoke	0.447	0.800																		
3 After Effects	0.137	0.124	0.060																	
4 Gender	0.022	0.008	-0.039	-0.090																
5 Age	-0.028	0.049	0.071	0.144	-0.347															
6 Full Time Student	0.095	-0.037	-0.050	-0.158	0.362	-0.529														
7 Working Full Time	0.044	0.008	-0.001	-0.025	0.513	-0.222	0.183													
8 Married	0.018	0.065	0.066	0.103	-0.590	0.428	-0.314	-0.417												
9 Living with Parents	0.179	-0.038	-0.072	0.000	-0.066	-0.015	0.187	0.067	0.166											
10 Living in a House	0.167	0.247	0.305	0.126	-0.027	0.004	-0.025	-0.060	0.063	-0.078										
11 Social Cues	0.233	0.318	0.364	0.034	0.031	-0.064	0.002	0.027	0.067	-0.055	0.482									
12 Environmental Cues	0.051	0.023	0.198	-0.049	-0.055	0.000	-0.030	-0.035	-0.062	-0.099	0.211	0.298								
13 Prior Experience with Wildfire	0.048	0.194	0.332	0.104	-0.114	0.094	-0.135	-0.123	0.090	-0.108	0.343	0.317	0.346							
14 Evacuation Impediments	0.010	0.042	0.130	0.045	-0.084	0.009	0.018	-0.150	0.054	-0.110	0.166	0.111	0.104	0.176						
15 Communication via Local Authorities	0.028	0.102	0.102	0.213	-0.030	0.059	-0.085	0.025	0.085	0.048	0.177	0.114	-0.110	0.115	0.183					
16 Communication via Local News	-0.079	0.092	0.117	0.023	0.028	0.087	-0.137	-0.091	0.015	-0.157	0.109	0.150	0.069	0.063	0.200	0.224				
17 Communication via National TV	0.034	0.108	0.089	0.017	0.103	0.100	-0.007	-0.037	0.085	-0.017	0.085	0.115	0.078	0.110	0.196	0.240	0.441			
18 Communication via Internet Web Sources	0.127	0.234	0.213	0.157	-0.105	0.189	-0.157	-0.077	0.125	0.012	0.058	0.045	0.032	0.172	0.149	0.136	0.221	0.295		
19 Communication via Social Media	0.048	0.134	0.099	0.107	-0.066	0.093	-0.074	-0.159	0.080	-0.031	0.180	0.083	0.106	0.194	0.132	0.174	0.110	0.190	0.264	
20 Communication via Peers																				

Correlation is significant at the 0.01 level.

Correlation is significant at the 0.05 level.

Given the statistical tests conducted, it can be surmised that the environmental cues are predictors of risk perceptions. Therefore, for the purposes of this study, hypothesis 1 will be considered upheld.

Hypothesis 2

The second hypothesis asserted that observing what others were doing positively relates to the risk perceptions. In this case, the question inquired about whether seeing local businesses closing and seeing friends, relatives, neighbours and coworkers evacuating were considerations in the participants' decision process for their own evacuation. The question was ranked on a scale of 1 to 5 where 1 was "not at all considered" and 5 was "it was a huge consideration". As noted earlier, these two variables were combined to form a new variable called, "Social Cues". Looking at all of the participants, the average ranking was 3.93 ($m = 3.93$, $sd = 1.057$, $n = 246$). This indicates that the social cues were certainly a consideration for the majority of the participants when considering their own evacuation requirements. That being said, it doesn't explicitly imply that social cues are positively correlated to their risk perceptions.

When social cues were controlled into the regression model (Table 6), social cues did not indicate that they were predictors of perceived risk. The standardized regression coefficient for social cues is small, for each of the listed perceived risks and not statistically significant (Wildfire $\beta = 0.057$, Smoke $\beta = 0.057$, and the After Effects $\beta = 0.053$).

Table 8, the intercorrelation table, indicates that social cues are directly, albeit weakly, correlated to the perceived risks for the three dependent variables (Wildfire Pearson $r = 0.167$, Smoke Pearson $r = 0.247$, and After Effects Pearson $r = 0.305$), all at

the 0.01 significance level. The disparate answers between the tests are perhaps due to some collinearity between the variables when introduced into the regression model. To further flesh this out, the social cues variable was separated back into the two original variables (seeing businesses closing and seeing friends, relatives, etc. evacuating) and a series of paired *t* tests were conducted (See Table 9).

Table 9

Paired t Tests - Social Cues and Perceived Risk

		Mean	n	Std. Dev.	<i>t</i>	df	Significance
Pair 1	Seeing Local Businesses Closing	3.510		1.4110			
	Wildfire Risk	4.187	246	0.8223	-7.03	245	0.000
Pair 2	Seeing Local Businesses Closing	3.510		1.4110			
	The Smoke Risk	3.690	246	0.8427	11.329	245	0.048
Pair 3	Seeing Local Businesses Closing	3.510		1.4110			
	The After Effects Risk	2.898	246	0.7968	21.976	245	0.000
Pair 4	Seeing Friends, Relatives, Neighbours, and Coworkers Evacuating	4.370		1.0000			
	Wildfire Risk	4.187	246	0.8223	-0.863	245	0.022
Pair 5	Seeing Friends, Relatives, Neighbours, and Coworkers Evacuating	4.370		1.0000			
	The Smoke Risk	3.690	246	0.8427	4.831	245	0.000
Pair 6	Seeing Friends, Relatives, Neighbours, and Coworkers Evacuating	4.370		1.0000			
	The After Effects Risk	2.898	246	0.7968	14.151	245	0.000

The results of the t tests were significant at the 0.05 or less level; however, given the weakness of correlation (Table 8) and the indeterminate results with the regression analysis (Table 6); further research would have to be done before hypothesis 2 could be upheld.

Hypothesis 3

The third hypothesis states that young adults, aged 18 to 24 years, relied primarily on social media for their information about the wildfire and that this positively related to their risk perceptions.

Question 2 in the survey purposely inquired about information sources, stating, “Please rate how much you relied on the following information sources for information about the wildfire and/or evacuation during the wildfire?” The scale was from 1 to 5, where 1 was “Did not rely on” and 5 was “Greatly relied on”. In a comparison of the results between 18 to 24 year olds and adults 25 and older, it was apparent that their use of information sources is very similar, see Figure 12.

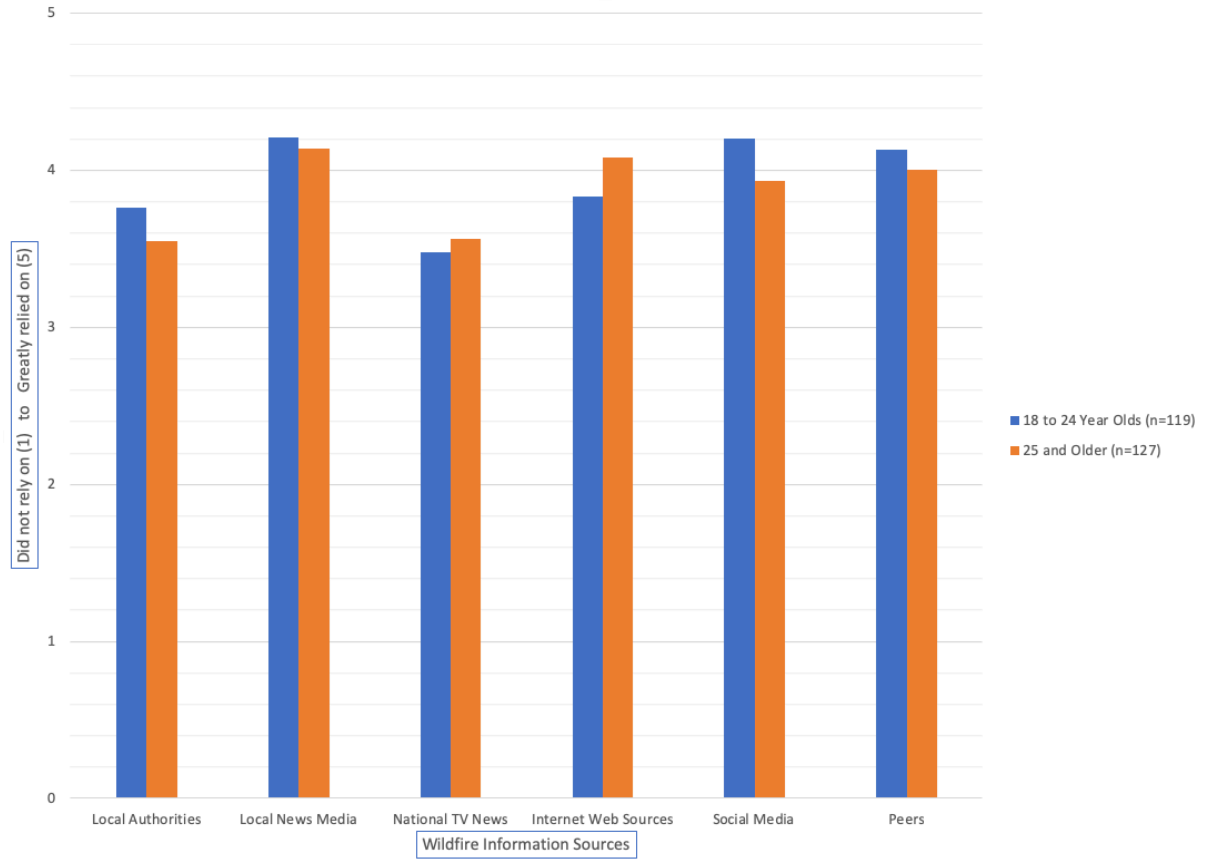


Figure 12. Information sources used for wildfire information by age group.

For young adults, 18 to 24 years of age, they relied almost equally between local news media ($m = 4.21$, $sd = 1.146$, $n = 119$) and social media ($m = 4.20$, $sd = 4.20$, $n = 119$). Adults 25 years of age and older, like their younger counterparts, also relied the most on local media ($m = 4.14$, $sd = 1.342$, $n = 127$), but to a slightly lesser extent than the 18 to 24 year olds. The next most prevalent source of information for 25 and older was internet web sources with a mean of 4.08 ($sd = 1.152$, $n = 127$).

Looking at the percentage values, for “greatly relied on (5)”, per age group, for the information sources, revealed slightly different results, see Figure 13. The 18 to 24 year old age group relied primarily on social media; whereas, the results for the older adults indicated they relied primarily on local news sources. Of the younger adults, 60

percent said they greatly relied on social media as an information source compared to 49 percent for the older group.

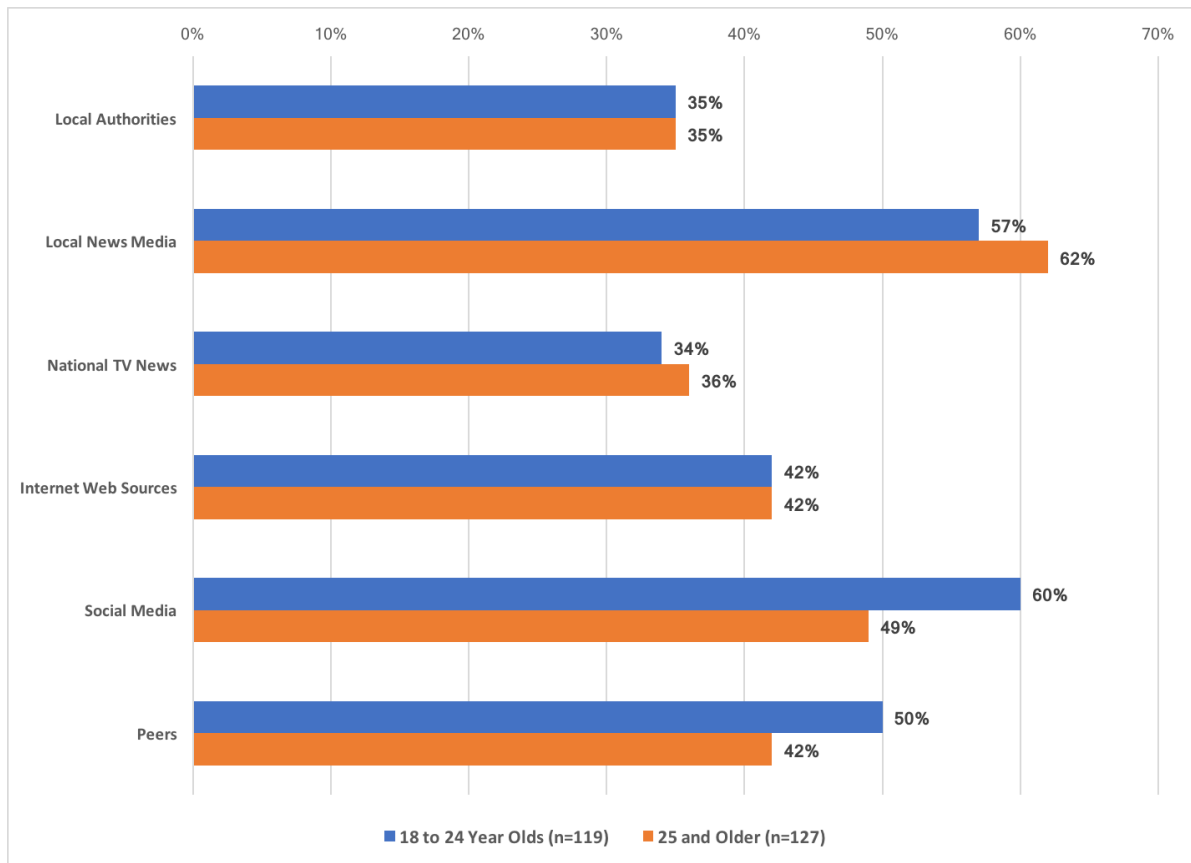


Figure 13. Comparison by age group of information sources “greatly relied on” for wildfire and evacuation information during the Fort McMurray wildfire in 2016.

A regression analysis, similar to the regression analysis in Table 6, was also run for the 18 to 24 year old age group, see Table 10 for the results. The standardized regression coefficient for social media sources against the perceived risk for fire ($\beta = 0.072$), smoke ($\beta = 0.073$) and the after effects ($\beta = 0.065$) were all quite small. The only one with statistical significance was social media sources and smoke, significant at the 0.05 level.

In light of the results noted above, it would be difficult to assert that hypothesis 3 was upheld. It was clear, from the information presented that younger adults, 18 to 24

years of age, utilize social media as one of their primary sources of disaster information; however, whether this related positively to their risk perceptions was not apparent.

Table 10

Regression Analysis – Risk Perception and Independent Variables, 18 to 24 Year Olds

(Section 1)

		FIRE	Smoke	After Effects
Gender	B (Logistic Regression Coefficient)	0.061	-0.138	-0.331
	Standardized Regression Coefficient)	0.187	0.189	0.168
	Exp(B)	0.032	-0.074	-0.189
	Significance	0.745	0.466	0.052
Age	B (Logistic Regression Coefficient)			
	Standardized Regression Coefficient)			
	Exp(B)			
	Significance			
Full Time Student	B (Logistic Regression Coefficient)	0.006	0.029	0.160
	Standardized Regression Coefficient)	0.178	0.180	0.161
	Exp(B)	0.004	0.017	0.103
	Significance	0.974	0.873	0.323
Work Full Time	B (Logistic Regression Coefficient)	0.204	0.079	0.147
	Standardized Regression Coefficient)	0.198	0.200	0.178
	Exp(B)	0.108	0.042	0.084
	Significance	0.305	0.695	0.412
Married	B (Logistic Regression Coefficient)	0.167	0.484	1.066
	Standardized Regression Coefficient)	0.442	0.446	0.398
	Exp(B)	0.036	0.106	0.247
	Significance	0.707	0.280	0.009
Living with Parents	B (Logistic Regression Coefficient)	-0.073	0.173	0.089
	Standardized Regression Coefficient)	0.178	0.179	0.160
	Exp(B)	-0.042	0.101	0.055
	Significance	0.682	0.338	0.580
Living in a House/Townhouse	B (Logistic Regression Coefficient)	0.446	0.012	-0.073
	Standardized Regression Coefficient)	0.183	0.185	0.165
	Exp(B)	0.239	0.006	-0.042
	Significance	0.017	0.950	0.658
Social Cues	B (Logistic Regression Coefficient)	0.052	0.135	0.177
	Standardized Regression Coefficient)	0.089	0.090	0.080
	Exp(B)	0.065	0.170	0.237
	Significance	0.563	0.137	0.030
Environmental Cues	B (Logistic Regression Coefficient)	0.227	0.071	0.038
	Standardized Regression Coefficient)	0.096	0.097	0.086
	Exp(B)	0.268	0.085	0.045
	Significance	0.020	0.464	0.658

Note. Highlighted yellow is significant at $p < .05$

Table 10 Continued

*Regression Analysis – Risk Perception and Independent Variables, 18 to 24 Year Olds**(Section 2)*

		FIRE	Smoke	After Effects
Prior Experience	B (Logistic Regression Coefficient)	-0.032	-0.091	-0.035
	Standardized Regression Coefficient)	0.057	0.058	0.052
	Exp(B)	-0.058	-0.167	-0.069
	Significance	0.578	0.119	0.496
Evac Impediments	B (Logistic Regression Coefficient)	-0.027	0.050	0.095
	Standardized Regression Coefficient)	0.073	0.074	0.660
	Exp(B)	-0.041	0.076	0.154
	Significance	0.707	0.500	0.150
Local Authorities	B (Logistic Regression Coefficient)	0.026	0.006	0.096
	Standardized Regression Coefficient)	0.067	0.068	0.061
	Exp(B)	0.038	0.009	0.148
	Significance	0.698	0.926	0.117
Local News Media	B (Logistic Regression Coefficient)	-0.045	-0.065	-0.035
	Standardized Regression Coefficient)	0.075	0.076	0.068
	Exp(B)	-0.061	-0.090	-0.051
	Significance	0.553	0.393	0.610
National Television News	B (Logistic Regression Coefficient)	-0.067	-0.010	0.051
	Standardized Regression Coefficient)	0.064	0.064	0.057
	Exp(B)	-0.113	-0.018	0.092
	Significance	0.296	0.874	0.380
Internet Web Sources	B (Logistic Regression Coefficient)	0.035	0.017	-0.051
	Standardized Regression Coefficient)	0.073	0.073	0.065
	Exp(B)	0.054	0.026	-0.084
	Significance	0.627	0.817	0.434
Social Media Sources	B (Logistic Regression Coefficient)	0.090	0.152	0.097
	Standardized Regression Coefficient)	0.072	0.073	0.065
	Exp(B)	0.128	0.218	0.147
	Significance	0.215	0.040	0.142
Peers, friends, relatives, etc.	B (Logistic Regression Coefficient)	0.067	0.108	0.058
	Standardized Regression Coefficient)	0.078	0.079	0.070
	Exp(B)	0.083	0.134	0.077
	Significance	0.391	0.176	0.411

Note. Highlighted yellow is significant at $p < .05$

Hypothesis 4

The fourth hypothesis was linked with the third hypothesis, in that it was about information sources that young adults relied on. A quick re-examination of Figure 13 indicates that young adults relied on social media (60 percent), their peers (50 percent), and internet web sources (42 percent) more so than local authorities (35 percent) for

information about disasters and evacuation. The interesting result is that 57 percent of young adults stated they greatly relied on local news media for their wildfire and evacuation information. This was their second highest ranked source of information.

This hypothesis was focused on young people; however, the results for young people and older adults are very similar. The young people, as noted in hypothesis 3 utilized social media for their information more than their older counterparts; but the rest of the results were very similar. In both groups, 35 percent of the participants stated they greatly relied on local authorities for information. Local authorities were ranked fifth of the six options presented for either age group. Peers, defined in the survey as friends, neighbours, relatives and coworkers, were greatly relied on by 50 percent of younger people compared to older adults who greatly relied on their peers 42 percent.

The results of an independent samples *t* test indicated that the differences in the means (see Table 11) for the information sources, by age group, are not statistically significantly different. The largest difference in the means is within the social media variable, but the difference is only 0.27 ($t = 1.65$, $df = 244$). The rest of the differences are smaller than that.

Overall, the information sources relied on by younger adults and older adults were very similar. There was not a lot of variability between what they rely on for information. As a result, it would difficult to assert that there were differences between younger adults and older adults. For the purposes of the hypothesis, it could be said that young people relied more on other sources, than local authorities, as local authorities was ranked, fifth out of six sources. For older adults, local authorities were ranked last. So, although part of the hypothesis was confirmed, it was also true for older adults, indicating

that it was not just applicable to the young adult sample. Like the previous hypothesis, linking information sources to risk perceptions was not statistically significant, therefore, it cannot be stated that the information sources were predictors of risk perception.

Table 11

Independent t Tests - Information Source Variables by Age Group

Variables	Age Group	n	mean	std. deviation	mean difference	t	df	sig.
Local	18 to 24 Year Olds	119	3.76	1.21	0.21	1.32	244	0.19
Authorities	25 and Older	127	3.55	1.32				
Local News	18 to 24 Year Olds	119	4.21	1.15	0.08	0.47	244	0.64
Media	25 and Older	127	4.14	1.34				
National TV	18 to 24 Year Olds	119	3.48	1.42	-0.08	-0.43	244	0.67
News	25 and Older	127	3.56	1.39				
Internet	18 to 24 Year Olds	119	3.83	1.28	-0.25	-1.62	244	0.11
Web	25 and Older	127	4.08	1.15				
Social	18 to 24 Year Olds	119	4.20	1.19	0.27	1.65	244	0.10
Media	25 and Older	127	3.93	1.35				
Peers	18 to 24 Year Olds	119	4.13	1.03	0.14	1.03	244	0.31
	25 and Older	127	4.00	1.03				

Descriptive Statistics

Question 1 – Risk Perceptions

The first research question inquired about the risk perceptions of adults during a wildfire. It further sought to specify whether there were differences between younger adults and older adults. A number of the hypotheses dealt with risk perceptions and the differences between younger and older adults. The findings revealed that they are very similar. To explore this a little further, the original questions in the survey were reexamined. Questions 4 through 7 ask about the likelihood of something happening as a result of, a number of different variables. The participants were to answer on a scale of 1 to 5, where 1 was, “extremely unlikely”, and 5 was, “extremely likely”. The variables for each of the questions were the same: the wildfire itself; the smoke; the potential toxic emissions; the after effect of potential flooding; the after effect of potential landslides;

and other. For the analysis, the smoke and toxic emissions were combined to form one variable as were the after effects of potential flooding and potential landslides. This was done for each of the four questions. The methodology was the same as was done when combining the other variables, as explained in the methodology section. This combining of variables aligned with the combining of the dependent variables in the examination of the hypotheses. Question 4 asks about the extent the threats posed to the damage and destruction of the participant's home. Question 5 asked about the extent personal harm to self, friends, or family that would be likely from the threats. Question 6 asked about the likelihood of loss of services such as electricity, water, and telephone. Finally, question 7 was concerned with loss of either work time or school time by participants as a result of the threats.

An independent *t* test was run to determine the differences in the means between younger adults and older adults in terms of the questions posed, see Table 12. With the exception of two pairs, the differences in the means between the age groups were not significantly different. The two pairs, where the means could arguably be different, were question 4, the after effects, the difference is 0.37 ($t = 2.578$, $df = 240$); and question 7, the after effects again, the difference is 0.43 ($t = 2.497$, $df = 240$). In both of these cases the younger adults indicated a higher average likelihood of harm to their home, or missing school or work, as a result of potential landslides and potential flooding.

The table indicated some other interesting findings. The after effects, potential landslides and potential flooding all ranked, on average, less than 2.7 for all of the questions. This suggested that participants, on average, regardless of age, viewed the extent of harm or damage, of these after effects, as somewhat unlikely.

The smoke, in all of the situations, for all of the age groups, ranked between 3 and 4. This suggested that people viewed the smoke, and the toxic emissions (because they were included in that variable), as a threat that was somewhat likely but not extremely likely to cause damage or harm.

Table 12

Independent t Tests – Risk Perceptions and Age

The Likelihood	The Risk	Age Group	n	mean	std. deviation	mean difference	t	df	sig.
Damage or Destruction to Home (Q. 4)	The Wildfire	18 to 24 Year Olds	118	4.03	1.13	0.12	0.800	241	0.425
		25 and Older	125	3.91	1.24				
	The Smoke	18 to 24 Year Olds	119	3.88	0.89	-0.14	-1.234	243	0.218
		25 and Older	126	4.02	0.91				
	The After Effects	18 to 24 Year Olds	119	2.43	1.11	0.37	2.578	240	0.011
		25 and Older	123	2.06	1.13				
Personal Harm to Self, Friends, or Family (Q. 5)	The Wildfire	18 to 24 Year Olds	119	3.70	1.37	-0.03	-0.174	242	0.862
		25 and Older	125	3.73	1.36				
	The Smoke	18 to 24 Year Olds	119	3.46	1.19	-0.11	-0.731	242	0.466
		25 and Older	125	3.58	1.24				
	The After Effects	18 to 24 Year Olds	119	1.94	1.14	0.01	0.091	241	0.928
		25 and Older	124	1.92	1.19				
Impact to Services (electricity, water, telephone, etc.) (Q. 6)	The Wildfire	18 to 24 Year Olds	119	4.34	1.10	-0.22	-1.725	242	0.860
		25 and Older	125	4.57	0.92				
	The Smoke	18 to 24 Year Olds	119	3.47	1.22	0.26	1.617	241	0.107
		25 and Older	124	3.12	1.29				
	The After Effects	18 to 24 Year Olds	119	2.49	1.33	0.04	0.235	240	0.814
		25 and Older	123	2.45	1.34				
Impact to Ability to Work and/or Attend Classes (Q. 7)	The Wildfire	18 to 24 Year Olds	119	4.61	0.88	0.03	0.274	241	0.784
		25 and Older	124	4.57	0.96				
	The Smoke	18 to 24 Year Olds	119	3.90	1.18	-0.06	-0.399	242	0.690
		25 and Older	125	3.96	1.20				
	The After Effects	18 to 24 Year Olds	119	2.69	1.40	0.43	2.497	240	0.013
		25 and Older	123	2.26	1.27				

Note. The yellow highlighted mean differences are significant at the 0.05 level.

The wildfire ranked, between 3.70 and 4.57 in all circumstances, which indicated

that people were a little more concerned of the threat of the fire itself, than the other variables. Looking at this in terms of percentage of respondents who selected, “Extremely Likely”, or 5, on the scale of 1 to 5, demonstrated the similarities between the two age groups, see Figure 14, Figure 15, and Figure 16. The charts depict the likelihood of the impact of the fire, the smoke, and the after effects by age group.

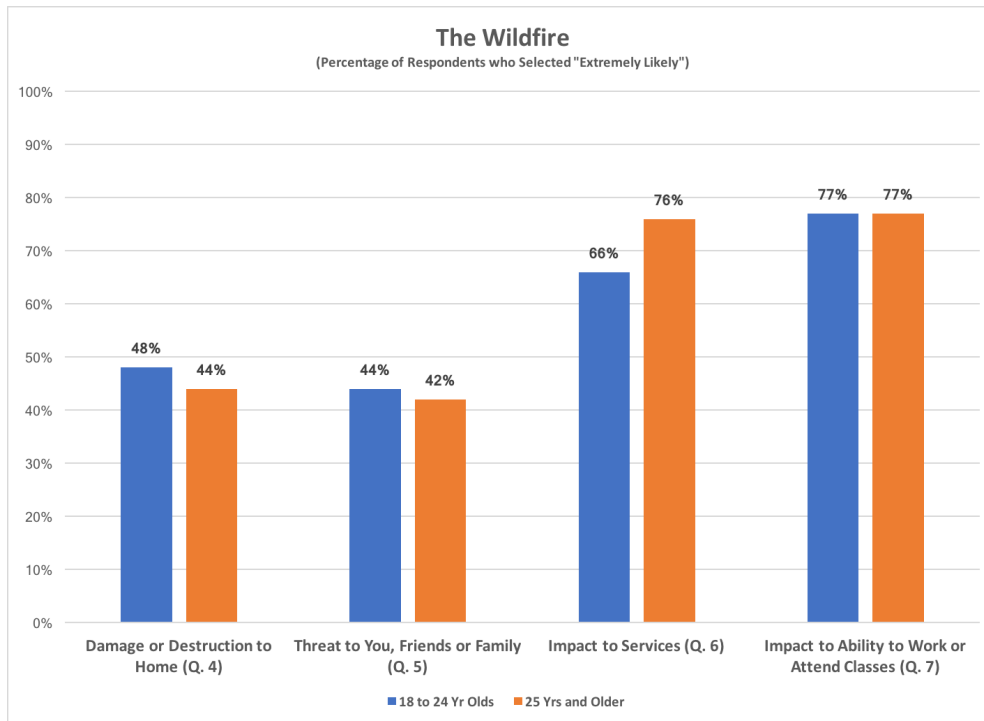


Figure 14. Respondents who selected “Extremely Likely” for the threat of wildfire impacting them personally by age group.

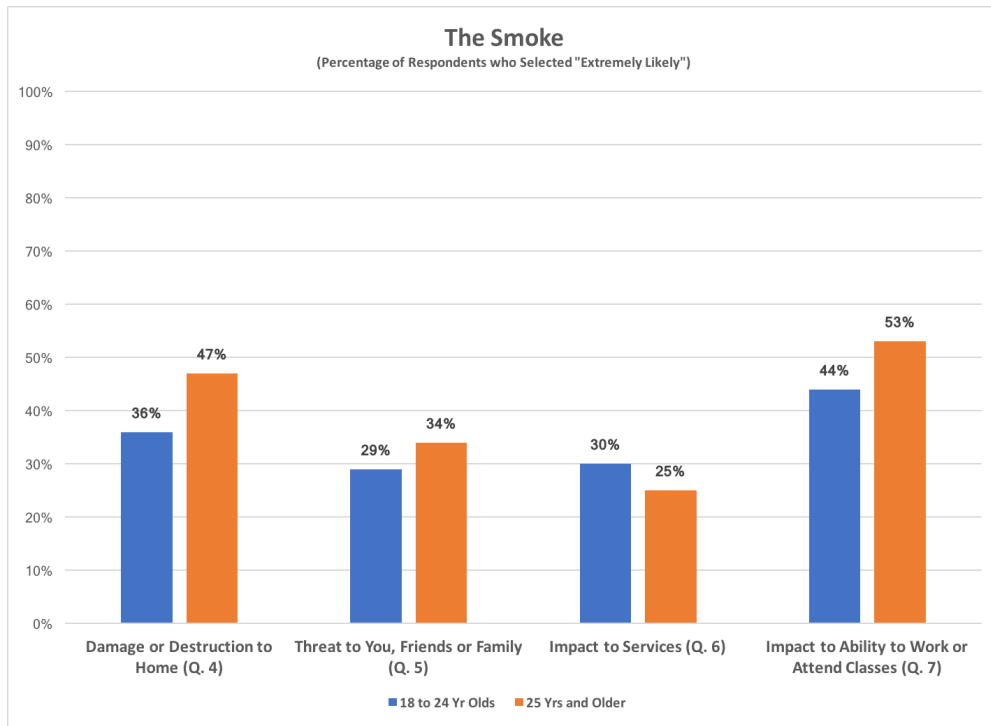


Figure 15. Respondents who selected “Extremely Likely” for the threat of smoke impacting them personally by age group

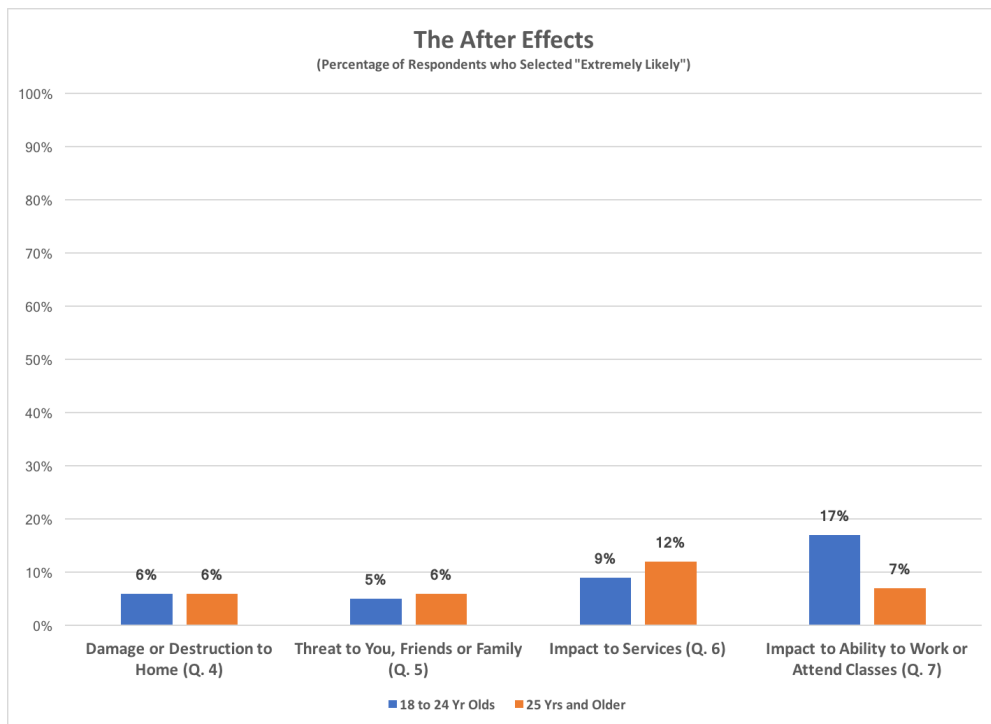


Figure 16. Respondents who selected “Extremely Likely” for the threat of the after effects impacting them personally by age group

As noted previously, the fire itself was clearly perceived to be the greatest threat, based on the percentage of respondents who thought the impacts related to the fire were extremely likely. The smoke caused moderate concern, whereas the after effects were not perceived, by most to be an extremely likely threat.

The research question also sought to learn whether the risk perceptions, as discussed above, were the same for males and females. Looking at the same three charts, but comparing males and females, one can see again, that they are very similar between the groups (see Figures 17, 18, 19). Females tended to select “extremely likely” in a slightly higher proportion than men for the fire and smoke variables, but not for the most part, in a statistically significant way. The mean difference, on the scale of 1 to 5, is less than 0.5 in all circumstances ($n = 163$ to 165 for females; $n = 80$ for males).

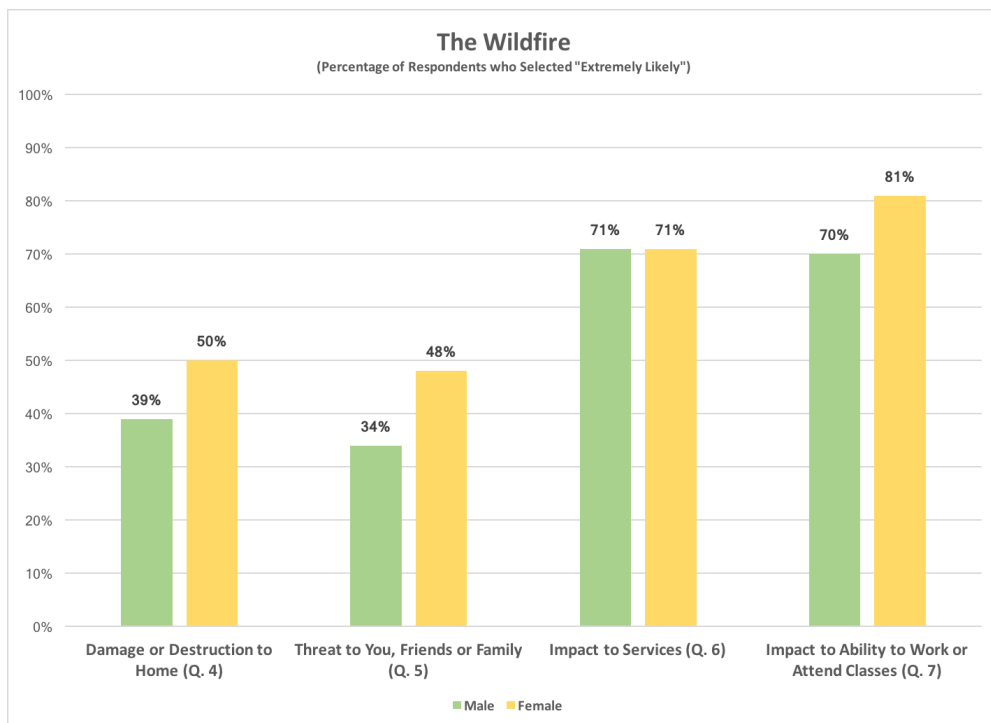


Figure 17. Respondents who selected “Extremely Likely” for the threat of wildfire impacting them personally by gender.

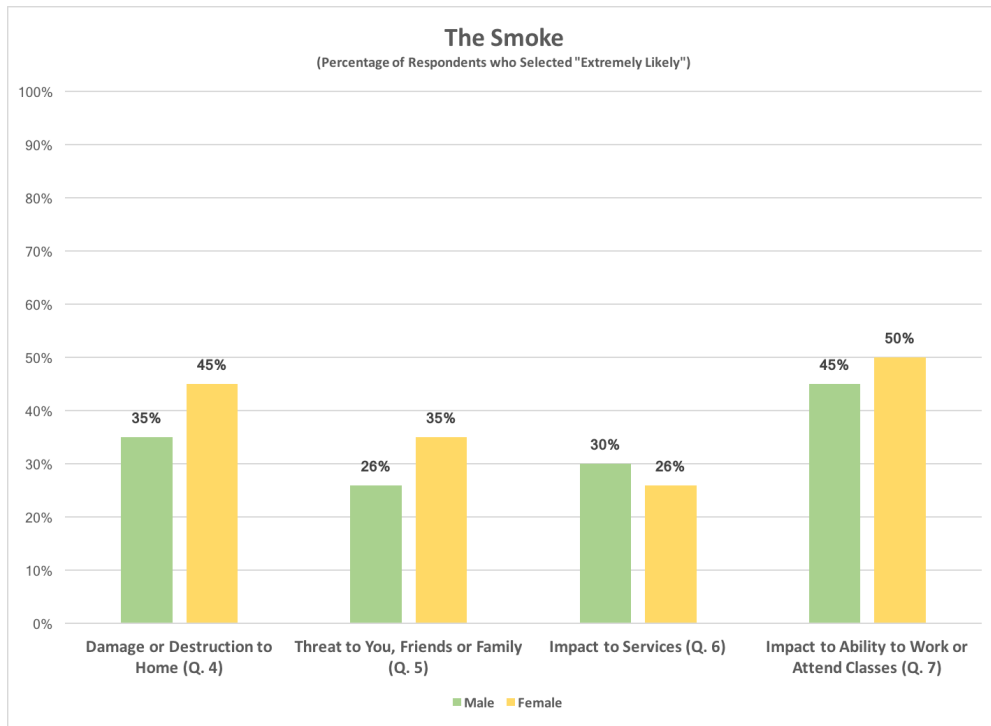


Figure 18. Respondents who selected “Extremely Likely” for the threat of smoke impacting them personally by gender.

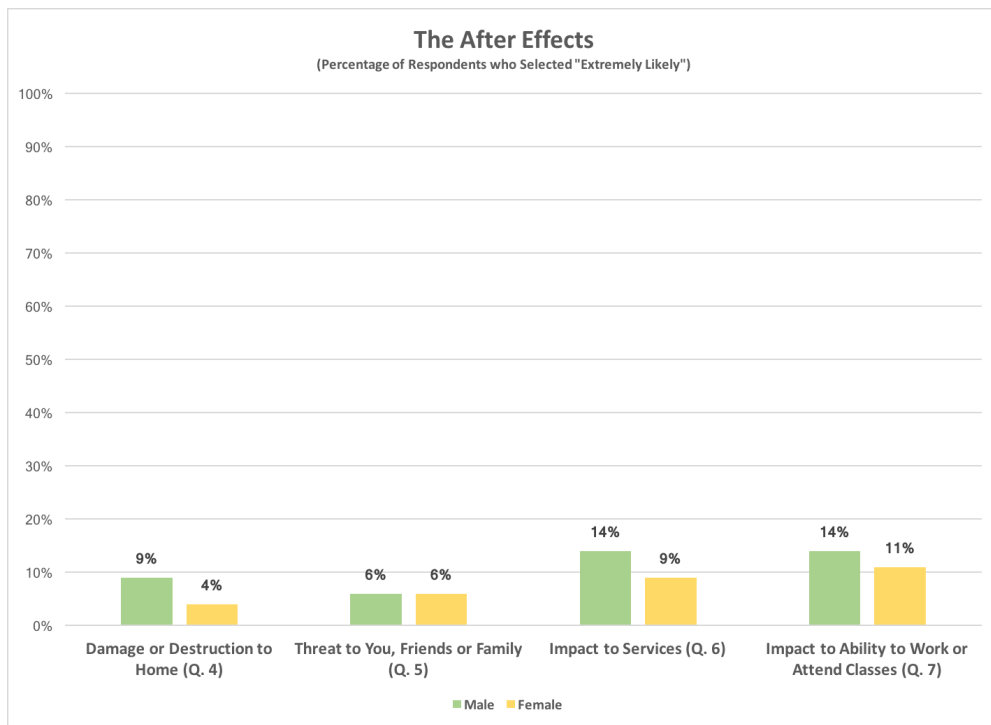


Figure 19. Respondents who selected “Extremely Likely” for the threat of the after effects impacting them personally by gender.

Similar to the charts comparing age, it was evident that the after effects were not considered an extremely likely threat by the majority of males and females. It was interesting though, that unlike fire and smoke, where the majority of females considered those variables to be of greater concern than males; in the case of the after effects, more males considered the after effects extremely likely than females.

For this research question, it appeared that the differences in risk perceptions between younger adults and older adults and between males and females are minimal.

Question 2 – Information Sources

This research question sought to determine how young adults received evacuation and disaster information. Much of the data analysis for this was covered with hypotheses three and four. The outcome, specifically for young adults, indicated that 60 percent of young adults “greatly relied on” social media as their source of disaster related information (see Figure 20). Local news media was “greatly relied on” by 57 percent of young adults, followed up with peers and internet web sources.

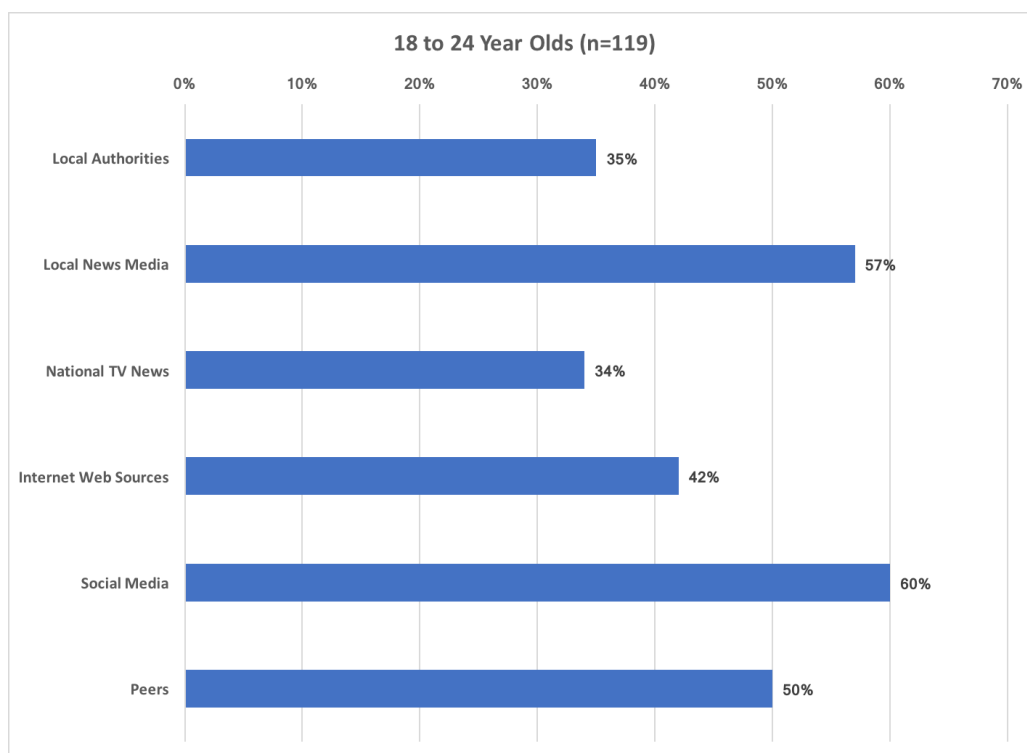


Figure 20. Information sources “greatly relied on” by 18 to 24 year olds.

The research question only intended to look at the information sources related to 18 to 24 year olds; however, while conducting some exploratory research on this age group and gender differences, some intriguing results emerged. Females, overall, selected “greatly relied on” more than males for the information sources (see Figure 21). The largest differences were with local news media, where 62 percent of females selected “greatly relied on” and 44 percent of males selected this; and with social media, where 65 percent of females selected “greatly relied on” compared with 47 percent of males. An independent t test was conducted, revealing that the differences in the means between males and females were statistically significant at the 0.05 level, for the “local news media” ($t = -2.08$, $df = 50$) and “social media” ($t = -2.03$, $df = 51$) variables (see Table 13).

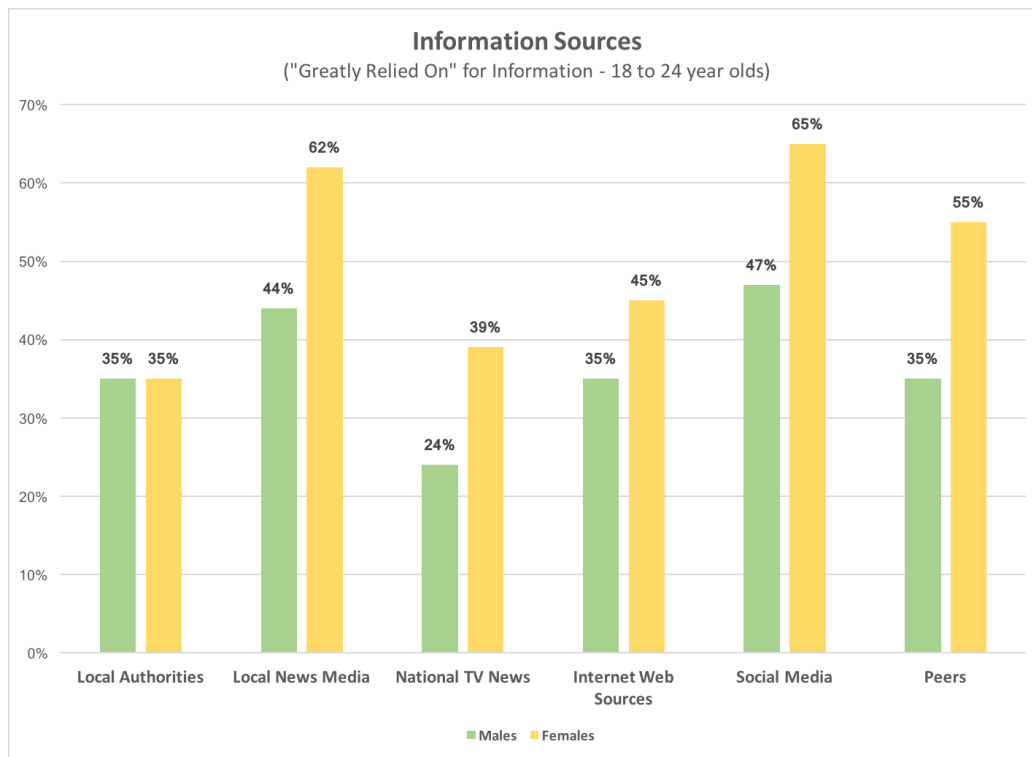


Figure 21. Information sources “greatly relied on” by 18 to 24 year olds, gender comparison.

Table 13

Independent t Tests - Information Sources, 18 to 24 Year Olds and Gender

Variables	Age Group	n	mean	std. deviation	mean difference	t	df	sig.
Local Authorities	Males	34	3.71	1.14	-0.08	-0.34	117	0.74
	Females	85	3.79	1.24				
Local News Media	Males	34	3.84	1.33	-0.53	-2.08	50	0.04
	Females	85	4.36	1.03				
National TV News	Males	34	3.26	1.38	-0.30	-1.04	117	0.30
	Females	85	3.56	1.44				
Internet Web	Males	34	3.65	1.37	-0.26	-1.00	117	0.32
	Females	85	3.91	1.25				
Social Media	Males	34	3.82	1.36	-0.53	-2.03	51	0.05
	Females	85	4.35	1.09				
Peers	Males	34	3.85	1.13	-0.39	-1.90	117	0.06
	Females	85	4.25	0.98				

Note. The yellow highlighted mean differences are significant at the 0.05 level.

For the remaining variables (local authorities, national TV news, the internet, and peers) the mean differences between males and females were not statistically significant

and therefore can be assumed to be similar, despite any discrepancies indicated by the responses.

As noted, social media played a large role informing people about disaster and evacuation information. Part of the research question sought to learn the preferred social media platforms that people used. In Question 3 of the survey, participants were asked to rank their social media platforms from most used to least used. Facebook, by far, was the most prevalent amongst younger adults (69 percent) and older adults (72 percent) alike, see Figure 22.

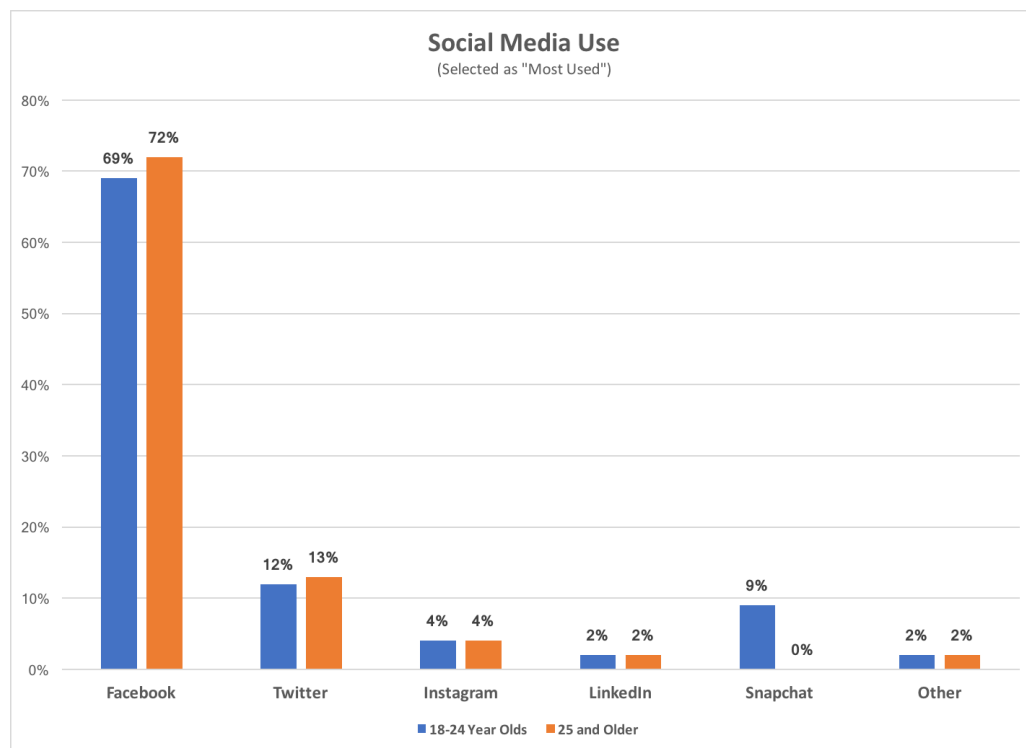


Figure 22. Social media, by platform, selected as “most used” comparison between 18 to 24 year olds and 25 and older.

Twitter was the next most favoured social media platform amongst both groups. Snapchat had a 9 percent usage amongst the younger age group; whereas, the older age group had no respondents select it as their “most used” platform.

The results were similar again, between males and females. Figure 23 breaks down social media use by age group and by gender. Women, in both groups were more inclined to use Facebook; 72 percent for females in the 18 to 24 year old category and 77 percent for females in the 25 and older category. Twitter, in the younger age group was used more by males (15 percent), compared to females (10 percent); but, in the older age group it was reversed, males (8 percent), females (15 percent). Snapchat, was preferred equally by men and women between the ages of 18 to 24 years of age.

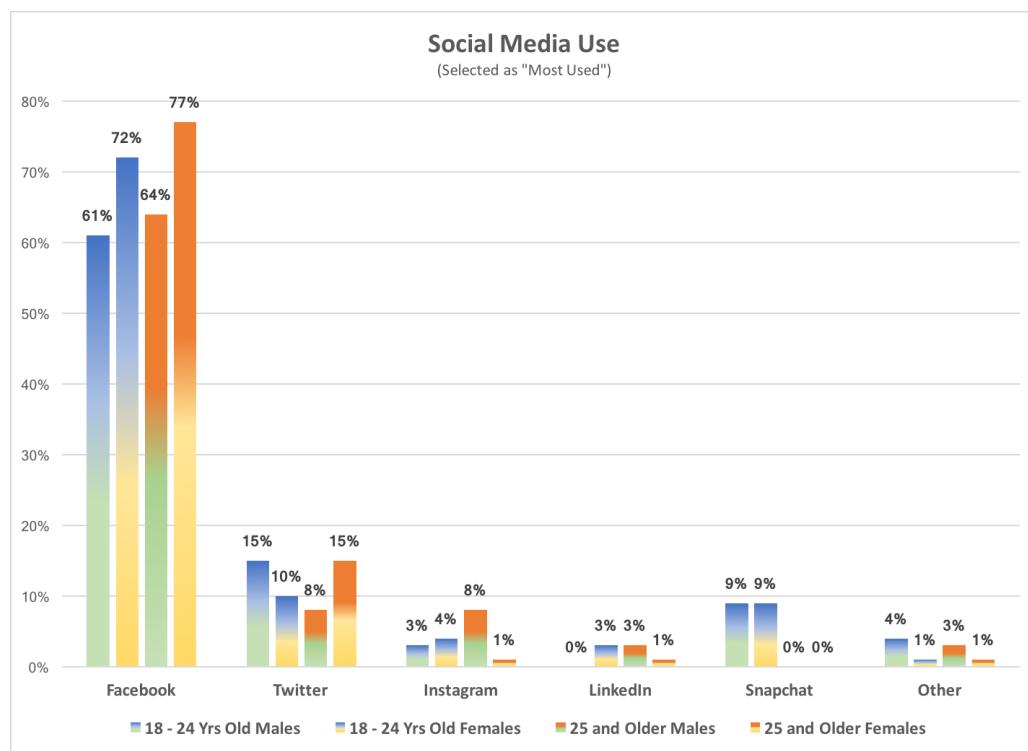


Figure 23. Social media, by platform, selected as “most used” comparison between 18 to 24 year olds and 25 and older and by gender.

Question 3 – Evacuation Behaviours

A number of the questions in the survey were aimed at obtaining some evacuation information from the participants. As a research question, learning about their evacuation behaviours seemed appropriate. Queries such as: at one point in time people evacuated; who they evacuated with; where they went; and where they stayed, were covered.

Date and Time of Evacuation.

The Fort McMurray wildfire started on May 1, 2016. An evacuation order, for one neighbourhood, was issued that evening (RMWB, 2016a). On May 3, due to the size and continued growth of the wildfire, an evacuation order was issued for the entire municipality (KPMG, 2017). Questions 10 and 11 of the survey asked participants the date and the time of day that they evacuated. Tables 14 and 15 depict the responses.

Table 14

The Date that Participants Evacuated

Date (Q. 10)	Frequency	Percent
Before May 1	5	2%
May 1	7	3%
May 2	12	5%
May 3	195	82%
May 4	13	5%
May 5	2	1%
After May 5	2	1%
Did not leave	1	0%
Total	237	100%

Table 15

The Time of Day that Participants Evacuated

Time of Day (Q. 11)	Frequency	Percent
Middle of the night	2	1%
Pretty early in the morning	4	2%
First thing in the morning	5	2%
Late morning	5	2%
Early afternoon	72	30%
Late afternoon / Early evening	97	41%
Evening	39	16%
Late evening	14	6%
Total	238	100%

The majority of the participants, 82 percent, evacuated on May 3, the day the mandatory evacuation order was pronounced. Seven percent of the people evacuated afterwards. The time of day results revealed that most people, 87 percent, evacuated between noon and 9:00 p.m.

As noted, the majority of people evacuated on the 3. Looking at the comparison between young adults, 18 to 24 years old, and older adults, 25 years or older, revealed no differences in this, see Table 16. The difference between those who evacuated prior to May 3 compared to those afterwards, between the age groups is minimal.

Table 16

Date of Evacuation – Age Group Comparison

Date	18 to 24 Years Old	25 and Older
Before May 3	9%	11%
May 3	83%	82%
After May 3	9%	6%

It was interesting to note the differences with gender and date of evacuation, see Table 17. The majority of people, male and female, evacuated on May 3; however, more females (11 percent more) evacuated on May 3, the day of the evacuation order, than males. It would appear, as a result, that less females than males evacuated after May 3. A Chi-Square test of independence was done on the two variables, gender and date of evacuation. The relationship between the two was statistically significant at the 0.05 level ($\chi^2 = 17.374$, $df = 7$), indicating that they are not independent of each other.

Table 17

Date of Evacuation – Gender Comparison

Date	Male	Female
Before May 3	11%	10%
May 3	75%	86%
After May 3	14%	4%

As noted, most people evacuated between noon and 9:00 p.m. As far as the time of day of evacuation, between age groups (see Table 18), the relationship was not statistically significant at the 0.05 level ($\chi^2 = 8.952$, $df = 7$), therefore the age groups and the time of day of evacuation were independent of each other. When time of day of evacuation was examined in relationship to gender (see Table 19), the results were statistically significant at the 0.05 level ($\chi^2 = 14.135$, $df = 7$), therefore, the results were related. It was apparent that females evacuated earlier in the day than males, with only 7 percent of females evacuating after 9:00 p.m.

Table 18

The Time of Day that Participants Evacuated, by Age Group

Time	18 to 24 Years Old	25 and Older
Before noon	5%	4%
Noon to 9:00 p.m.	88%	88%
Late Evening / Night	9%	8%

Table 19

The Time of Day that Participants Evacuated, by Gender

Time	Male	Female
Before noon	4%	4%
Noon to 9:00 p.m.	85%	89%
Late Evening / Night	12%	7%

Who People Evacuated With.

The next question, related to evacuation behaviours, was who people evacuated with. Question 12 of the survey, allowed respondents to select from several options: immediate family; other relatives; friends / neighbours / roommates; by yourself; and other. The respondents could select more than one response. The results indicated minimal variation in the responses between 18 to 24 year olds and older adults and then between males and females (See Table 20). The majority of participants, in all circumstances greater than 50 percent, evacuated with their immediate family. The next most frequent, in all of the groups, was evacuating with friends, neighbours, and roommates, at 20 to 23 percent in all groups. The younger age group had a few less participants evacuate by themselves at 6 percent compared to the older age group at 9 percent; however, the results were not statistically significant at the 0.05 level ($\chi^2 = 2.540$, $df = 1$). The only other significant appearing difference (statistically significant at the 0.05 level) was between males and females in their response to “other” ($\chi^2 = 6.022$, $df = 1$). Females selected “other” at a much higher frequency than males, 10 percent versus 3 percent, respectively. An informal review of the responses that females included in the “other” variable could all be summarized either by answers in other variables, i.e. with family or with friends, or by the following three most commonly noted answers, “With

pets”, “With coworkers”, and “With colleagues”. The male responses, in the “other” variable (there were only three), were, “With pets”, “With coworkers”, and “With an individual who had no other means of evacuation (was an employee of my father’s)”. Therefore, although the differences for the “other” variable between males and females was statistically significant, it was not practically different.

Table 20

Who did Participants Evacuate With – Comparison by Age and by Gender

Q. 12	18 to 24 Years Old (n = 113)		25 and Older (n = 125)		All Male (n = 77)		All Female (n = 161)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Who did you evacuate with?								
Immediate family	91	53%	84	52%	53	56%	122	51%
Other relatives	21	12%	12	7%	8	9%	25	10%
Friends / neighbours / room mates	38	22%	32	20%	22	23%	48	20%
By yourself	10	6%	19	12%	8	9%	21	9%
Other	11	6%	15	9%	3	3%	23	10%
Total	171	100%	162	100%	94	100%	239	100%

Mode of Transportation.

Question 13 in the survey asked about mode of transportation. The options were: personal vehicle; someone else’s personal vehicle; municipal transit bus; Greyhound (or similar commercial) bus; plane; and other. The results (see Figure 24) indicated that 71 percent of respondents evacuated in their own personal vehicle. Twenty percent of respondents evacuated in someone else’s personal vehicle. More people, evacuated by plane (6 participants) than by municipal transit bus (3 people).

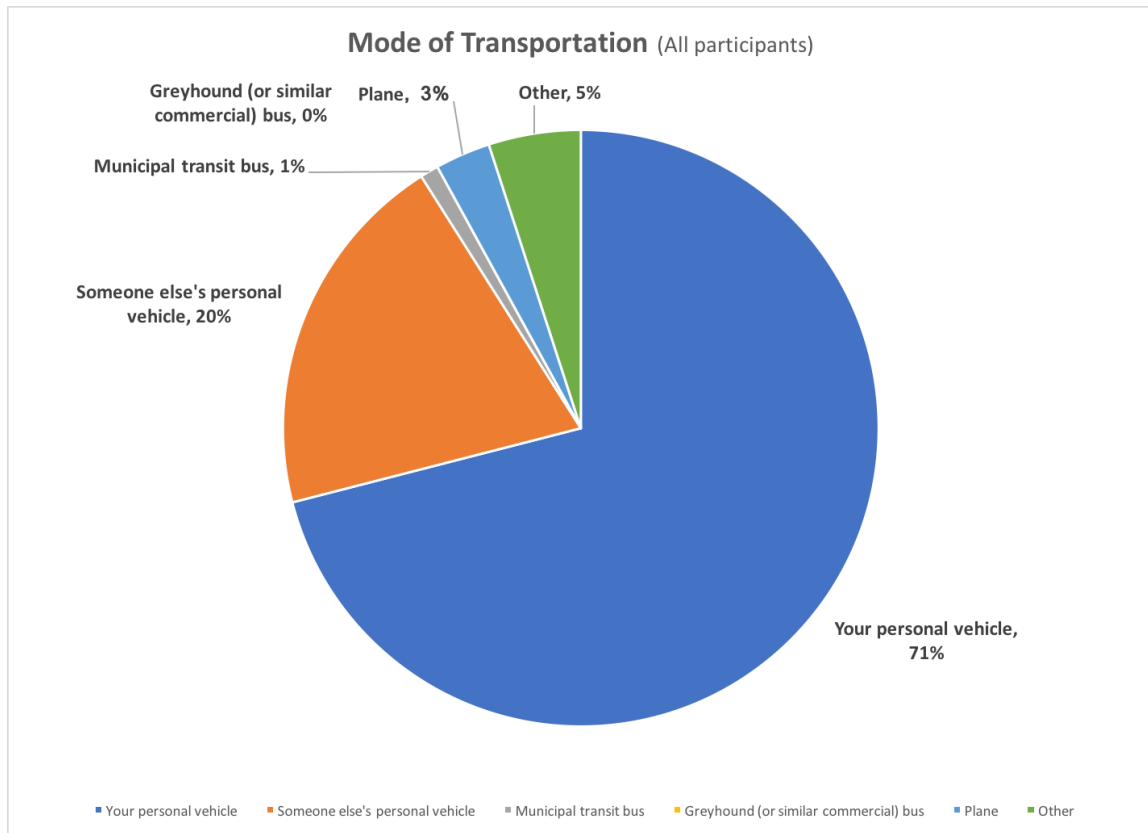


Figure 24. Mode of transportation for evacuation by all participants.

The differences between age groups for mode of transportation were not statistically significant at the 0.05 level ($\chi^2 = 4.778$, $df = 4$), indicating that the age groups are independent of each other. The differences were very minor. The most notable being that 68 percent of 18 to 24 year olds took their own personal vehicle, compared with 74 percent for the 25 and older group; conversely, 23 percent of the 18 to 24 year old group travelled in someone else's personal vehicle whereas, only 17 percent of the 25 and older group travelled in someone else's vehicle. The differences in gender and mode of transportation were almost nonexistent. The percentage of males and females that evacuated in their own personal vehicle was the same, 71 percent. Travelling in someone else's personal vehicle yielded similar results between males (19 percent) and females (20 percent). Some of the "other" comments were interesting and worth noting. One

person evacuated in a school bus. A number of people mentioned that they evacuated in their employer's vehicles ("work truck"), another person stated they fled in a motor home.

Where did they go?

The survey inquired where respondents evacuated to. The options presented, were: stayed within the Fort McMurray area; north to an industry camp; Edmonton; Red Deer; Calgary; and other. This was a multiple response field, because a number of people initially went to one location, and then ended up at another. Figure 25 indicates that the majority of people (45 percent) evacuated to Edmonton, Alberta. A small percentage (2 percent) stayed within the Fort McMurray area. A large number of respondents (18 percent) fled north to an oil field camp.

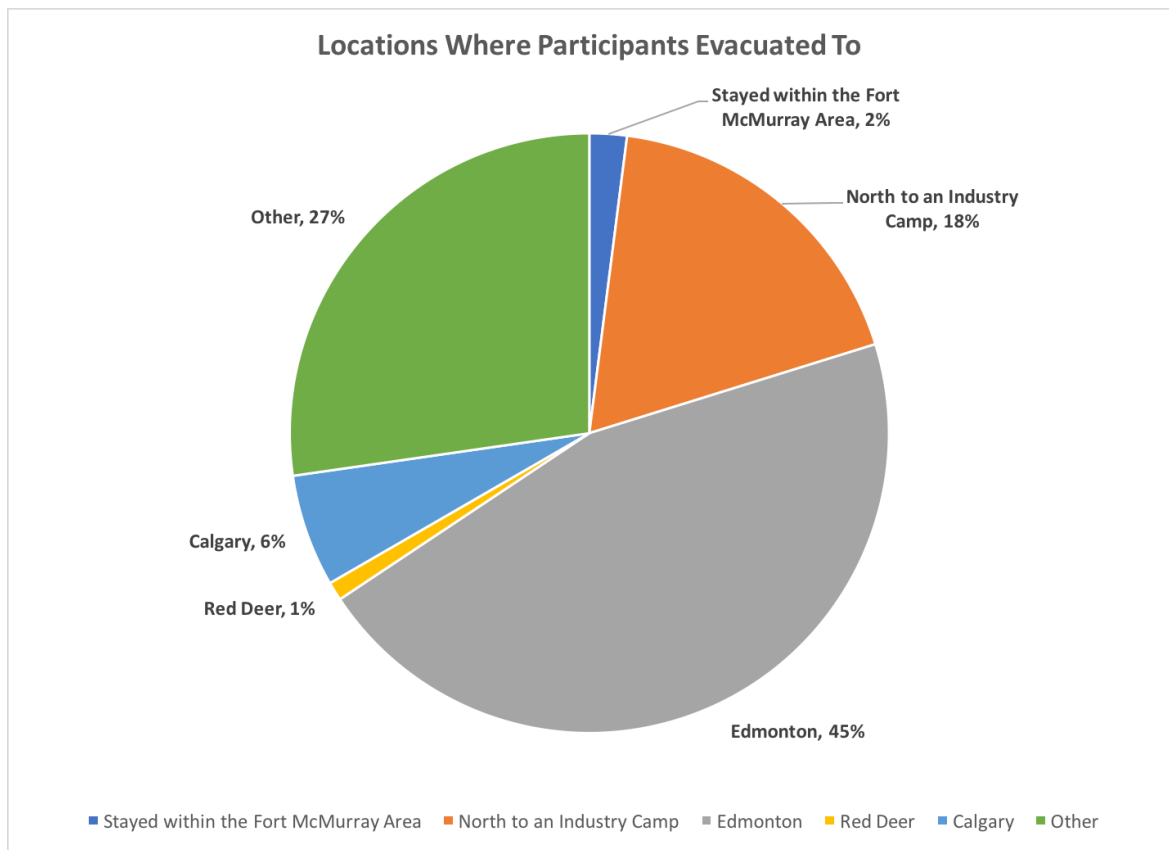


Figure 25. Locations where participants evacuated to.

Twenty-seven percent of the participants fled to other locations. Some of the “other” responses were not clear; however, many of the respondents travelled a great distance in their evacuation. One respondent stated that they went to India. Ten respondents headed off to the Maritimes. Several went to British Columbia. Table 21 indicates the locations, by province and territory where participants went. The average distance travelled (excluding the person that went to India) is 443 miles. Appendix F has further details of the locations and distances that people travelled.

Table 21

Locations, by Province and Territory, That Evacuees Went

<u>Provinces & Territories</u>	<u>Participants</u>
Alberta	225
British Columbia	9
Ontario	3
New Brunswick	2
Nova Scotia	4
Newfoundland	4
North West Territories	1

The results comparatively by age group and by gender were not notably different. See tables 22 and 23 for details.

Table 22

Locations Where Participants Travelled To – By Age Group

Q. 15 Where did you go?	18 to 24 Years Old (n = 113)		25 and Older (n = 125)	
	Frequency	Percent	Frequency	Percent
Stayed within the Fort McMurray Area	3	2%	4	2%
North to an Industry Camp	25	16%	33	20%
Edmonton	73	48%	68	42%
Red Deer	0	0%	3	2%
Calgary	11	7%	9	6%
Other	41	27%	45	28%
Total	153	100%	162	100%

Table 23

Locations Where Participants Travelled To – By Gender

Q. 15 Where did you go?	All Male (n = 77)		All Female (n = 161)	
	Frequency	Percent	Frequency	Percent
Stayed within the Fort McMurray Area	1	1%	6	3%
North to an Industry Camp	19	20%	39	18%
Edmonton	51	54%	90	41%
Red Deer	2	2%	1	0%
Calgary	8	8%	12	5%
Other	14	15%	72	33%
Total	95	100%	220	100%

Where did they Stay?

The final curiosity, in terms of evacuation behaviours, was where the evacuees stayed. Question 14 asked that exact question. This multiple response question had the following options: with friends; with relatives; in a hotel or a motel; at an evacuation

shelter; and other. The majority of participants, 26 percent, stayed with relatives. The next most frequently selected item was staying in a hotel or a motel, 22 percent.

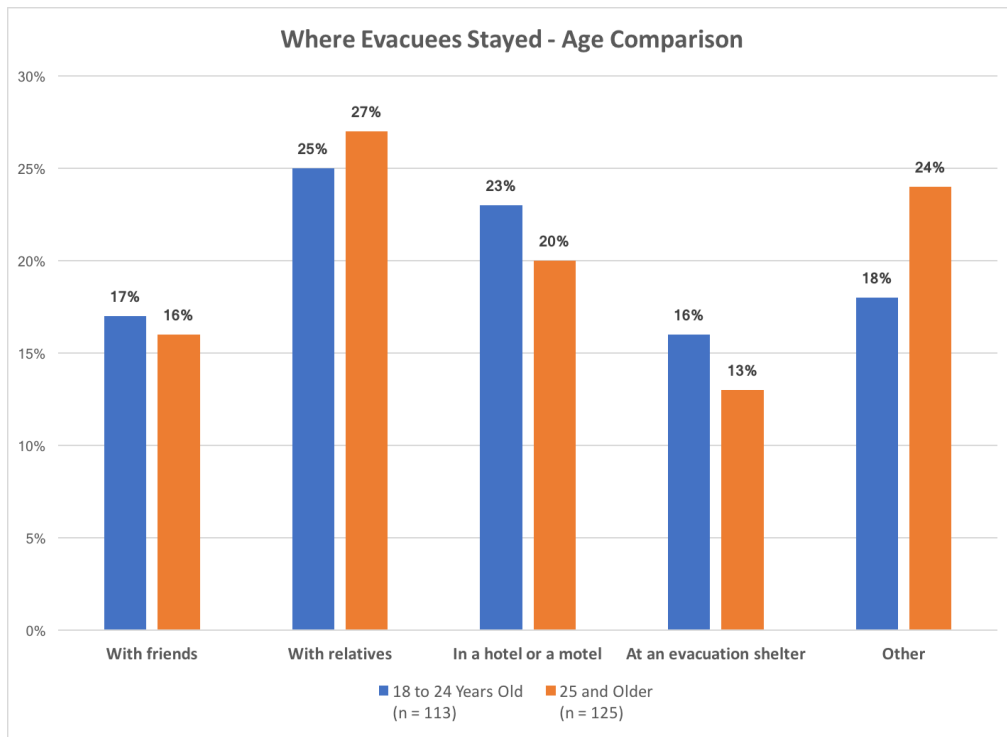


Figure 26. Where evacuees stayed by age group.

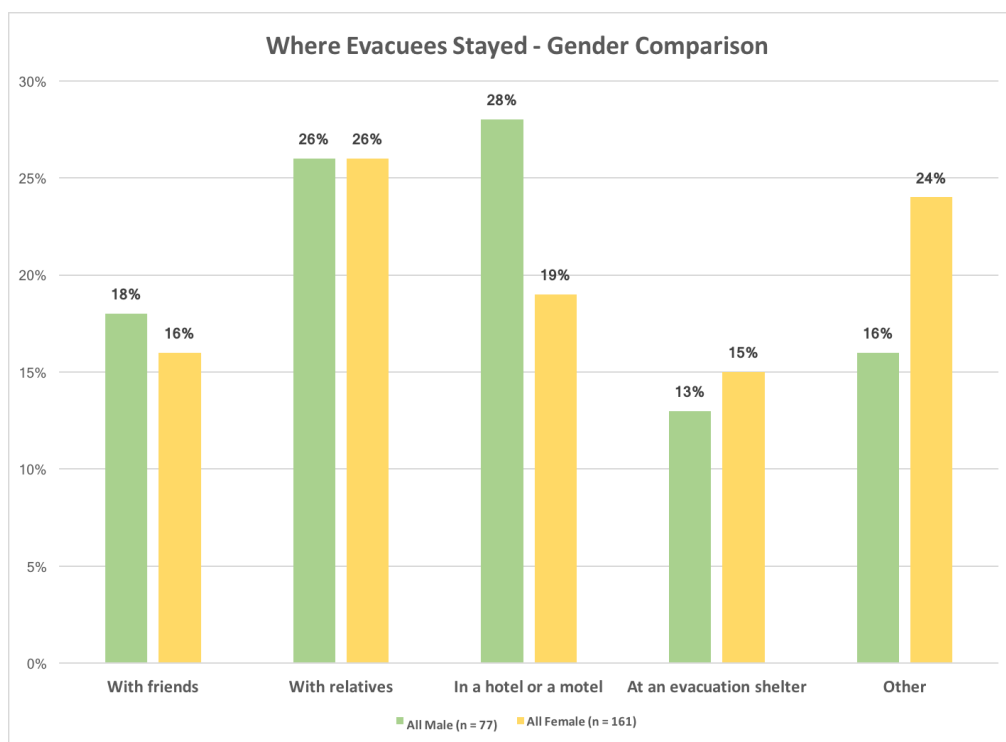


Figure 27. Where evacuees stayed by gender.

Figures 26 and 27 depict the results as a comparison by age group and a comparison by gender. It was interesting to observe that more young people, 16 percent, stayed at an evacuation shelter than older adults, 13 percent. This result was not statistically significant at the 0.05 level ($\chi = 1.444$, $df = 1$). More males, 28 percent, than females, 19 percent, stayed in a hotel or a motel. This result was also not statistically significant at the 0.05 level ($\chi = 1.584$, $df = 1$). The only statistically significant result at the 0.05 level, from the two comparisons, was the “other” variable between males, 16 percent, and females, 24 percent ($\chi = 5.551$, $df = 1$).

Overall, 21 percent, of the respondents selected “other” to describe where they stayed. A review of their specific answers indicated a wide range of other options. Many people stayed in a recreational vehicle, summer cottage, or other vacation properties.

Nine people indicated that they slept in their vehicles for a night or more. Several respondents indicated that they stayed or were provided lodging by strangers who offered to help them out. Some other participants stayed at the University of Calgary's or Mount Royal University's residence halls.

A Review of the Demographics

One of the last groupings of questions in the survey were demographic in nature. Part of the focus of this research project was to examine differences between younger adults, 18 to 24 years of age and older adults, 25 and older. The original intent was not necessarily to examine gender differences; however, the opportunity presented itself and it made sense to conduct some exploratory analysis on the differences between the genders, as has been noted in the research results above. Full demographic details of the survey participants can be found in Appendix G.

There were 299 participants in the survey. Of those, 20 participants skipped all of the questions with the exception of the first one. Those individual cases were eliminated. Ten participants selected, "no" to the very first question, "Were you living in Fort McMurray or the surrounding area during the wildfire in May 2016?" Those cases were eliminated as well. Question 17 asked about the participants' age on May 1, 2016. Anyone who selected "17 or younger" was also eliminated from the study. The original thought was to leave them in; however, where much of the research was comparing 18 to 24 year olds with 25 and older, it did not make sense to leave the 17 or younger people in the study. There were 23 cases that were 17 or younger as of May 1, 2016. The final number, after the case deletion was 246 participants.

Of the 246 participants, 33 percent were male (81 participants) and 67 percent were female (165 participants). In terms of age, 48 percent were between the ages of 18 to 24 years (119 participants) and 52 percent (127 participants) were 25 years of age or older. Figure 28 indicates the breakdown by age and gender of the participants. As a note, the 18 to 24 year age range had a 42 percent difference between male and female respondents (34 males and 85 females), a much larger gap than the 25 and older age group.

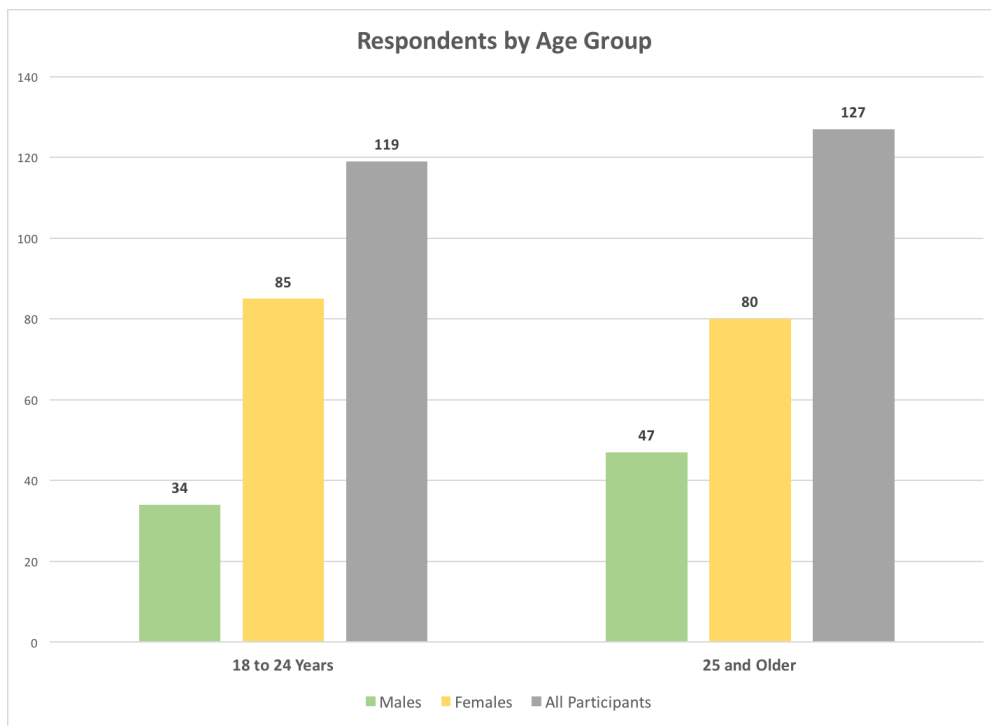


Figure 28. Respondents by gender and age group.

Question 18 was a multiple response set, meaning that participants could select more than one answer. The question inquired about occupational and student status, providing the following options: working full time; working part time; full time student; part time student; and unemployed. Of the survey group, 37 percent were employed full time and 29 percent identified as full time students, see Table 24 for the full results.

When comparing this to ages, there were more 18 to 24 year olds who were full time students (39 percent) than the 25 and over adults (18 percent); whereas, the older adults had a greater percentage of people working full time (57 percent) than their younger counterparts (20 percent).

Table 24

Occupational / Student Status of All Participants

Q. 18 (Multiple Response Set)		
Occupational / Student Status	All Participants	
Working Full Time	112	37%
Working Part Time	52	17%
Full Time Student	88	29%
Part Time Student	24	8%
Unemployed	25	8%
Total	301	100%

As for marital status, the majority of participants, 55 percent, were single.

Twenty eight percent of respondents identified as being married, see Figure 29. Only four percent of the 18 to 24 year olds were married in contrast to 50 percent of the 25 and older adults. Conversely, 81 percent of the younger adults were single and only 31 percent of the older adults were single.

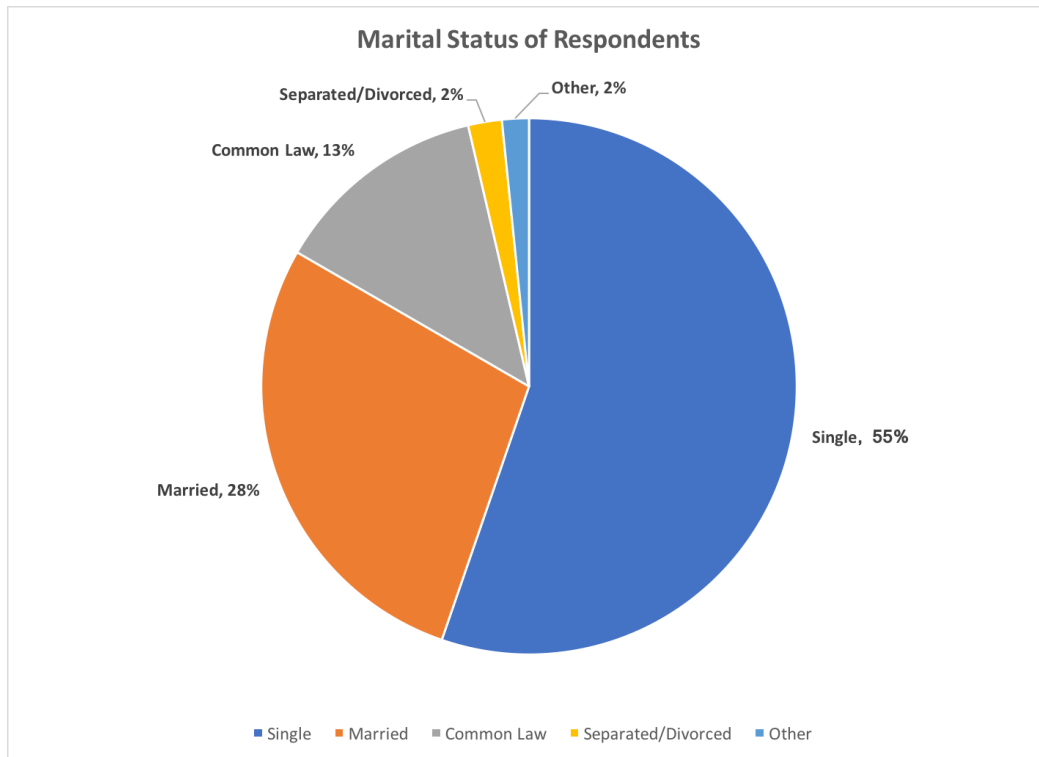


Figure 29. Pie chart indicating marital status of the survey participants.

Question 20 dealt with living arrangements. Sixty four percent of the 18 to 24 year olds lived with their parent(s). Only eight percent of the 25 and older group lived with theirs. The contrast is 54 percent of the 25 and older age group lived with their spouse or common law partner; only 13 percent of the younger age group lived with theirs.

The final demographic question inquired about the type of housing a participant resided in. Seventy percent of the respondents lived in a house or townhouse. The next most prevalent type of housing was apartment or condo buildings (20 percent). Only two percent of participants lived in a college residence. See Figure 30 for further details.

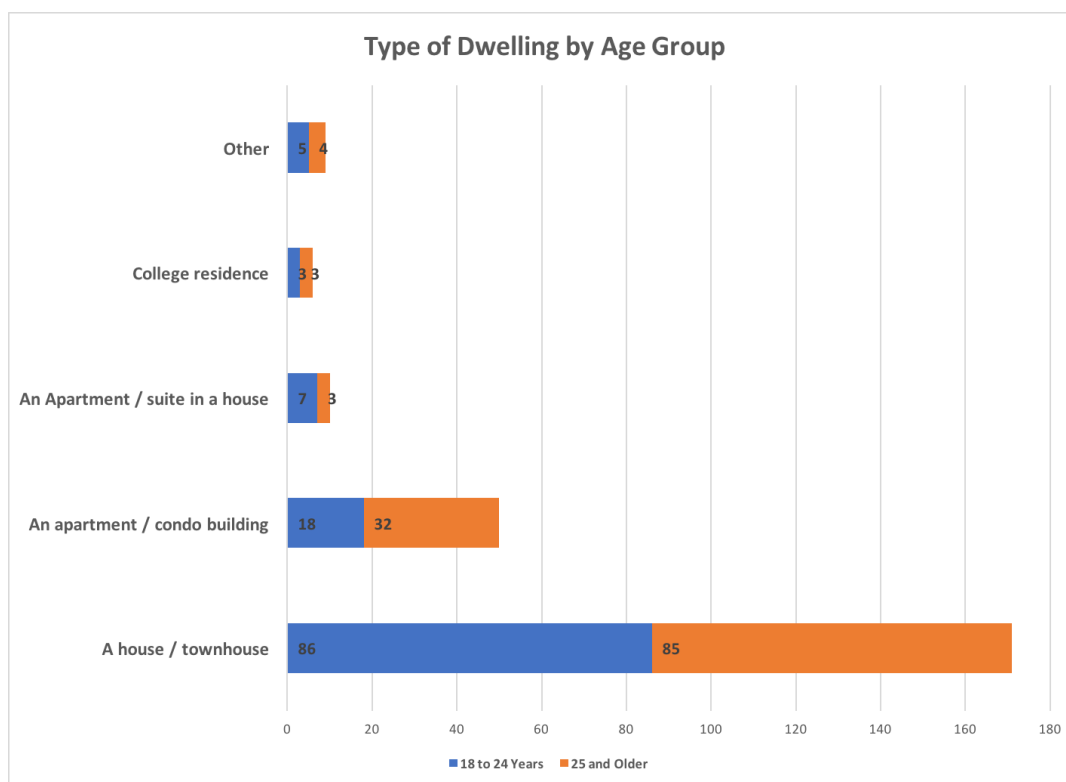


Figure 30. Type of dwelling lived in by participants compared by age group.

The demographics were numerous and can be examined in a number of different lights. As mentioned, additional details can be found in Appendix G.

The Qualitative Questions

Participants were given an opportunity in question 22 to state in a couple of words or less one positive outcome learned or gained from their wildfire experience. Of the respondents, 226 took the time to write something. Few responses were only a couple of words, many of them were quite lengthy. Some of the key themes that stood out: be prepared, make sure your gas tank is full, leave when instructed to, resiliency, community, good people, and family is everything, to name a few. Some of the more interesting ones: “Have anti-depressants to help control the crying”, “The zoo was free and so was [the] West Edmonton mall attractions!”, “If your gut feeling says to go – do it

– even if you leave from work without permission...” and “Don’t sleep thru it”. One of the more thought provoking comments was, “The fact that stuff is stuff and if I didn’t think to pack something in my car when we thought we would lose our home, then it must not have been that important”. Figure 31 is a “word cloud” created from the most common words used by participants in question 22.

Question 23 stated, “If you have any other comments that you would like to share, concerning your evacuation or wildfire experience in May of 2016, please do so here”. One hundred and one participants left comments. One of the common themes that people commented on here was that the municipality should have initiated the evacuation sooner. The other recurring comments were about support of the other municipalities, the province, and the country. A couple of quotes,

It was a traumatic experience that brought a lot of mental illnesses to the community of Fort McMurray. Till this day, I still have PTSD and anxiety whenever I hear the sirens go off on the firetruck. I feel that my attention is drawn into the sound, and I start to feel anxious on wondering what is happening. I’m glad no one got hurt in Fort McMurray after they evacuated, however, this fire was a learning experience to always have gas in your warehouse, an emergency kit, and to become aware of hot temperatures that surround Fort McMurray. We all came together as one, and that made us #fortmacstrong. (Comments from a respondent, Question 22)

The experience was heartwarming when it comes to the surrounding area willing to help us. Some even bought water and drove to the highway 63 to hand us water. Simple gestures like that was very heartwarming. It's been almost a year & I get

teary eyed just talking about it because I don't think I'll ever forget the avalanche of kindness we felt and received across the country. I never felt that kind of help in my life and it's very overwhelming that goes through my soul. Throughout the course of our stay in Edmonton, I can't stop thanking every individual who was willing to help us. God bless their beautiful heart. And if you're one of those people who helped us, THANK YOU a million times over. (Comments from a respondent, Question 22)

All of the comments from question 22 and 23 can be found in Appendix H.

V – Discussion

The Fort McMurray evacuation survey research project started out as a comparative examination of evacuation experiences between college age students at Keyano College and the faculty and staff of the college. The premise was that younger adults receive information differently and have different experiences than older adults. Younger people, in many cases, do not own their home (Hou, 2010), they do not have partners (Statistics Canada, 2012), and do not have the same financial commitments that older adults have. Where 24 percent of Canadian young people live outside of traditional family groups (Statistics Canada, 2012) it would appear logical that they may have different considerations than older adults in terms of their risk perceptions and evacuation behaviours. Emergency managers need to be aware, if special considerations need to be managed to reach out and effectively communicate to the younger adult age group. This project set out to find and document the differences between 18 to 24 year olds and 25 and older adults during the Fort McMurray wildfire in May of 2016.

As the project unfolded, it became apparent that the opportunity was present to utilize the same analyses to compare differences between genders. As a result, the project includes these findings as well.

Hypotheses

The first hypothesis, as per the data, would appear to be upheld. People who observe the environmental cues are more inclined to believe they are at risk (Drabek, 2013; Lindell & Perry, 1993; Van Willigen et al., 2005). In the case of the participants of the survey, seeing the fire and smoke impacted their perceptions of their personal risk.

The second hypothesis aimed to prove that social cues enhanced risk perception. This concept has been discussed by researchers, attesting that indeed, seeing others prepare for evacuation, or conversely, not evacuating, affects risk perceptions (Auf der Heide, 1989; Huang et al., 2012). Baker (1991), however, had different findings, and suggested that seeing others evacuating does not necessarily influence someone else's evacuation decisions. In the case of the Fort McMurray study, the participants, on average, indicated that social cues were more than just a "considered this", but not, on average, "it was a huge consideration". On the scale of 1 to 5, the average was 3.93. The regression analysis (Table 6) indicated that social cues were not statistically significant as predictors of risk. The intercorrelation table (Table 8) indicated there was a direct, but weak correlation between social cues and perceived risk. There could be a variety of reasons why this result appeared to be inconclusive. Perhaps, where 82 percent of the respondents evacuated on May 3 and the majority indicated they left in the afternoon or early evening, the participants didn't have the time to truly consider what others were doing. As it was a mandatory evacuation order, maybe the social cues did not matter because everyone was leaving anyway. Baker (1991) suggested that, because public officials have instructed people to leave, this could be sufficient enough reason for them to leave, regardless of what the neighbours are doing. This could be an area for further research in relation to wildfires. Social cues may matter more in situations where there is a longer evacuation notice and time to leave.

The third hypothesis was specifically about the use of social media sources used by 18 to 24 year olds and the related impact on risk perceptions. It did turn out that 18 to 24 year olds relied more on social media for their information than other sources;

however, it was unclear the relationship between their social media use and their risk perceptions. For the most part, the findings were not statistically significant.

This hypothesis is related to the next hypothesis, that postulated that young people confirmed their disaster and risk information from sources other than official sources and this related positively to their risk perceptions. Local authorities were ranked fifth of the six options presented for sources of information. Therefore, to some extent, the fourth hypothesis is upheld, in that young people relied more on other sources than the official sources. As far as a comparator, this argument falls apart somewhat. Older adults also ranked official sources as fifth out of six options for information. The results between the two groups were very similar, with the greatest disparity between younger and older adults with the social media variable. Younger adults selected “greatly relied on” for social media 60 percent; whereas older adults greatly relied on social media 49 percent. In light of research conducted by the Pew Research Centre (2017a; 2017b; 2014) and others (Catalyst, 2015; Insights West, 2016), it perhaps goes without saying that the younger population utilizes social media more so than older people, so it shouldn’t be surprising that they use social media more than older adults to obtain disaster and evacuation information.

It was not possible to indicate that information sources are linked to risk perception. As a result, it was impossible to compare younger adults and older adults in terms of what sources influenced their risk perceptions because none of the sources were statistically significant predictors of risk for either age group. This could be a flaw in the survey design, in that if more specific questions were asked related to risk and the use of information sources, the results may have been examined differently.

Descriptive Statistics

The descriptive statistics were intended to glean additional information about risk perceptions and evacuation behaviours. The statistics were predominantly focused on comparing young adults (18 to 24 years) with older adults (25 and older) and with comparisons between the genders.

The first question focused on risk perceptions. Much of the data about risk perceptions had been previously analyzed while looking at the hypotheses; but the comparisons between the groups indicated little difference. The age groups, both young and old, perceived the fire itself to be the greatest threat. Males and females concurred. The females' opinion of "extremely likely" was, for the most part, more frequent than males across all categories, but not statistically significant. This finding appeared to be consistent with other research that suggested that females are a little less skeptical than males to heed a disaster warning and take adaptive action (Drabek, 2013).

The next question focused a little more in depth on information sources for disaster and evacuation information. As commented on earlier, 60 percent of the young adults selected "greatly relied on" for social media as their source of disaster related information. The surprise was the second most prevalent source of information for young adults – local news media (57 percent). Given the research indicating how connected the younger generation is, the indication that 18 to 24 year olds relied on their local radio stations and newspapers for information seems to be inconsistent. The older adults ranked local news media the highest, 62 percent, for their source of information. This finding was a little reminiscent of the San Bernardino County study by Taylor and colleagues who reported on the small local radio station being the only information

source with up to date and accurate information (Taylor et al., 2007). The findings were further interesting, when considering the Pew Research Centre (2015b) report that states, Millennials obtain 61 percent of their political news from Facebook and 37 percent from local TV.

The comparison between males and females was interesting as well. Sixty five percent of females ranked social media “greatly relied on”, as their source of information compared to 47 percent of males. When looking at social media platforms, more females (74 percent) used Facebook than males (63 percent). The differences in Facebook use, could account for the differences between males and females for social media use for disaster and evacuation information.

The findings from this question are not consistent with recent findings by Liu, Fraustino and Jin (2016). In a study they conducted in 2013, they found that people were more inclined to seek additional disaster information from television and speaking personally with people they know, rather than utilizing social media (Liu, Fraustino, & Jin, 2016). Their report had a much larger sample size ($n = 2,015$) of participants in the United States, but was not broken down by age group or by gender. Meanwhile, Veil, Buehner and Palenchar (2011), indicated that emergency managers must embrace and utilize social media, because it will be used regardless. Therefore, it may be beneficial to conduct a larger survey in Canada to specifically identify the social media trends in terms of disaster communication.

The date and time of day that people evacuated were looked at with the next descriptive statistical question. The findings indicated that most participants (82 percent) evacuated on May 3. There were almost no differences between the age groups; the

younger adults and the older adults primarily evacuated on May 3. The evacuation order, for the entire municipality, was issued on May 3rd by the Regional Municipality of Wood Buffalo (KPMG, 2017). It makes sense, that most people evacuated that day. More females evacuated on May 3 (86 percent) than males (75 percent). This could be another confirmation that females tend to heed evacuation warnings and more readily adopt protective action than males (Drabek, 2013; Gladwin & Peacock, 2000). After May 3, 14 percent of males evacuated, where only 4 percent of females evacuated, presumably, because most had already left the day before. The timeline of the notice no doubt had an influence on the hastiness with which people left. Had the fire been slow moving, perhaps there would have been greater variation in the timeline for people to leave.

As for the time of evacuation, it was apparent that the majority of people left between noon and 9:00 p.m. A slightly higher percentage of females (89 percent) evacuated during that time frame than males (85 percent), but it was still fairly consistent. There was no difference between the younger and older age groups as 88 percent of both groups evacuated between noon and 9:00 p.m. Again, this was consistent with the date and timeline of the evacuation. The first evacuation order was given in the evening on May 1 for one neighbourhood; it was reduced to “shelter in place” shortly afterwards the next day (KPMG, 2017). May 3 at 2:34 p.m. was when the next mandatory evacuation order went out (KPMG, 2017). By 6:49 p.m. an evacuation order was put out for the entire municipality (KPMG, 2017). It may have been interesting to have participants select a specific time of evacuation rather than a range of times. This would have provided a broader picture of evacuation behaviour when aligned with the actual evacuation order timeline.

The Canadian census indicates that 63.3 percent of males, aged 20 to 24 were living with their parents in 2011; 55.2 percent of young women were living with their parents in 2011 (Statistics Canada, 2012). The participants, aged 18 to 24 years, in the Fort McMurray Survey had more females (66 percent) living with their parents, than males (59 percent). When compared with who evacuated with their immediate family, it was not surprising then, that more younger females evacuated with their family members than younger males (see Figure 32).

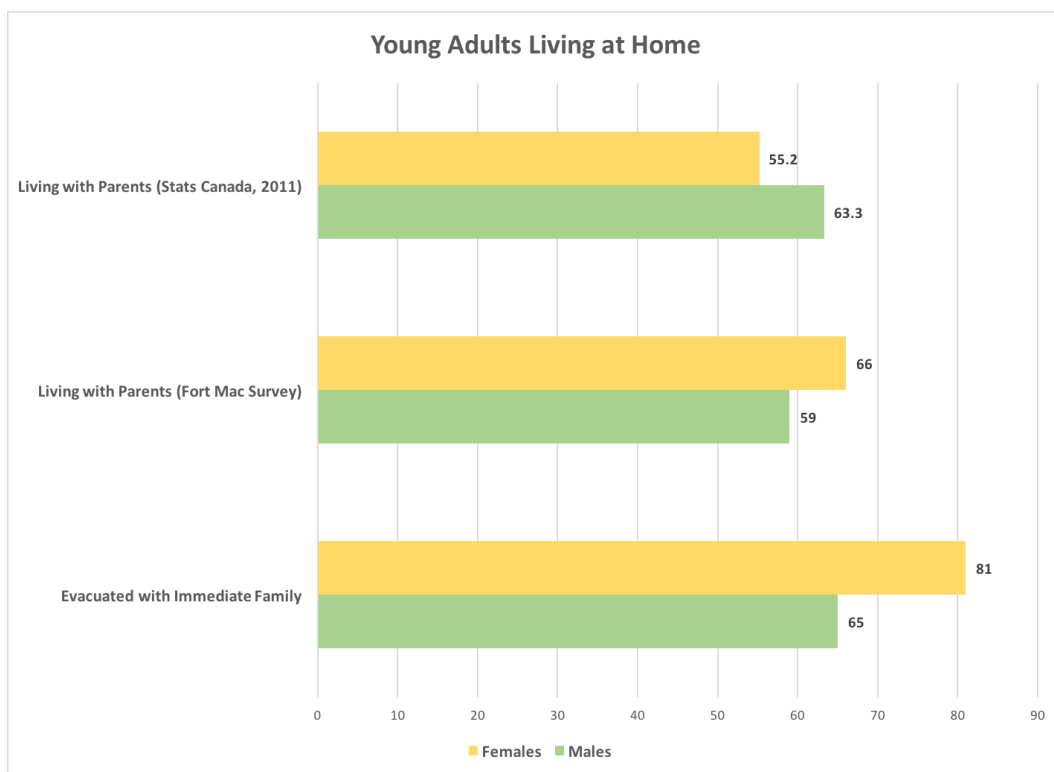


Figure 32. Young adults (18 to 24 years) living with parents, taken from the research survey results; compared with young adults (20 to 24 years) living with parents, taken from a Statistics Canada Report (2012, p. 3); compared with the results, from the survey, of 18 to 24 year olds who evacuated with their immediate family.

As noted in the results section, there were no statistically significant differences in who respondents evacuated with by age group. The younger adults and the older adults had similar results, although the younger adults more frequently evacuated with

immediate family (53 percent for the young adults versus 52 percent for the older adults), other relatives (12 percent for the young adults versus 7 percent for the older adults) and friends, neighbours, and roommates (22 percent for the young adults versus 20 percent for the older adults); whereas the older adults were slightly more likely to evacuate by themselves (12 percent for the older adults versus 6 percent for the younger adults). These findings could be attributed to the fact that a larger percentage of young people were still living with their parents, and thus more inclined to evacuate with them. A shortcoming of the survey, could be that the older adults (52 percent) who indicated that they evacuated with their immediate family, could be referring to a spouse and children; whereas, the younger adults (53 percent) may have been indicating they evacuated with their parents. If the survey question specified “with parents”, the results could have been analyzed more specifically.

The next question discussed mode of transportation utilized by the evacuees. There were no statistically significant differences; however, a little less (68 percent) of the younger age group took their own personal vehicle compared with the older age group (74 percent). This could potentially be attributed to the younger adults not owning their own vehicles; whereas, the older adults most likely have greater economic means and therefore own their own vehicles. That, however, is only a supposition that further research could flesh out.

The text field, “other” for this question in the survey, allowed participants to state an alternative choice to the choices indicated. A number of people wrote that they took their work vehicles. This was interesting. The Oil and Gas industry is the largest employer in the Fort McMurray region. It makes sense that numerous employees drive

vehicles owned by their employer and would take them as they evacuate. Many respondents, in the qualitative questions at the end of the survey made positive comments about oil and gas industry employers helping out in a significant way during the wildfire. It would be a worthwhile venture to understand the role of industry during the Fort McMurray wildfire.

Lastly one of the respondents indicated that he or she evacuated in their motorhome. This was also a great option and could have perhaps been captured in the survey question. A recreational vehicle would allow a person to pack much more than just what would fit in a personal vehicle. It also would provide the person with a place to live when they arrived at a safe location. This would have been a good statistic to examine.

Fort McMurray is a fairly isolated community in Northern Alberta. The closest community to Fort McMurray, of any notable size (20,000 people or more), that the respondents evacuated to, is Fort Saskatchewan, Alberta, with a population of 24,569 people (Government of Alberta, Municipal Services Branch, 2016). Only 2 respondents travelled the 409 km (254 miles) to Fort Saskatchewan. Edmonton, Alberta is just a little south west of Fort Saskatchewan, 434 km (270 miles) from Fort McMurray. Edmonton is where the majority, 141 (45 percent) of the evacuees travelled to. Of the respondents, 71 percent stayed within the province of Alberta. Much of the remainder travelled to other locations within Canada. Many of the respondents indicated they went east to the Maritimes - Nova Scotia, Newfoundland and New Brunswick. Fort McMurray's oil and gas industry attracts workers from across the country, many of them from the east coast. This could explain the respondents who headed that direction.

The differences between the age groups and between the genders for where people evacuated to are not largely different. Less females went to Edmonton (41 percent) compared to males (54 percent); however, more females selected “other” (33 percent) than males (15 percent). As noted earlier, the “other” variable was populated with a variety of answers and can be found detailed in Appendix F.

The last descriptive statistic question looked at was where people stayed. As the results describe, again, there are very few differences between gender and between age groups for this question. The majority of people (26 percent) stayed with relatives. The Van Willigen et al. (2005) university study indicated that 29 percent of evacuees stayed with parents and 31 percent with relatives. It would be interesting to have examined more closely where participants’ final destination was and where they stayed at that destination. Although 45 percent of people evacuated to Edmonton, can it be inferred that almost half of those people, or more, had relatives in Edmonton? Ideally, a better breakdown of “where” and “with whom” could be analyzed to further determine final destination. The question allowed for multiple responses, so although some indicated they stayed in a hotel or motel or at an evacuation shelter, there was no indication of how long they stayed there. It perhaps was only for a night or two. Further clarification in the survey design could have elicited more useful information.

Qualitative Questions

The qualitative questions (questions 22 and 23) provided an opportunity for participants to write a few comments about their experiences with the Fort McMurray wildfire. Their responses weren’t intended to be the subject of intense scrutiny, as they were open ended inquiries with no specific stated purpose other than an opportunity to

share some thoughts. These thoughts were interesting and in many regards telling. It is clear that people were truly appreciative and overwhelmed with the support they received from other Albertans and other Canadians. There were some negative comments about the lack of timely information and the mishandling of the evacuation by Fort McMurray officials. The survey wasn't designed to query what people thought about their evacuation experience or to rate their experience. This would have provided an opportunity for first hand feedback about the shortcomings of the evacuation which could be utilized for future learning. The KPMG (2017) report about the Fort McMurray wildfires identified evacuation as opportunity for improvement. The report suggests that although the municipal plan addressed evacuation, the plan did not address a mass evacuation (KPMG, 2017). Residents apparently received mixed messages concerning evacuation. In the morning of May 3, a press conference was held where residents were urged to "get on with lives...but be prepared to act on short notice... evacuation is a long way off" (KPMG, 2017, p. 68); however, later on in the day a mandatory evacuation order was issued (KPMG, 2017). It is perhaps some of these issues that people referred to in their comments for questions 22 and 23.

Limitations

This research study had a number of limitations. To start with, the survey intended to reach out to Keyano College's students and faculty. Initial research indicated that the college had approximately 3,000 full time students and 13,000 continuing education students (Alberta Chamber of Resources, n.d.). Given the large population of the college, the researcher presumed that respondents would be plentiful. An article in Fort McMurray's local news prior to the fire stated that the local economy, due to the

downturn in the oil and gas sector, was impacting the college and that enrollment was down (Barry, 2016, February 16). The Colleges and Institutes Canada web site puts enrollment at Keyano College at 781 full time students and 2,108 part time students (Colleges and Institutes Canada, 2017). Despite several inquiries, the college has not confirmed their enrollment numbers for 2017. Needless to say, the sample from the college, including staff and students was 299 participants. As indicated previously, several of these individual cases were removed, for a variety of reasons, leaving the usable sample at 246 participants. The small sample size is a limitation of the study.

Another, related limitation of the study is that the college itself is like a small community within Fort McMurray. It is possible that with the community atmosphere of the college, that the respondents do not behave as other people within the broader Fort McMurray community. This was commented on by Van Willigen et al. (2005) in their university study. They stated, “Our results suggest that students occupy a unique position within university communities which buffers them from the effects of natural hazards” (p. 180). The Van Willigen et al. (2005) study was done at a much larger institution with a larger sample size, so there would no doubt be differences compared with a small college, such as Keyano College. Regardless, the results of this research could not truly be related to the larger Fort McMurray population, rather, it is a sample of the college only.

Another limitation, as discussed earlier, is that the information source questions do not relate as well to the risk perception concepts. If the study was designed a little differently, and more specific questions were asked about the information sources, i.e. “To what extent did you believe the information you heard from the radio or local

media?” or “When utilizing social media for disaster information who were you obtaining your information from? Friends, Local Government Facebook/Twitter Account, Provincial Government Facebook/Twitter Account, News Media Facebook/Twitter Account, etc. As can be seen, despite the fact that social media was a prevalent source of disaster information the question was not detailed enough to learn whose social media account the information was being gleaned from.

A couple of other minor changes to the questions in the survey would have garnered more useful data for analysis. More specific times for when people evacuated as opposed to broad ranges; then the times could have been linked with more detail to the evacuation notices.

The question about evacuating with parents as well as evacuating with immediate family could have been clarified to eliminate some ambiguity with the analysis. Evacuating with your parents is different than evacuating with your family, i.e. spouse and children.

Some clean up with the questions about where people went and with whom would also have provided some additional useful information, particularly if final destination was included as another variable. Duration evacuated could also have been included in this section. For example, when someone states they stayed in their car, did they stay in their car for the entire time or did they end up somewhere else. How long did they stay at each venue?

The question about age, specifically for the “25 and older” variable should have been broken up further. The 25 and older age range includes Millennials, Generation X, and Baby Boomers. The research indicates that Millennials and Generation Z, the

younger group, have very similar traits in terms of technology use (Pew Research Center, 2014; Taylor & Keeter, 2010). Not knowing the age breakdown of the “25 and older” age group participants is a limitation of the study. Ideally, the categories should have been, 18 to 24 (Generation Z, with a slight overlap of the Millennials); 25 to 35 (Millennials / Generation Y); 37 to 52 (Generation X); and 53 and older (Baby Boomers).

In the demographic section, income would have been another variable worth including. Prior research has indicated that income is linked to risk perceptions and evacuation intentions (Gladwin & Peacock, 2000; Hasan et al., 2011); therefore, this variable could have been used to enhance the analysis.

Finally, some questions related to the specifics of their evacuation experience, for example, “Rate the way you feel the local government/provincial government handled the disaster”. Information, first hand from people who experienced the disaster, would surely help inform emergency officials to better plan and prepare for the next disaster.

As with any survey there needs to be a balance in the amount of questions and the value that each question brings to the study vis a vis the time the respondents have available and their desire to participate. In this study, soliciting students and staff in the hallways of Keyano College, required a survey that took less than ten minutes to complete. As a result, the quantity of questions was intentionally limited. A different delivery model, or perhaps two surveys, a long and a short, could have perhaps gained greater data.

Opportunities for Additional Research

This research study had some limitations, which if resolved, could provide opportunity for additional research. There are a few other areas for additional research that this study identified.

Social cues and duration of notice is one such opportunity. As noted, the evacuation of Fort McMurray occurred very quickly. One moment people were being told to, “be prepared to leave”, and the next moment they were being told to “leave” (KPMG, 2017). Social cues, in this situation, may not have played a role, simply because everyone was scrambling to evacuate. Research on timing and notice is common in hurricane studies (Gladwin & Peacock, 2000; Huang, 2014); however, Sorensen et al. (1987) identified a number of years ago that more research was required for fast moving events. Further research, specific to wildfires in Canada, could be done to determine if length of time of notice changes risk perception related to social cues.

Males and females appear to use social media differently. It would be interesting to conduct further research specific to social media use in Canada, during disasters. A detailed study on Twitter feeds during Hurricane Sandy was done by Murthy and Gross (2017); a study along the same lines would be informative. Taking it a step further, focusing on males and females, and the differences in their usage and messaging, if any, may provide insight about which social media platforms to use and the messages that should be disseminated in them.

Finally, the role of industry during the Fort McMurray wildfire was not covered in this study. The oil and gas sector is the largest employer in the region of Fort McMurray. Their relationship and partnership with the community is significant. Many of the

industry camps have their own fire departments and acted as first responders, fighting the blaze, alongside the provincial forest fire fighting teams, the Fort McMurray Fire Department, and the hundreds of other fire fighters who arrived. The industry camps housed evacuees and used their own private planes, vehicles and buses to assist their employees, their employees' families and others to evacuate. Many of the respondents, in their answers to questions 22 and 23 made reference to the great job that the industry did and how the outcome may have been different had it not been for them. As a result, this would be an interesting study. Do similar isolated communities have the same types of partnerships with industry? Do they share plans and resources for disasters?

Conclusion

The study was first envisioned as a look at evacuation decision making of the residents of Fort McMurray. This was pared down to a manageable, and accessible sample, at Keyano College. It becomes next to impossible to conduct data analysis on evacuation decision, when all of the participants evacuated. The mandatory evacuation order was not optional, and as a result, all of the respondents, with the exception of three, left. Of the three, one of them commented that she was out of town at the time of the fire; leaving only two respondents (less than 1 percent of the sample) that did not evacuate. In the end, studying evacuation decision, when there was no decision to be made, makes for a difficult study.

Shifting gears, the study sought to examine the risk perceptions as a precursor to evacuation decision making. Comparing younger adults with older adults is not common as evidenced in the literature review. Given the differences, socially, economically, and from a family perspective, between 18 to 24 year olds and 25 and older adults, it made

sense to examine differences with regards to their risk perceptions and evacuation behaviours.

As this study has revealed, there are not very many significant differences between the two age groups when looking at their risk perceptions and their evacuation behaviours. As an additional component of the study, these same variables were looked at between genders. The results, again, are generally the same. There are not very many differences between the genders.

The most important finding is that young adults, in this study, relied on social media more than other sources of evacuation and disaster information. Older adults ranked social media as the second most relied on source of information. Given all of the other available sources of information, it was with interest to note that young adults greatly relied on local media as the next most relied upon source of information. Older adults relied more on local media than social media.

The message to emergency managers is that these two mediums, social media and local media, are the most important information sources that both younger adults and older adults rely on for disaster and evacuation information.

Some of the other interesting findings were related to the evacuation behaviours. Again, there were not significant differences between the groups studied; however, recognizing the distances that people travelled to evacuate, the methods they took and the people they went with are all intriguing precursors to a good sociological study. As for the hypotheses, few were proven, but the academic exercise of running the analyses was a worthwhile venture, if anything, to prove that there are few differences between groups,

in a small contained college setting, when it comes to risk perceptions and evacuation behaviours.

#FortMacStrong

APPENDIX A – Census Information

Table A1

Population by Age and Gender in the Regional Municipality of Wood Buffalo in 2015

Age	Female	Male	Total
0 to 4	2,759	2,898	5,657
5 to 9	2,261	2,425	4,686
10 to 14	1,790	1,905	3,695
15 to 19	1,637	1,902	3,539
20 to 24	2,323	2,717	5,040
25 to 29	4,106	4,719	8,825
30 to 34	4,222	5,297	9,519
35 to 39	3,262	4,188	7,450
40 to 44	2,660	3,891	6,551
45 to 49	2,148	2,969	5,117
50 to 54	2,363	3,281	5,644
55 to 59	1,562	2,300	3,862
60 to 64	816	1,262	2,078
65 to 69	372	522	894
70 to 74	187	194	381
75 and over	173	141	314
Total	32,641	40,611	73,252

Note. All data is taken directly from the RMWB Census (RMWB, 2015, p. 17).

Table A2

Population by Age Groups and Gender in the Regional Municipality of Wood Buffalo in 2015

Age	Female	Male	Total	% of the Total Pop.
0 to 14	6,810	7,228	14,038	19.16%
15 to 19	1,637	1,902	3,539	4.83%
20 to 24	2,323	2,717	5,040	6.88%
25 to 29	4,106	4,719	8,825	12.05%
30 to 64	17,033	23,188	40,221	54.91%
65 and over	732	857	1,589	2.17%
Total	857	40,611	73,252	100%

Note. All data is taken directly from the RMWB Census (RMWB, 2015, p. 17) and grouped into the age groups shown.

Table A3

Canada Census Data Population of Wood Buffalo in 2011

Age	Male	Female	Total	% of the Total Pop.
0 to 4	2,705	2,555	5,260	7.86%
5 to 9	1,985	1,775	3,760	5.62%
10 to 14	1,845	1,690	3,535	5.28%
15 to 19	2,105	1,920	4,025	
15 years	385	375	760	1.14%
16 years	370	320	690	1.03%
17 years	385	375	760	1.14%
18 years	445	420	865	1.29%
19 years	510	430	940	1.41%
20 to 24 years	3,235	2,945	6,180	9.24%
25 to 29 years	4,365	3,750	8,115	12.13%
30 to 34 years	3,700	3,220	6,920	10.34%
35 to 39 years	3,290	2,450	5,740	8.58%
40 to 44 years	3,020	2,480	5,500	8.22%
45 to 49 years	3,130	2,530	5,660	8.46%
50 to 54 years	3,155	2,455	5,610	8.39%
55 to 59 years	2,225	1,405	3,630	5.43%
60 to 64 years	1,020	690	1,710	2.56%
65 to 69 years	380	285	665	0.99%
70 to 74 years	145	135	280	0.42%
75 to 79 years	70	110	180	0.27%
80 to 84 years	30	45	75	0.11%
85 years and over	15	40	55	0.08%
Total	36,415	30,480	66,896	99.99%

Table A4

Canada Census Data Population by Age Groups of Wood Buffalo 2011

Age	Male	Female	Total	% of the Total Pop.
0 to 17 years	7,675	7,090	14,765	22%
18 to 24 years	4,190	3,795	7,985	12%
25 to 29 years	4,365	3,750	8,115	12%
30 to 64 years	19,540	15,230	34,770	52%
65 and over	640	615	1,255	2%
Total	36,415	30,480	66,896	100%

Note. All data is taken directly from the Statistics Canada web site (Statistics Canada, 2011) and grouped into the age groups shown.

APPENDIX B - Fort McMurray Evacuation Study (The Survey)

The survey for this study starts on the next page. The survey was administered through an internet website, Survey Monkey. The website address was:

www.surveymonkey.com/r/FortMacEvac

Fort McMurray Evacuation Study

Study Information Sheet

We would like you to take part in a study conducted by researchers from Jacksonville State University, Department of Emergency Management. The lead researcher, Chris Kearns, works in emergency response in Lethbridge, Alberta. Chris helped out in the Emergency Operations Centre during the Fort McMurray wildfire in 2016.

Keyano College has kindly agreed to help us promote this important research project. Thanks!

Participating in this study is optional.

If you choose to be in the study, you will complete an online survey. The questions will be about your evacuation experiences during the Wildfires in 2016. This survey will help us learn more about how to communicate and facilitate an evacuation of young adults. The survey will take 7 to 10 minutes to complete.

You can skip questions that you do not want to answer or stop the survey at any time. The survey is anonymous, and no one will be able to link your answers back to you. Please do not include your name or other information that could be used to identify you in the survey responses.

At the end of the survey, you will be given the option to leave your name, telephone number, and email address solely for the purpose of participating in a raffle for a pair of Wireless Beats Headphones. This information will not be linked or associated with any of your survey answers. Once the raffle has been completed (June 1st) your personal information will be deleted. Odds of winning the prize are dependent on the number of participants who participate in the survey and those who wish to participate in the raffle. You may only enter the raffle once.

This research is for residents of Canada over the age of 18; if you are not a resident of Canada and/or under the age of 18, please do not complete this survey.

If you have any comments, concerns, or questions regarding the conduct of this research please contact the researchers listed below.

Lead Researcher
Chris Kearns, M.Sc.
Dept. of Emergency Management, Jacksonville State University
Cell: (403) 894-0574
Email: Jsu7059k@stu.jsu.edu

Faculty Advisor
Dr. Tanveer Islam
Dept. of Emergency Management, Jacksonville State University

Office: (256) 782-5938
Email: tislam@jsu.edu

If you have questions or concerns about your rights as a research participant, you can contact the Jacksonville State University IRB Board by email, addressed to Dr. Joe Walsh, Vice Provost, (256) 782-8186 or by email at ejwalsh@jsu.edu. Alternatively, you may contact Mr. Louis Dingley, Keyano College, at (780) 791-4832 or by email at Louis.Dingley@keyano.ca

What is an IRB? An Institutional Review Board (IRB) is a committee made up of scientists and non-scientists. The IRB's role is to protect the rights and welfare of human subjects involved in research. The IRB also assures that the research complies with applicable regulations, laws, and institutional policies.

If you want to participate in this study, click the "Next Page" button to start the survey.

Thank you!

Wildfires and evacuations are difficult events. If you feel you'd like to speak with a mental health professional about your experiences, please call Alberta Health Services' Health Link at 811 or visit <http://www.albertahealthservices.ca/assets/news/advisories/ne-pha-wildfire-mental-health-resources.pdf> for a list of local resources. Thanks.

Fort McMurray Evacuation Study

The Questions

1. Were you living in Fort McMurray or the surrounding area during the wildfire in May 2016?

☐ Yes

☐ No

Fort McMurray Evacuation Study

The Questions Continued...

2. Please rate how much you relied on the following information sources for information about the wildfire and/or evacuation during the wildfire? (where 1 is low/no reliance and 5 is high/great reliance)

	Did not rely on (1)	(2)	Somewhat relied on (3)	(4)	Greatly relied on (5)
Local authorities (Mayor, RCMP, Fire Dept., etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local news media (Newspapers, i.e. <i>Fort McMurray Today</i> ; Radio Stations, i.e. CRUZ FM, KAOS Radio, Rock 97.9, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
National television news media (CTV National News, CBC National News, the Weather Network, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet website sources (i.e. CTV or CBC websites, Alberta Emergency Management web site, RMWB web site, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media sources (i.e. Facebook, Instagram, Twitter, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peers such as friends, relatives, neighbours, coworkers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

3. What social media platforms did you use in May of 2016? Place in order from most used to least used:
(where 1 is the most used and 6 is the least used)

	<input type="text" value="Facebook"/>	<input type="checkbox"/> N/A
	<input type="text" value="Twitter"/>	<input type="checkbox"/> N/A
	<input type="text" value="Instagram"/>	<input type="checkbox"/> N/A
	<input type="text" value="LinkedIn"/>	<input type="checkbox"/> N/A
	<input type="text" value="Snapchat"/>	<input type="checkbox"/> N/A
	<input type="text" value="Other"/>	<input type="checkbox"/> N/A

4. To what extent did you think each of the following threats posed to the damage or destruction of your home: (where 1 is extremely unlikely and 5 is extremely likely)

	Extremely Unlikely (1)	(2)	Somewhat Likely (3)	(4)	Extremely Likely (5)
The wildfire itself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The potential toxic emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential landslides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (Extremely Likely)

5. To what extent did you think that each of the following threats could cause you (or your friends/family) personal harm or potentially kill you (or them): (where 1 is extremely unlikely and 5 is extremely likely)

	Extremely Unlikely (1)	(2)	Somewhat Likely (3)	(4)	Extremely Likely (5)
The wildfire itself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The potential toxic emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential landslides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (Extremely Likely)

6. To what extent did you think the following threats would impact your services (i.e. electricity, water supply, landline and cellular telephone, etc.): (where 1 is extremely unlikely and 5 is extremely likely)

	Extremely Unlikely (1)	(2)	Somewhat Likely (3)	(4)	Extremely Likely (5)
The wildfire itself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The potential toxic emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential landslides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (Extremely Likely)

7. To what extent did you think that each of the following threats would impact your ability to work and/or attend classes: (where 1 is extremely unlikely and 5 is extremely likely)

	Extremely Unlikely (1)	(2)	Somewhat Likely (3)	(4)	Extremely Likely (5)
The wildfire itself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The potential toxic emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The after effect of potential landslides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (Extremely Likely)

8. To what extent did you consider the following issues in deciding whether or not to evacuate? (where 1 is not at all and 5 is greatly considered)

	Not at all considered (1)	(2)	Considered this (3)	(4)	It was a huge consideration (5)
Seeing the wildfire approaching	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing or smelling smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling a change in the wind intensity or direction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing combustibles nearby (i.e. gas, propane, brush, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing local businesses closing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing friends, relatives, neighbours and coworkers evacuating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hearing local authorities issue official evacuation orders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Previous personal experience with wildfires	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concern about protecting your home from the fire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Not at all considered (1)	(2)	Considered this (3)	(4)	It was a huge consideration (5)
Concern about evacuation expenses such as gas, food, and lodging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concern about where to stay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concern about other special considerations (pets, medical needs, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concern about getting stranded on the highway	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Possibility of rain (slowing down the fire/putting it out)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other significant consideration?					
<input type="text"/>					

9. Did you evacuate?

☐ Yes

☐ No

Fort McMurray Evacuation Study

The Questions Continued...

The wildfire started on Sunday, May 1st, 2016. The first evacuation order, for one neighbourhood, was given at 10:00 p.m. By Tuesday, May 3rd, the wildfire had grown and a mandatory evacuation order was given for the entire region.

10. When did you leave your home?

- ☐ Before May 1st
- ☐ May 1st
- ☐ May 2nd
- ☐ May 3rd
- ☐ May 4th
- ☐ May 5th
- ☐ After May 5th
- ☐ I did not leave

11. What time of day did you leave?

- ☐ Middle of the night (midnight to 3:00 a.m.)
- ☐ Pretty early in the morning (3:00 to 6:00 a.m.)
- ☐ First thing in the morning (6:00 to 9:00 a.m.)
- ☐ Late morning (9:00 a.m. to noon)
- ☐ Early afternoon (noon to 3:00 p.m.)
- ☐ Late afternoon / Early evening (3:00 p.m. to 6:00 p.m.)
- ☐ Evening (6:00 to 9:00 p.m.)
- ☐ Late evening / Night (9:00 p.m. to midnight)

12. Who did you evacuate with (select multiple answers if necessary)?

- ☐ Immediate family
- ☐ Other relatives
- ☐ Friends / neighbours / room mates
- ☐ By yourself
- ☐ Other (please specify)

13. What mode of transportation did you take to evacuate?

- ☐ Your personal vehicle
- ☐ Someone else's personal vehicle
- ☐ Municipal transit bus
- ☐ Greyhound (or similar commercial) bus
- ☐ Train (just kidding...there are no trains)
- ☐ Plane
- ☐ Other (please specify)

14. Where did you stay once you evacuated? (select all that are applicable)

- ☐ With friends
- ☐ With relatives
- ☐ In a hotel or a motel
- ☐ At an evacuation shelter
- ☐ Other (please specify)

15. Where did you evacuate to?

- ☐ Stayed within the Fort McMurray area
- ☐ North to an Industry Camp
- ☐ Edmonton
- ☐ Red Deer
- ☐ Calgary
- ☐ Other (please specify)

Just a few demographic / wrap up questions and we'll be all finished!

16. What is your gender?

- ☐ Male
- ☐ Female

17. What was your age on May 1st, 2016

- ☐ 17 or younger
- ☐ 18
- ☐ 19
- ☐ 20
- ☐ 21
- ☐ 22
- ☐ 23
- ☐ 24
- ☐ 25 or older

18. What was your occupational / student status at the time of the wildfire? (select as many as apply)

- ☐ Working full time
- ☐ Working part time
- ☐ Full time student
- ☐ Part time student
- ☐ Unemployed

19. What was your marital status at the time of the wildfire?

- ☐ Single
- ☐ Married
- ☐ Common Law
- ☐ Separated / Divorced
- ☐ Other (please specify)

20. During the time of the wildfire what were your living arrangements?

- ☐ Living with spouse / common law partner
- ☐ Living with parents
- ☐ Living with relatives
- ☐ Living with friends / room mates
- ☐ Living by yourself
- ☐ Other (please specify)

21. In May of 2016 what type of dwelling did you live in?

- ☐ A house / townhouse
- ☐ An apartment / condo building
- ☐ An apartment / suite in a house
- ☐ College residence
- ☐ Other (please specify)

22. In a couple of key words (or less) state one positive outcome you learned / gained from your wildfire experience.

23. If you have any other comments that you would like to share, concerning your evacuation or wildfire experience in May of 2016, please do so here:

Fort McMurray Evacuation Study

The Prize Raffle

Thank you for your participation!

If you would like to be entered in the raffle for a pair of Wireless Beats Headphones, please enter your name and contact information below (this information will be kept separate from the survey results and will not be used in any way other than for the raffle). If you win the prize, you will be contacted via text message or by email (you can provide your address information at that time, so that your prize can be delivered to you). The draw date is June 1st.

24. Contact Information (for the prize raffle only)

Name	<input type="text"/>
Email Address	<input type="text"/>
Cell Phone Number (for texting only)	<input type="text"/>

Thanks again for your participation!!

Wildfires and evacuations are difficult events. If you feel you'd like to speak with a mental health professional about your experiences, please call Alberta Health Services' Health Link at 811 or visit <http://www.albertahealthservices.ca/assets/news/advisories/ne-pha-wildfire-mental-health-resources.pdf> for a list of local resources. Thanks.

APPENDIX C - Email to Staff and Students at Keyano College

The email from the Marketing and Media Liaison, of Keyano College, Carmen Toth, To the Staff and Students at Keyano College (as emailed to Chris Kearns, April 18, 2017), is on the next page.

research

Carmen Toth [Carmen.Toth@keyano.ca]

Sent: Tuesday, April 18, 2017 2:16 PM

To: Chris Kearns

Chris

We send out the following message to all students today via email. Hope this gets you your extra 50 surveys. Good luck.

Students – Take a short survey to win Headphones

Were you involved in the evacuation for the wildfires? Then, we need your experience.

A study is being conducted to see the effect this evacuation had on young adults. It is strictly for academic purposes and has been approved by the Keyano Ethics Committee.

If you can spare a few minutes visit

<https://www.surveymonkey.com/r/FortMacEvac>

Everyone entering will be entered into a draw for a pair of Wireless Beats Headphones.

Thank you in advance for your time.

Carmen Toth
Interim Marketing & Communications Director
213 Bob Lamb Building
Keyano College
8115 Franklin Ave
Fort McMurray, AB T9H 2H7

Direct: 780-588-4777

Email: Carmen.Toth@keyano.ca



APPENDIX D - Jacksonville State University IRB Approval

The Jacksonville State University Institutional Review Board Approval (Dated March 15, 2017) is on the following page.



OFFICE OF THE VICE PROVOST
JACKSONVILLE STATE UNIVERSITY

March 15, 2017

Dear Chris Kearns:

Your proposal submitted for review by the Human Participants Review Protocol for the project titled: "Fort McMurray Evacuation Study", has been reviewed and approved as exempt. If the project is still in process one year from now, you are asked to provide the IRB with a renewal application and a report on the progress of the research project.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Joe Walsh', is written over a horizontal line.

Joe Walsh
Executive Secretary, IRB

JW/jh

201 Bibb Graves Hall
700 Pelham Road North
Jacksonville, AL 36265-1602
P. 256.782.5284
P. 800.231.5291
F. 256.782.5541
ejwalsh@jsu.edu
www.jsu.edu

An Equal Opportunity | Affirmative Action Employer

APPENDIX E - Keyano College Research Ethics Board Approval

The Keyano College Research Ethics Board Approval (Dated March 31, 2017) is on the following page.



8115 Franklin Avenue
Fort McMurray, AB T9H 2H7
Phone: (780) 791-4850
Fax: (780) 791-4841

Research Ethics Board

March 31, 2017

Christopher Kearns
PSCC Manager
City of Lethbridge
(403) 330-5196
chris.kearns@lethbridge.ca

Dear Chris,

The Research Ethics Board has reviewed your application for your project "Fort McMurray Evacuation Study." Your application to conduct research at Keyano College has been approved given the method of contacting and recruiting participants is by way of setting up an information booth at a strategic location in the College as discussed. As mentioned, we will pass on the word as well for you.

Please notify the committee of any methodological changes that occur throughout your project and provide us with a brief final report upon project completion.

If you have any questions or require research support, please contact me at louis.dingley@keyano.ca, or 780-791-4832.

All the best,

Louis Dingley
Chair, Research Ethics Board

APPENDIX F – Locations Where Participants Evacuated

Table F1

Communities and Locations Where the Participants Evacuated

Alberta	Participants	Miles	Other Provinces & Territories	Participants	Miles
Anzac	2	30	New Brunswick	2	2,880
Athabaska	8	188	British Columbia	3	509
Bonnyville	3	259	Vancouver	3	985
Boyle	6	178	Victoria	3	1,041
Calgary	20	459	Ontario	1	1,232
Camrose	1	296	Toronto	2	2,357
Canmore	1	516	Nova Scotia	4	3,066
Cold Lake	6	270	Newfoundland	4	3,739
Conklin	1	96	Yellowknife	1	1,013
Daysland	1	306			
Drayton Valley	2	355	Other Countries	Participants	
Edmonton	141	270	India	1	
Fort McKay	5	36			
Ft. Saskatchewan	2	254			
Grasslands	1	158			
Jasper	1	492			
Kikino	1	205			
Lac La Biche	8	180			
Leduc	1	295			
Lloydminster	3	355			
Morinville	2	259			
Olds	1	405			
Pincher Creek	1	589			
Red Deer	3	369			
Rocky Mountain House	1	407			
Sherwood Park	2	271			
St. Albert	1	271			

APPENDIX G – Demographic Details of the Participants

Table G1
Demographic Details of the Participants

Q. 16		All Participants		18 to 24 Years		25 and Older				
Gender								Males	Females	
Male	81	33%	34	29%	47	37%	34	42%	85	52%
Female	165	67%	85	71%	80	63%	47	58%	80	48%
Total	246	100%	119	100%	127	100%	81	100%	165	100%

Q. 17		All Participants		18 to 24 Years		25 and Older				
Age								Males	Females	
18 to 24 Years	119	48%	119	100%	0	0%	34	42%	85	52%
25 and Older	127	52%	0	0%	127	100%	47	58%	80	48%
Total	246	100%	119	100%	127	100%	81	100%	165	100%

Q. 18 (Multiple Response Set)		All Participants		18 to 24 Years		25 and Older				
Occupational / Student Status								Males	Females	
Working Full Time	112	37%	32	20%	80	57%	46	50%	66	32%
Working Part Time	52	17%	37	23%	15	11%	12	13%	40	19%
Full Time Student	88	29%	63	39%	25	18%	21	23%	67	32%
Part Time Student	24	8%	15	9%	9	6%	8	9%	16	8%
Unemployed	25	8%	13	8%	12	9%	5	5%	20	10%
Total	301	100%	160	100%	141	100%	92	100%	209	100%

Q. 19		All Participants		18 to 24 Years		25 and Older				
Marital Status								Males	Females	
Single	136	55%	96	81%	40	31%	43	53%	93	56%
Married	69	28%	5	4%	64	50%	25	31%	44	27%
Common Law	32	13%	14	12%	18	14%	10	12%	22	13%
Separated/Divorced	5	2%	1	1%	4	3%	1	1%	4	2%
Other	4	2%	3	3%	1	1%	2	2%	2	1%
Total	246	100%	119	100%	127	100%	81	100%	165	100%

Q. 20		All Participants		18 to 24 Years		25 and Older				
Living Arrangements								Males	Females	
Living with spouse / common law partner	82	33%	15	13%	67	53%	26	32%	56	34%
Living with parents	86	35%	76	64%	10	8%	24	30%	62	38%
Living with relatives	20	8%	8	7%	12	9%	8	10%	12	7%
Living with friends / room mates	26	11%	8	7%	18	14%	13	16%	13	8%
Living by yourself	20	8%	4	3%	16	13%	8	10%	12	7%
Other	12	5%	8	7%	4	3%	2	2%	10	6%
Total	246	100%	119	100%	127	100%	81	100%	165	100%

Q. 21		All Participants		18 to 24 Years		25 and Older				
Type of Dwelling								Males	Females	
A house / townhouse	171	70%	86	72%	85	67%	56	69%	115	70%
An apartment / condo building	50	20%	18	15%	32	25%	20	25%	30	18%
An Apartment / suite in a house	10	4%	7	6%	3	2%	1	1%	9	5%
College residence	6	2%	3	3%	3	2%	4	5%	2	1%
Other	9	4%	5	4%	4	3%	0	0%	9	5%
Total	246	100%	119	100%	127	100%	81	100%	165	100%

APPENDIX H – Comments from Question 22 and Question 23

The responses for both of these questions are unedited and appear as the respondents entered them in their survey.

Question 22

In a couple of key words (or less) state one positive outcome you learned / gained from your wildfire experience.

Responses:

- SAFETY PRECAUTION
- That we have a lot of people in our lives that are there for us even though we don't always stay in contact.
- adversity brings people together.
- Always keep your gas tank half full
- Avoid watching mainstream media
- We need one another.
- Our community banded together to try and repair it and now we are back to business as usual
- Keep the gas tank full. keep a portable, tidy, up-to-date file cabinet. Have emergency kit prepared. Back up all photos to a usb stick. Have emergency funds.
- I grew up a lot being forced out of my home.
- Learned that even in bad situations im able to keep calm and make sure that my child is safe.
- Resilience and an ability to quickly respond to changing conditions. And how to fit a bunch of animals in a tiny car!
- Unity
- Never lose hope.
- met friendly people helped me
- keep important files secured and ready to grab in case of emergency
- Always be Prepared
- Be aware/be prepared/be knowledgeable/stay calm.
- To always be prepared
- My pets didn't die because of community assistance. Sense of community grew for many.
- Strength to deal with emegency situation, human around us caring generous and have hearts of Golds.
- When there's a fire near the city keep your fuel tank full.
- Stronger understanding of the generosity people exhibit towards others in difficult situations.
- I decided to finally go to college.
- Don't rely on authorities. Social media is more up to date and ontop of situations.
- How to evacuate in case of emergency

- The fact that stuff is stuff and If I didn't think to pack something in my car when we thought we would lose our home then it must not have been that important.
- I learnt to never take things for granted
- I will never underestimate nature and always make sure to have my medical supplies that are detrimental to my health and lungs considering I have asthma. Especially a half mask with cartridges. The smoke affected me greatly for weeks during and after the fire.
- My family and the city of Fort McMurray formed a tighter bond.
- Stay calm, anxiety
- Always keep your vehicle fuelled up.
- I learned just how kind and helpful complete strangers can be.
- To be grateful
- When it comes down to it the community will help each other out and be there for each other.
- People's sympathy
- I SURVIVED!!!
- Help from government and redcross
- New connections and friends
- Quick response by the local government saved many lives.
- Importance of staying calm while packing.
- Be thankful for everything you have, including your family
- Emergency preparedness
- Edmonton people are super nice!!!
- PTSD
- No matter how hard it is, God will provide a way to overcome it.
- I learn that material things doesn't really matter. It showed me how people can outpour love even if they did not know us. The love we got from the edmonton communiy was overwhelming and right across canada.
- That things can change from maybe bad to life threatening in just a moments notice. Be aware of actions on the environment.
- My safety is my first preference.
- What matters in life
- To always listen to radio station because I was home watching CTV yet I did not know what was happening in my city until I went out to pick my kids from school.
- very supportive community
- Resilience of so many that lost so much
- Seeing the province and country come together to help those who were evacuated.
- people helped
- Always have 2 jerry cans of gas in the garage and, a emergency checklist or backpack with supplies.
- People are very helpful
- none..
- The confidence to remain calm, and make sound decisions

- nothing.
- To be more prepared and to always help one another out through issues that arise in our community
- money, food, time away from school, no diplomas
- Importance of family
- People help others
- Be prepared and have an evacuation plan in place
- Kindness of Humanity still exists.
- Always have gas in the car Not to be afraid to ask for help
- Material items really don't mean anything when it comes down to it. It still amazes me how friendly and open people were.
- The kindness of strangers and support of the Government.
- Everyone came together in unity
- I know I can live even if I lost everything material.
- What a home is, compared to a house. How special and sacred 'piece of mind' is.
- I learned how people come together in the time of need.
- Keep all important documents in one place
- Be prepared for food, gas, and other essentials if you smell smoky
- be aware of the news
- To always be prepared with important and personal belongings
- Can rely on others to help each other in times of need more than you think.
- Seeing the whole community come together and helping each other out.
- Family is what matters most
- How to evacuate
- Fort Mac strong:)
- generous people are a lot, they are very nice
- Family is everything.
- It brought the community closer together.
- Always have a more than three quarters of a tank in your vehicle
- Chance to spend more time at my summer home.
- Pride of my home town.
- Importance of preparation (supplies/important items)
- Be Independent
- Organized chaos
- I have learned to always be prepared and to take what is most valuable and important with you. (ex. i.d. important paper, food, clothing, blankets, etc.)
- Very nice to see people acting calmly and helping each other - minimal casualties for such a huge disaster!
- The appropriate measures taken to follow an evacuation, and to be more prepared if it ever happened again.
- Anti-depressants help control the crying.
- We survived & Albertans help hold us up.
- Stay with family. They won't leave you and will protect you. Always have your emergency sets prepared and ready for any weather.

- The people were very helpful
- Canadians are the most helpful people on earth! They helped us a lot such as gas, water, food at the highway. And that we will always have each others back.
- people were nothing but kind and generous and more than willing to help. I believe now that people do come together when everyone needs it most. I learned that we are Fort Mac strong, Alberta strong.
- my fiancé and I went ahead with our wedding and made some amazing friends who took great care of us
- When push comes to shove, I can do what needs to be done to stay safe.
- My family members were all safe and that was all that mattered.
- Dont leave it too late
- I learnt to never underestimate these life tragedies that may occur at any time especially when least expected.
- I did not really PANIC. Tried to remain CALM so others around me did not stress.
- Humbling
- Sometimes you have to take matters in your own hands. We evacuated before the warning for Beacinhill and by that time, it was already on fire.
- friends and family is the most important thing there is and it is what it is motto
- Leave as soon as you hear the announcement
- I'm resilient and resourceful.
- i have learned that the most important things in life are not your house/car but whether your loved ones are safe.
- Think fast
- Better sense of community
- I learned that I don't need as much stuff as I have. The kindness of others was overwhelming and felt amazing.
- I learned that love amazing
- I was was so relieved, that I remembered taking my two pets with.
- The zoo was free and so was West Edmonton mall attractions. The children of our community benefited greatly from these experiences as it took their minds off of their fears.
- Always have your gas tank full
- -we can never predict what's gonna happen tomorrow -do to others what you want others to do to you (help people)
- ALWAYS BE PREPARED!
- Family banded together.
- things mean nothing, family is all that matter. things can be replaced, family cannot.
- The generosity and understanding from my fellow Canadians was unimaginable.
- some people are good.
- Confidence to handle life threatening situations
- Be prepared and don't let your gas tank go below half.
- That our house didn't burn to the ground. To properly prepared yourself for an emergency.

- That there is so much kindness in our community and in Canada. people care truly for one another
- Never to take things for granted and never to ignore warnings from authorities
- To really focus on the little things in life and not take anything for granted
- Keep your gas tank full during wildfire season!
- Things and houses are replaceable, memories and family members are not. Learn what truly matters.
- Help
- That the government gives out money to protect us.
- ALWAYS BE PREPARED FOR AN EMERGENCY!!!!!! IF YOUR GUT FEELING SAYS TO GO - DO IT - EVEN IF YOU LEAVE FROM WORK WITHOUT PERMISSION...
- Canadians are very very supportive of each other. Edmonton was a very great and supportive community
- I learned that positive thinking really helps get through any stressful situation. It reduces stress and instilled hope in me.
- Strength in positive thinking
- To make the best out of the situation
- Strength with family and friends
- grateful
- Personal strength
- Have personal emergency plans made and ready to put in action
- Things are just things. Not that it wasn't heart wrenching to watch people lose everything, but once my family was safe, the rest didn't seem as important.
- Na
- Resilience. Possessions don't matter.
- I learned how compassionate people can be.
- People are ready to help
- The generosity of people was amazing, was blown away by all the help and support that was offered by total strangers
- Strength and solidarity in the community.
- Good community
- Connected with family
- Don't sleep thru it
- Leave earlier. Don't wait for the FD.
- our friends & community pulled together to help each other in a time of crisis!!!
- I'm still here
- Have your valuable stored in a place where you can get them quickly.
- I really don't know
- A stronger sense of community within fort mcmurray
- Better sense of community; knowing neighbours; opportunity to live in a large City(Edmonton) and a pedestrian lifestyle
- It gave me a push to continue my education as I lost my job
- Pack an emergency bag

- Never give up
- Put your documents in a safe place
- resilience
- Community support and the feeling of support from the rest of the country
- Be prepared for any emergency. Keep gas fuel full.
- Awareness of emergency preparedness
- You never take anything for granted and never ever think that this could never happen to our home town. I couldn't believe the generosity that we were shown in stores and businesses. So giving. I so appreciate everything that was done for us.
- Paying attention to surrounding areas when traveling
- Patience
- Be prepared
- Material possessions don't matter. People do.
- always be prepared
- Connection with people * Quick responses * Kindness of people
- resilience of our town is exceptional
- compassion amid the adversities
- Sense of community
- Got to visits home town
- How welcoming and kind Canada has been.
- Hard to find one, the quick international response was comforting
- I learned that the community can come together and help each other
- Trust in strangers
- Safety and preparedness is key
- Community, unity, recognize all our blessings, our stuff was just physical and could be replaced, others have it mu h worse, made us stronger
- To be more aware
- Time to travel. Free time to reflect.
- It brought my family closer together.
- Always be prepared
- Being calm can save your life.
- To never take anything for granted.
- I learned that possessions and things don't matter, and that family and friends are all you need.
- do not procrastinate
- How friends and family can help me through any situation.
- Learned what really matters in life.
- Canadianism
- No matter much expensive items you have, when it's gone all of us are equal. You can't take all those things with you to the grave. You were born with nothing, you'll die with nothing. I have friends who lost everything, what matters is they're safe. Yes it's hard to accept that your hard earned money into buying stuff is gone but those things are irreplaceable, your life isn't. I know it's easy for me to say

because our house didn't burn down but I know the feeling of not having those things back home(third world country). I gained the wisdom of appreciating the simple things like spending time with family and friends.

- Staying with friends and family is okay in short periods
- crisis bonds a community.
- it made me realize how strong I am, going through such a time in my life. Also , it made me realize how nice Canadians are in caring for people who went through a terrific experience like the wildfire.
- Gratitude
- Resilency
- Preparedness
- Vacation
- Strength of numbers
- I learned resilience that I could be strong and cope in any situation cause I survived the fire ,the evacuation and even getting settled in a new environment.
- Run from danger.
- Be prepared to leave in a moments notice with important things stored in one place
- Not to panic and always keep suitcase ready with gas full
- People are compationate
- How important family and friends are ; and the collaboration of all communities and surrounding areas.
- Prepare
- Be ready. Life is more important than anything you own.
- life happens
- Always plan ahead
- Kindness from strangers
- People are kind and that help will be given to those who need it.
- Coming together as a community afterwards and supporting each other
- We all supported one another
- Everyone sticks together
- Always be prepaired
- Be prepared
- Being a part of the evacuation and then return to Fort McMurray really made me feel proud to be a part of this community. It really put into perspective the important things in life. When you are in a situation where you realize you might not make it, and every decision you make could mean life or death for your children, things that used to be important are not anymore.
- Leave immediately. Only bring what's really important.
- How to deal with stress
- I get a new home

Question 23

If you have any other comments that you would like to share, concerning your evacuation or wildfire experience in May of 2016, please do so here:

Responses:

- GAS STATION PROXIMITY
- I feel like there should be someone in charge to keep everyone updated. Perhaps the radio station and announce what is going on in every part of the city if possible. But then again, the smoke really interrupts with the signal
- Glad mostly everyone was able to work together, maintain order and get out safe, except for the one crash that was had that killed around 4 people, may they rest in peace.
- I was very lucky with my gas and living arrangements. Although I did have to miss my final semester of my senior year and my grad was pushed until September.
- the fire department did an amazing job with dealing with the situation at hand
- Karma has a way of rewarding the kind people of the world. My dad let people stay in his motorhome in Anzac overnight (because they had nowhere to go/stay/sleep). The couple left in the morning, but when they heard that we had to evacuate as well, they called us right away to tell us we could stay with them. We didn't need it (as we have family in Morinville) but it was refreshing to see such kindness from complete strangers!
- was worry a lot,
- late notice to evacuate
- More prevention work. More education.
- I was scared and worried but on the same day when I met kind people, I realized I am in good hands and above all my trust on my creator become stronger.
- It sucked knowing you were about to lose your home because we could see the fire through the trees when we left Abasand.
- It was the most frightening experience of my life and my spouse and I lost little and did not experience the nightmare of heading South through the wildfire but I will never have any doubt that this was an escape not an evacuation.
- If we didn't flee due to concerns and allowed authorities to dictate us, many would not have made it. The authorities and government dropped the ball on this one and are lucky that it didn't cost lives.
- Authorities were very effective in safely evacuating 88000 people. It was incredible
- Life changing and terrifying experience.
- IT DAMAGED MY SELF AS IM SO WORRIED NOW EVERYTIME I SEE FIRE .
- N/A
- We should have multiple exit to the north and to the south as well.
- I hope no one else ever has to go through this.

- It was a heartbreaking experience. I never faced this kind of wildfire in my entire life. It was a life threatening situation. I suggest that safety control measures should be taken ahead of time as a preventive measure in order to protect entire life of the people in FortMcMurray.
- Ended up dropping out of school due to fire.
- I am still in Fort mcmurray because of love shown by individuals and corporate bodies through red cross and Alberta government; it really helped me to get out of the trauma caused by the wildfire.
- na
- Humanity can be amazing in a time of need
- Wildfird could have been stopped if the provncial government acted swiftly
- It was a traumatic experience that brought a lot of mental illnesses to the community of Fort McMurray. Till this day, I still have PTSD and anxiety whenever I here the sirens go off on the firetruck. I feel that my attention is drawn into the sound, and I start to feel anxious on wondering what's happening. Im glad no one got hurt in Fort McMurray after they evacuated, however, this fire was a learning experience to always have gas in your warehouse, an emergency kit, and to become aware of hot temperatures that surround Fort McMurray. We all came together as one, and that made us #fortmacstrong.
- it was horrible
- evacuated from beacon hill and police did not have time to get through before the fire got to my house. my neighbor kicked in our back door and saved my little sister as the house behind mine was already burning.
- The evacuation order was issued way too late, but everyone was very helpful and it turned out to be a pretty smooth process
- There was no notice the morning of that the fire was a threat. We should have been notified that we should prepare in case of. Instead I left with nothing.
- Help out people in need. Look to Twitter for information on available help.
- I don't think anyone took it seriously at first, or even after. It is still incredibly hard to believe that this happened.
- Was out of town during the fire, but was heading back home from Vancouver the day it happened (may 3rd). got turned around by police in grassland. was very concerned for the safety of my family who was in town at the time as well as concerned about my home that I have lived in in Fort McMurray for 21 years, since I was born.
- I'm proud of the unity that the community displayed during the chaos. I'm also grateful to the cities, such as Edmonton and Lac La Biche, for being warm and inviting to us.
- I hope it will not happen again because I am still financially effected .
- traffic, hard to get out
- Worst day.. EVER.
- I hope that no individual, or being would ever have to experience what I, amongst a whole city went through that day. #AllLivesMatter
- the notice was late. It was late afternoon when fire is very big before they decide to evacuate

- My concern is that the fire department of Fort McMurray is taking all the credit. However there were other heroes that day.
- None
- Don't understand why the evac wasn't the day before. People in leadership knew how bad it was but for people who are uninformed and wild fires are not common to them didn't know what to do or know how bad it was. Evac should have been voluntarily the days before. People should have been told this could be very serious days before and should leave if possible. Know I would have.
- Thankful for the tremendous support from the Oil Sands companies!
- The credit for the evacuation should go to the oil companies. If it had not been for the massive amount of safety Training lives would have been lost. there were not enough first responders until a state of emergency was called and that was Wednesday. Why was the site equipment refused on Sunday. Push that fuel into the valleys and nothing is lost. Why did the Premier refuse to call a state of emergency when it was first requested on Sunday.
- The college did nothing for students or staff. Kicked out of the school when it closed, no information on what to do, where to go. What about students who do not own a vehicle? For staff, it took quite awhile for the decision to shut down the college. They think of the bottom line not the well-being of the staff. Because of their (the college) indecision we ended up trapped North and then didn't think about family or personal (emotional & psychological) needs during the evacuation and re-entry. Keyano management entered housing units and threw away personal bar fridges (that didn't need to be tossed as they only had drinks in them) and did not reimburse or replace them. Housing units were never cleaned inside for smoke damage and still smell like smoke.
- The city's evacuation routes were not followed. On Hospital St. The police blocked the road south where the large "E" for evacuation is directing drivers to go.
- up north some of us went without food or water. Were kicked out at 4:30 am when owners of private camps closed them, leaving us with no where to go. Shell gave us gas & water. Thankful for the first responders that finally got us out in the convoys. Anxiety & panic attacks since the fire makes life almost unbearable. Our community has increased domestic violence, families torn apart, drug abuse, and mental illness issues. as May 3 approaches many like ourselves don't want to be here.
- Learnt who you're friends are and who care for u. Uofa sucks! They're not welcoming and seemed to be pushing us away.
- Always pack some emergency supplies
- Always have a full tank of gas, emergency supplies in your car, extra clothing, gas, food in your car. Be calm during the whole thing and always be kind to one another
- I headed up north first but the line was ridiculous until they allowed us to head south. During that process we had stopped at Petro to gas up where the line was super long. When I got up to my turn it was another 30 mins trying to find a person who would allow me to use their Petro card... some people cared more about getting fired than they did helping out all the others as it was a company

card . That had made many people including myself time more wasted and the situation more stressful . Once we had gotten gas and went north, everything was much more smooth

- I believe everything that took place was the best way possible to handle such a situation. There were very few fatalities which was the most impressive aspect about the evacuation.
- All sites were great assisting evacuation because not everybody went straight to the South. Many people went North and were accommodated by companies. I left camp at 4:30am on May 4th to drive south. There was not much fire, but lots of smoke at that time. There was no extreme traffic until several hours south of town.
- Thanks to the RCMP firefighters and to all local enforcement
- I just think they weren't on top of it. Darby Said WHEN the fire hits town, at that point, we should have been evacuated area by area. Not left alone until the town was up in flames. My brother and I were both home, he was sick and I was about to go back to sleep, who knows what could have happened if I did.
- No comment Red Cross was extremely helpfullb
- The city of McMurray really dropped the ball! They had much more resources available
- My apartment were burnt,my sister and i lost all out stuffs including clothes gifts winter outfits that we brought from our country.We're international students and our family is back home in our country.
- Good thing my toy collection is okay.
- If it was not for social media and Pete Potetco (last broadcast station) from the RCMP detachment I would not have known to evacuate. The city and authorities performed poorly when it came to evacuation. I do not even remember an official order to evacuate Timberlee.
- it was a tragic, and scary on different levels for different people. But fortunately or luckily for me, i encountered good people from fort mc in Edmonton and on the way to Edmonton with good hearts. I can say we rebuild fort mc not just physically but with our deeds. we've got people with big hearts in fort mc!!
- send strength/ hope/courage and love to the people still dealing with rebuilding and fighting with insurance companies.
- 10/10 would evacuate again (I made more money and worked less)
- red tape is far, far too much. WalMart wouldn't let me cash the Red Cross coupons for food/clothes because of no ID. It was left in fire. Greed. Greed is horrible after a disaster.
- People should have been evacuated sooner. I could see the fire from my home before my area was even evacuated.
- The provincial and city emergency response team did a fantastic job during and after the evacuation looking after the safety of residents. Adequate information and support provided
- I'm glad my family and my dog got out safe and myself. It is something I will never forget. Being from Fort McMurray born and raised it definitely has stuck with me from the effect it had on my home and my home town.

- Having a party with all your buddies that you were supposed to takw a road trip with
- It was the most surreal experience I've ever had thanks to all Canadians who helped
- It felt really good to know that the entire country had our back
- No
- Im very proud with my community and my very selfless family for helping out the evacuees in fort McKay
- I need a better plan of action for managing pet safety. Luckily all survived with no lasting effects, but with a large number, early planning is key.
- We should have been evacuated much, much sooner than we were. Lives were put at risk unnecessarily, and it is frustrating that no one has taken responsibility or apologized for this.
- Na
- Still a long road ahead.
- The evacuation should have been called earlier and the water bomber should have been on standby like it normally was in the summers beforehand.
- I seem to be more emotional after the fire for no known reason
- They should have told the community to leave earlier. They put people at risk.
- Hats off to first responders!
- I feel as though major incidents happen and overall the RMWB did well during and after the evacuation. My life has since returned to normal
- My home is gone and it was really hard for me and my family
- I have seen Canadian people how good they are to other nationality in times of hardships.
- The wildfire was a horrific experience, you don't know what you should do during those times; but everyone in the community helped each other. Everyone got connected in an instance and that was the most wonderful thing that happened despite of the frightful situation.
- It is truly overwhelming to see such camaraderie between people especially during this difficulty time.
- Used many resources from evacuation supplies centers, thankful my family and friends were not physically hurt
- It could have been worse. I'm grateful to have been in Canada while something like this happened.
- Surprisingly civil. At least what I saw, only once did I see someone freak out and nearly hit someone with their vehicle while trying to evacuate faster than everyone else.
- I think that the officials should have evacuated everyone a little bit sooner. I resided in Waterways and we had no evacuation notice and the only way we knew to get out was because the fire was coming down over the hill and that's is when we knew it was time to go
- I think mandatory evacuation should have been done from the start of the fire for the entire city

- The experience was heartwarming when it comes to the surrounding area was willing to help us. Some even bought water and drove to the highway 63 to hand us water. Simple gestures like that was very heartwarming. It's been almost a year & I get teary eyed just talking about it because I don't think I'll ever forget the avalanche of kindness we felt and received across the country. I never felt that kind of help in my life and it's very overwhelming that goes through my soul. Throughout the course of our stay in Edmonton, I can't stop thanking every individual who was willing to help us. God bless their beautiful heart. And if you're one of those people who helped us, THANK YOU a million times over.
- impressed by the help of local agencies and companies. 2) May 1-3 was too long a waiting period to evacuate people. 3) "Lessons learned" should be conducted so that we can avert future crises.
- No comments
- It'd be nice if we are given an advance evacuation notice instead of a last minute rushed notice.
- News media blow things out of proportion. I don't recall which paper it was but they stated with graphs that my area in Wood Buffalo was 80% burnt down. While in fact it was only 20%. This really made me lose hope, I thought I lost my home. I was fortunate to not have
- Big learning experience and makes you value what you have and who you have in your life.
- Alberta and RMWB were great with financial help and up to date info
- Our grad was postponed... Sad.
- Do not forget the hinterlands
- It's all good now
- The radio stations were incredibly helpful and encouraging. I don't know what I would have done without them.

REFERENCES

- 2009 Victorian Bushfires Royal Commission [VBRC]. (2010). *Final Report: Summary*. Victoria, AUS: Parliament of Victoria. Retrieved from http://www.royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC_Summary_PF.pdf
- Alberta Chamber of Resources. (n.d.) *Keyano College*. Retrieved from <http://www.acr-alberta.com/AboutACR/Members/FeaturedMembers/KeyanoCollege/tabid/324/Default.aspx>
- Alberta Emergency Management Agency (AEMA). (2016, October 19). *Taming “the Beast”: Alberta’s coordinated response to the 2016 Wood Buffalo wildfires* (presentation). Edmonton, AB: Government of Alberta, Municipal Affairs. Retrieved from <http://www.aema.alberta.ca/documents/PL3-AEMA-RMWB-Generic-Brief-17-Oct-2016.pdf>
- Anderson, J.Q., & Rainie, L. (2012). *Millennials will benefit and suffer due to their hyperconnected lives*. Retrieved from Pew Research Center’s Internet & American Life Project: http://www.pewinternet.org/~media/Files/Reports/2012/PIP_Future_of_Internet_2012_Young_brains_PDF.pdf
- Antunes, P., Bernard, M., & Owusu, P. (2016). *The economic impacts of the 2016 Alberta wildfires*. Ottawa, ON: The Conference Board of Canada. Retrieved from <http://www.conferenceboard.ca/e-library/abstract.aspx?did=8420>
- Auf der Heide, E. (1989). *Disaster Response: Principles of Preparation and Coordination*. Retrieved from <http://library.ndmctsgh.edu.tw/milmed/avitation/file-med/DisasterResponse.pdf>
- Baker, E.J. (1991). Hurricane evacuation behavior. *International Journal of Mass Emergencies and Disasters*, 9(2). 287-310.
- Barry, G. (2016, February 16). Tough times put Keyano’s vision on hold. *Fort McMurray Today.com*. Retrieved from <http://www.fortmcmurraytoday.com/2016/02/16/tough-times-puts-keyanos-vision-on-hold>
- Bateman, J.M., & Edwards, B. (2002). Gender and evacuation: A closer look at why women are more likely to evacuate for hurricanes. *Natural Hazards Review*, 3(3), 107-117.
- Beatson, R., & McLennan, J. (2011). What applied social psychology theories might contribute to community bushfire safety research after Victoria’s “Black

- Saturday". *Australian Psychologist* (46), 171-182. doi: 10.1111/j.1742-9544.2011.00041.x
- Benight, C., Grunfest, E., & Sparks, K. (2004). Colorado Wildfires. *Quick Response Research Report #167*. Boulder, CO: Natural Hazards Center, University of Colorado.
- Beverly, J., & Bothwell, P. (2011). Wildfire evacuations in Canada 1980-2007. *Natural Hazards*, 59(1), 571-596. doi: 10.1007/s11069-011-9777-9.
- Canadian Interagency Forest Fire Centre Inc. (2015). *Canada Report 2015*. Retrieved from <http://www.cifffc.ca/images/stories/docs/2015%20canada%20report.pdf>
- Canadian Radio-Television and Telecommunications Commission (CRTC). (2016). *Communications Monitoring Report (CMR)*. Retrieved from <http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2016/cmr.pdf>
- Canadian Wireless Telecommunications Association (CWTA). (2017). *Facts & Figures: Wireless phone subscribers in Canada*. Retrieved from <https://www.cwta.ca/facts-figures/>
- Carter, T.M., Kendall, S., & Clark, J.P. (1983). Household response to warnings. *International Journal of Mass Emergencies and Disasters*, 1(1), 95-104.
- Catalyst. (2015). *With Growth Comes Change: The Evolving Mobile Landscape in 2015*. Retrieved from <http://catalyst.ca/2015-canadian-smartphone-market/>
- Colleges and Institutes Canada. (2017). *Keyano College*. Retrieved from <https://www.collegesinstitutes.ca/members/keyano-college/>
- Cote, D.W., & McGee, T.K. (2014). An exploration of residents' intended wildfire evacuation responses in Mt. Lorne, Yukon, Canada. *Forestry Chronicle*, 90(4), 498-502. doi: 10.5558/tfc2014-100
- Dash, N., & Gladwin, H. (2007). Evacuation decision making and behavioral responses: Individual and household. *Natural Hazards Review*, 8(3), 69-77. doi: 10.1061/(ASCE)1527-6988(2007)8:3(69)
- Dotson, L.J., & Jones, J. (2005). *Identification and analysis of factors affecting emergency evacuations: Main report*. Washington, D.C.: U.S. Nuclear Regulatory Commission.
- Dow, K., & Cutter, S.L. (1998). Crying wolf: Repeat responses to hurricane evacuation orders. *Coastal Management*, 26(4), 237-252. doi: 10.1080/08920759809362356
- Drabek, T.E. (2013). *The human side of disaster*. Boca Raton, FL: CRC Press.

- Eiser, J.R., Bostrom, A., Burton, I., Johnston, D.M., McClure, J., Paton, D.,... White, M.P. (2012). Risk interpretation and action: A conceptual framework for responses to natural hazards. *International Journal of Disaster Risk Reduction* 1, 5-16. doi: 10.1016/j.ijdr.2012.05.002
- Fitzpatrick, C., & Mileti, D.S. (1991). Motivating public evacuation. *International Journal of Mass Emergencies and Disasters*, 9(2), 137-152.
- Floyd, D.L., Prentice-Dunn, S., & Rogers, R.W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology* 30(2), 407-429. doi: 10.1111/j.1559-1816.2000.tb02323.x
- Fort McMurray Tourism. (2017). Regional Municipality of Wood Buffalo. Retrieved from <http://www.fortmcmurraytourism.com/visitor-info/regional-municipality-of-wood-buffalo>
- Fothergill, A. (1996). Gender, risk and disaster. *International Journal of Mass Emergencies and Disasters*, 14(1), 33-56.
- French, J. (2016, May 28). Timeline of evacuation and return to Fort McMurray. The Edmonton Journal. Retrieved from <http://edmontonjournal.com/news/insight/timeline-of-evacuation-and-return-to-fort-mcmurray>
- Fry, R. (2017). *It's becoming more common for young adults to live at home – and for longer stretches*. Retrieved from the Pew Research Center website: <http://www.pewresearch.org/fact-tank/2017/05/05/its-becoming-more-common-for-young-adults-to-live-at-home-and-for-longer-stretches/>
- Garson, G.D. (2015). *Missing Values Analysis & Data Imputation*. Asheboro, NC: Statistical Associates Publishing.
- Gladwin, C.H., Gladwin, H., & Peacock, W.G. (2001). Modeling hurricane evacuation decisions with ethnographic methods. *International Journal of Mass Emergencies and Disasters*, 19(2), 117-143.
- Gladwin, H., & Peacock, W.G. (2000). Warning and evacuation: A night for hard houses. In W.G. Peacock, B.H. Morrow, & H. Gladwin (Eds.), *Hurricane Andrew: Ethnicity, gender and the sociology of disasters* (pp. 52-74). Miami, FL: International Hurricane Center.
- Gledhill, J. (2003, October). *Community Self-Reliance During Bushfires: The Case for Staying at Home*. Paper presented at the Third International Wildland Fire Summit, Sydney, Australia. Abstract retrieved from <http://www.fire.uni-freiburg.de/summit-2003/3-IWFC/Papers/3-IWFC-061-Gledhill.pdf>

[illegible]

- Hou, F. (2010). *Homeownership Over the Life Course of Canadians: Evidence from Canadian Censuses of Population* (Analytical Studies Branch Research Paper Series Catalogue no. 11F0019M – No. 325). Retrieved from Statistics Canada website: <http://www.statcan.gc.ca/pub/11f0019m/11f0019m2010325-eng.pdf>
- Huang, S-K. (2014). *Households' Evacuation Decision in Response to Hurricanes Katrina and Rita* (Doctoral dissertation). Retrieved from Dissertation Abstracts International (Vol. 76, no. 07, suppl. A)
- Huang, S-K., Lindell, M.K., Prater, C.S., Wu, H., & Siebeneck, L.K. (2012). Household evacuation decision making in response to Hurricane Ike. *Natural Hazards Review*, 13(4), 283-296. doi: 10-1061/(ASCE)NH.1527-6996.0000074
- Insights West. (2016). *2016 Canadian Social Media Monitor*. Retrieved from http://www.insightswest.com/wp-content/uploads/2016/05/Rep_InsightsWest_CDNSocialMediaMonitor_2016.pdf
- Insurance Bureau of Canada. (2016, July 7). Northern Alberta Wildfire Costliest Insured Natural Disaster in Canadian History – Estimate of insured losses: \$3.58 billion. Retrieved from <http://www.ibc.ca/bc/resources/media-centre/media-releases/northern-alberta-wildfire-costliest-insured-natural-disaster-in-canadian-history>
- Jin, Y., Liu, B.F., & Austin, L.L. (2014). Examining the role of social media in effective crisis management: The effects of crisis origin, information form, and source on publics' crisis responses. *Communications Research*, 41(1), 74-94.
- Kalton, G., & Kasprzyk, D. (1986). The treatment of missing survey data. *Survey Methodology*, 12(1), 1-16.
- Kearns, C., & Lowe, B. (2007). Disasters and people with disabilities. *Journal of Emergency Management*, 5(1), 35-40.
- Kinateder, M.T., Kuligowski, E.D., Reneke, P.A., & Peacock, R.D. (2015). Risk perception in fire evacuation behavior revisited: definitions, related concepts, and empirical evidence. *Fire Science Reviews* 4(1), 1-26.
- KPMG. (2012). *Lesser Slave Lake Regional Urban Interface Wildfire – Lessons Learned: Final Report*. Retrieved from <http://www.aema.alberta.ca/documents/0426-Lessons-Learned-Final-Report.pdf>
- KPMG. (2017). *May 2016 Wood Buffalo Wildfire Post-Incident Assessment Report*. Retrieved from <https://www.alberta.ca/assets/documents/Wildfire-KPMG-Report.pdf>

- Kulig, J., Reimer, W., Townshend, I., Edge, D., Lighfoot, N., Killel, A., & Hosgood, E. (2010). *Report of the Household Survey: Barriere, B.C.* Lethbridge, AB: University of Lethbridge.
- Kuligowski, E.D. (2011). Terror defeated: Occupant sensemaking, decision-making and protective action in the 2001 World Trade Center disaster. *Sociology Graduate Theses & Dissertations*. Paper 4. Retrieved from http://scholar.colorado.edu/cgi/viewcontent.cgi?article=1003&context=socy_grad_etds
- Lamoureux, M. (2016, May 6). 'Tragedy, layered on tragedy': Girl, 15, killed in Fort McMurray evacuation. Retrieved from CBC News website: <http://www.cbc.ca/news/canada/edmonton/tragedy-layered-on-tragedy-girl-15-killed-in-fort-mcmurray-evacuation-1.3569518>
- Lazo, J.K., Waldman, D.M., Morrow, B.H., & Thacher, J.A. (2010). Household evacuation decision making and the benefits of improved hurricane forecasting: Developing a framework for assessment. *Weather & Forecasting*, 25(1), 207-219. doi: 10.1175/2009WAF2222310.1
- Lim, G.J., & Rungta, M. (2013). Optimization in evacuation route planning. In A.B. Badiru, & L. Racz (Eds.), *Handbook of emergency response: A human factors and systems engineering approach* (pp. 97-119). Boca Raton, FL: CRC Press.
- Lindell, M. (2013). Evacuation planning, analysis, and management. In A.B. Badiru, & L. Racz (Eds.), *Handbook of emergency response: A human factors and systems engineering approach* (pp. 122-149). Boca Raton, FL: CRC Press.
- Lindell, M.K. (2000). An overview of protective action decision-making for a nuclear power plant emergency. *Journal of Hazardous Materials* 75(2-3). 113-129.
- Lindell, M.K. & Hwang, S.N. (2008). Households' perceived personal risk and responses in a multihazard environment. *Risk Analysis*, 28(2), 539-556. doi: 10.1111/j.1539-6924.2008.01032.x
- Lindell, M.K., & Perry, R.W. (1993). *Risk area residents' changing perceptions of volcano hazard at Mt. St. Helens* (Hazard Reduction and Recovery Center Publication 169A). College Station, TX: College of Architecture, Texas A&M University.
- Lindell, M.K., & Perry, R.W. (2004). *Communicating Environmental Risk in Multiethnic Communities*. Thousand Oaks, CA: Sage Publications.
- Lindell, M.K., & Perry, R.W. (2012). The protective action decision model: Theoretical modifications and additional evidence. *Risk Analysis*, 32(4), 616-632.

- Lindell, M.K., & Prater, C.S. (2000). Household adoption of seismic hazard adjustments: A comparison of residents in two states. *International Journal of Mass Emergencies and Disasters*, 18(2), 317-338.
- Lindell, M.K., Lu, J., & Prater, C.S. (2005). Household decision making and evacuation in response to Hurricane Lili. *Natural Hazards Review*, 6(4), 171-179. doi:10.1061/(ASCE)1527-6988(2005)6:4(171)
- Little, R.J.A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, 83(404), 1198-1202.
- Liu, B.F., Fraustino, J.D., & Jin, Y. (2016). Social media use during disasters: How information form and source influence intended behavioral responses. *Communication Research*, 43(5), 626-646. doi: 10.1177/0093650214565917
- MacLellan, T., Powell, A., & Saporito, L. (2014). *Governor's Guide to Mass Evacuation*. Washington, D.C.: National Governors Association. Retrieved from <https://www.nga.org/files/live/sites/NGA/files/pdf/GovGuideMassEvacuation.pdf>
- Maddux, J.E. & Rogers, R.W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of Experimental Social Psychology*, 19(5), 469-479. doi: 10.1016/0022-1031(83)90023-9
- McDermott, B.M., Lee, E.M., Judd, M., & Gibbon, P. (2005). Posttraumatic stress disorder and general psychopathology in children and adolescents following a wildfire disaster. *Canadian Journal of Psychiatry* 50(3), 137-143.
- McLennan, J., Cowlshaw, S., Paton, D., Beatson, R., & Elliott, G. (2014). Predictors of south-eastern Australian householders' strengths of intentions to self-evacuate if a wildfire threatens: Two theoretical models. *International Journal of Wildland Fire* 23(8), 1176-1188. doi: 10.1071/WF13219
- Michaels, S. (2003). Perishable information, enduring insights? Understanding quick response research. In J. Monday (Ed.), *Beyond September 11th: An account of post-disaster research* (pp. 15-48). Boulder, CO: University of Colorado, Natural Hazards Center.
- Mileti, D. (1999). *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Washington, D.C.: Joseph Henry Press.
- Mileti, D., & O'Brien, P. (1992). Warnings during disaster: Normalizing communicated risk. *Social Problems*, 39(1), 40-57. doi: 10.2307/3096912

- Mileti, D.S., & Peek, L. (2000). The social psychology of public response to warnings of a nuclear power plant accident. *Journal of Hazardous Materials*, 75(2-3), 181-194. doi: 10.1016/S0304-3894(00)00179-5
- Mileti, D.S., & Sorensen, J.H. (1990). *Communication of emergency public warnings: A social science perspective and state-of-the-art assessment*. Oak Ridge, TN: Oak Ridge National Laboratory. Retrieved from http://www.cires.org.mx/docs_info/CIRES_003.pdf
- MNP. (2015). *Review and Analysis of the Government of Alberta's Response to and Recovery from 2013 Floods*. Retrieved from <http://www.aema.alberta.ca/documents/2013-flood-response-report.pdf>
- Monster Worldwide Inc. (2016a). *Monster Multi-Generational Survey – From nylons and neckties, to nose rings and norm core: Today's Talent Spans Four Generations*. Retrieved from <https://hiring.monster.com/litereg/multigenreport.aspx>
- Monster Worldwide Inc. (2016b). *Monster Multi-Generational Survey – Move Over, Millennials: Gen Z is About to Enter the Workforce*. Retrieved from <https://hiring.monster.com/LiteReg/GenZReport.aspx>
- Murthy, D., & Gross, A.J. (2017). Social media processes in disasters: Implications of emergent technology use. *Social Science Research*, 63, 356-370.
- National Interagency Coordination Center. (2015). *National Interagency Coordination Center: Wildland fire summary and statistics annual report 2015*. Retrieved from https://www.predictiveservices.nifc.gov/intelligence/2015_Statsumm/annual_report_2015.pdf
- National Research Council (U.S.) Committee on Disaster Research in the Social Sciences: Future Challenges and Opportunities., & National research Council (U.S.) Division on Earth and Life Studies (NRC). (2006). *Facing hazards and disasters: Understanding human dimensions*. Washington, D.C.: National Academies Press.
- Neria, Y., Nandi, A., and Galea, S. (2007). Post-traumatic stress disorder following disasters: A systematic review. *Psychological Medicine* 38, 467-480.
- Norris, F.H., Friedman, M.J., Watson, P.J., Byrne, C.M., Diaz, E., and Kaniasty, K. (2002). 60,000 Disaster victims speak: Part I. An empirical review of the empirical literature, 1981-2001. *Psychiatry* 65(3), 207-239.
- Order in Council 107/2016. (2016, May 4). Retrieved from http://www.qp.alberta.ca/documents/orders/Orders_in_Council/2016/516/2016_107.pdf

- Paveglio, T., Carroll, M.S., & Jakes, P.J. (2008). Alternatives to evacuation – protecting public safety during wildland fire. *Journal of Forestry*, 102(2), 65-70.
- Peek, L., Morrissey, B. & Marlatt, H. (2011). Disaster hits home: A model of displaced family adjustment after Hurricane Katrina. *Journal of Family Issues* 32(10), 1371-1396. doi: 10.1177/0192513X11412496
- Perry, R.W., Lindell, M.K., & Greene, M.R. (1982). Crisis communications: Ethnic differentials in interpreting and acting on disaster warnings. *Social Behavior & Personality: An International Journal*, 10(1), 97-104.
- Pew Research Center. (2014). *Millennials in Adulthood: Detached from Institutions, Networked with Friends*. Retrieved from http://www.pewsocialtrends.org/files/2014/03/2014-03-07_generations-report-version-for-web.pdf
- Pew Research Center. (2015a). *Most Millennials Resist the 'Millennial' Label*. Retrieved from <http://www.people-press.org/files/2015/09/09-03-2015-Generations-release.pdf>
- Pew Research Center. (2015b). *Millennials & Political News: Social Media – the Local TV for the Next Generation?* Retrieved from <http://www.journalism.org/files/2015/06/Millennials-and-News-FINAL-7-27-15.pdf>
- Pew Research Center. (2017a). *Social Media Use by Age*. Retrieved from <http://www.pewinternet.org/chart/social-media-use-by-age/>
- Pew Research Center. (2017b). *How Often Americans are Using Social Media*. Retrieved from <http://www.pewinternet.org/chart/how-often-americans-are-using-social-media/>
- Portable Atlas (PAT). (2013). *Public Domain Maps of Alberta*. Retrieved from http://ian.macky.net/pat/map/ca/ab/ab_blu.gif
- Pujadas Botey, A., & Kulig, J. C. (2014). Family functioning following wildfires: Recovering from the 2011 Slave Lake fires. *Journal of Child & Family Studies* 23(8), 1471-1483. doi:10.1007/s10826-013-9802-6
- Quantifying disaster. (2017, January 20). *MacEwan News*. Retrieved from http://www.macewan.ca/wcm/MacEwanNews/STORY_FT_MAC_ECON_RESE_ARCH_2
- Quarantelli, E.L., Baisden, B. & Bourdess, T. (1980). *Evacuation behavior and problems: Findings and implications from the research literature*. Columbus,

- OH: The Ohio State University. Retrieved from <http://udspace.udel.edu/handle/19716/1283>
- Regional Municipality of Wood Buffalo (RMWB). (2016a, May 1). *Media Releases: Mayor Blake declares state of local emergency (Localized to Gregoire)*. Retrieved from http://www.rmwb.ca/News-Room/Media-Releases/Mayor-Blake-Declares-State-of-Local-Emergency--Localized-to-Gregoire-_s2_p5437.htm
- Regional Municipality of Wood Buffalo (RMWB). (2016b, November 10). *Media Releases: State of Local Emergency to end November 10*. Retrieved from http://www.rmwb.ca/News-Room/Media-Releases/State-of-Local-Emergency-to-end-November-10_s2_p5839.htm
- Regional Municipality of Wood Buffalo (RMWB). (2016c, May 21). *RMWB Wildfire Recovery Information: Overview of Re-entry Timelines and Maps Now Available*. Retrieved from <http://www.rmwb.ca/News-Room/RMWB-Wildfire-Information/2016/5/Overview-of-Re-entry-Timelines-and-Maps-Now-Available.htm>
- Regional Municipality of Wood Buffalo (RMWB). (2015). Census 2015 the count is done. Fort McMurray, AB: Regional Municipality of Wood Buffalo. Retrieved from <http://www.rmwb.ca/Assets/Corporate/Census+Reports/Municipal+Census+2015+Report.pdf>
- Rippetoe, P.A., & Rogers, R.W. (1987). Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. *Journal of Personality and Social Psychology*, 52(3), 596-604. doi: 10.1037/0022-3514.52.3.596
- Rogers, R.W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology*, 91(1), 93-114.
- Scheffer, J. (2002). Dealing with missing data. *Research Letters in the Information and Mathematical Sciences*, 3, 153-160.
- Sorensen, J.H. (1991). When shall we leave? Factors affecting the timing of evacuation departures. *International Journal of Mass Emergencies and Disasters*, 9(2), 153-165.
- Sorensen, J.H., Vogt, B.M., & Mileti, D.S. (1987). *Evacuation: An assessment of planning and research*. Oak Ridge, TN: Oak Ridge National Laboratory.
- Statistics Canada. (2011a). *Census Profile: Wood Buffalo Alberta*. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CMA&Code1=860&Geo2=PR&Code2>

<http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/tbt-tt/Rp-eng.cfm?TABID=2&LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FRE=0&GC=0&GK=0&GRP=1&PID=102116&PRID=10&PTYPE=101955&S=0&SHOWALL=0&SUB=0&Temporal=2011&THEME=89&VID=0&VNAMEE=&VNAMEF=>

- Statistics Canada. (2011b). *2011 Census of Canada: Topic-based tabulations*. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/tbt-tt/Rp-eng.cfm?TABID=2&LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FRE=0&GC=0&GK=0&GRP=1&PID=102116&PRID=10&PTYPE=101955&S=0&SHOWALL=0&SUB=0&Temporal=2011&THEME=89&VID=0&VNAMEE=&VNAMEF=>
- Statistics Canada. (2012). *Living arrangements of young adults aged 20 to 29: Families, households and marital status, 2011 Census of Population*. Retrieved from Statistics Canada website: http://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-312-x/98-312-x2011003_3-eng.pdf
- Steelman, T.A., McCaffrey, S.M., Velez, A.K., & Briefel, J.A. (2015). What information do people use, trust, and find useful during a disaster? Evidence from five large wildfires. *Natural Hazards*, 76(1), 615-634. doi: 10.1007/s11069-014-1512-x
- Stephens, S.L., Adams, M.A., Handmer, J., Kearns, F.R., Leicester, B.,...Moritz, M.A. (2009). Urban-wildland fires: How California and other regions of the US can learn from Australia. *Environmental Research Letters*, 4(1), 1-5. doi: 10.1088/1748-9326/4/1/014010
- Stocks, B.J., Mason, J.A., Todd, J.B., Bosch, E.M., Wotton, B.M., Amiro, B.D.,...Skinner, W.R. (2002). Large forest fires in Canada, 1959-1997. *Journal of Geophysical Research: Atmospheres*, 107(D1), 5.1-5.12. doi: 10.1029/2001JD000484
- Taylor, J.G., Gillette, S.C., Hodgson, R.W., Downing, J.L., Burns, M.R., Chavez, D.J., & Hogan, J.T. (2007). Informing the network: Improving communication with interface communities during wildland fire. *Human Ecology Review*, 14(2), 198-211.
- Taylor, P., & Keeter, S. (Eds.). (2010). *Millennials: A Portrait of Generation Next*. Washington D.C.: Pew Research Center.
- Tierney, K., Lindell, M. & Perry, R. (2001). *Facing the Unexpected*. Washington, D.C.: Joseph Henry Press.
- Townshend, I., Awosoga, O., Kulig, J., Pujadas Botey, A., Shepard, B., & McFarlane, B. (2015). Impacts of wildfires on school children: A case study of Slave Lake, Alberta, Canada. *International Journal of Mass Emergencies and Disasters*, 33(2), 148-187.

- Van Willigen, M., Edwards, B., Lormand, S., & Wilson, K. (2005). Comparative assessment of impacts and recovery from Hurricane Floyd among student and community households. *Natural Hazards Review*, 6(4), 180-190.
- Van Willigen, M., Edwards, T., Edwards, B., & Hessee, S. (2002). Riding out the storm: Experiences of the physically disabled during Hurricanes Bonnie, Dennis and Floyd. *Natural Hazards Review*, 3(3), 98-106.
- Veil, S.R., Buehner, T., & Palenchar, M.J. (2011). A work-in-progress literature review: Incorporating social media in risk and crisis communication. *Journal of Contingencies & Crisis Management*, 19(2), 110-122. doi: 10.1111/j.1468-5973.2011.00639.x
- Vogt, B.M. & Sorensen, J.H. (1987). *Evacuation in emergencies: An annotated guide to research*. Oak Ridge, TN: Oak Ridge National Laboratory. Retrieved from <http://www.survivalring.org/classics/EvacuationInEmergencies-AnnotatedGuideToResearch-ORNL-TM-10277.pdf>
- Weinstein, N.D. (1989). Effects of personal experience on self-protective behavior. *Psychological Bulletin*, 105(1), 31-50. doi:10.1037/0033-2909.105.1.31
- Wordart. (2017). <https://wordart.com>