Search (and Rescue) for the Ultimate Selfie: How the use of social media and smartphone technology have affected human behaviour in outdoor recreation scenarios

by

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Abstract

The practice of outdoor recreation was historically a form of therapy and escape from the rigors of modern industrial daily work-life, and it remains a favored pastime today, with 70% of Canadians and 91% of British Columbia residents participating in “outdoor recreation or wilderness activities”. In recent years, there is a belief that the surge in popularity of hiking is due to beautiful destinations becoming more visible on social media. Further, the proximity of urban centres like Vancouver to such destinations reassures users that the safety benefits of urban technologies including smartphones, will remain accessible and reliable throughout their outdoor exploration and that help is available in the event of an emergency. This belief has led to many instances of Search and Rescue teams being activated, which would previously have been avoided by outdoor recreation participants making different choices based on their skill and experience. The culture of outdoor recreation has therefore been increasingly affected by smartphone technology in terms of users’ risk perception while recreating outdoors.

Keywords: Outdoor recreation; Risk perception; Search and Rescue services; Smartphone technology; Social media

Dedication

I would like to dedicate this thesis to my father, who died during the writing of it. He supported everything I ever tried to do, and was incredibly proud of me.

I would also like to dedicate it to the Search and Rescue Team Members who volunteer every day to help anyone who needs help. Their selfless dedication of their lives has been an inspiration for this project, and the amount of people who responded to my request for help with the survey demonstrates how supported they are amongst the outdoor recreation community.

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List of Acronyms

BCSARA	British Columbia Search And Rescue Association
CASL	Canadian Anti-Spam Legislation
CBC	Canadian Broadcasting Corporation
CTV	CTV Television Network
DNV	District of North Vancouver
EMBC	Emergency Management British Columbia
GPS	Global Positioning System
MEC	Mountain Equipment Co-op
MVRD	Metro Vancouver Regional District
NSR	North Shore Rescue
PLB	Personal Locator Beacon
SAR	Search and Rescue
SFU	Simon Fraser University

Glossary

App	An application designed for a mobile device (such as a smartphone).
Selfie	A self-portrait, (often with another person or as part of a group) taken by oneself using a digital camera especially for posting on social networks.

Chapter 1. Introduction

1.1. Research problem

The practice of outdoor recreation was historically a form of therapy and escape from the rigors of modern industrial daily work-life (Elliott, 2006; Hansen, 2019), and it remains a favored pastime today, with 70% of Canadians (Statistics Canada, 2018) and 91% of British Columbia (BC) residents participating in "outdoor recreation or wilderness activities" (Destination BC, 2014, para. 6). However, there appears to be a belief amongst the local community and stakeholders in the field based on reports in the media, personal observations, and anecdotes from individuals, that the use of smartphone technology and social media has changed some of the elements of outdoor recreation, particularly hiking. The proximity of urban centres like Vancouver to incredibly popular nature or wilderness sites seems to reassure some users that the safety benefits of urban technologies such as smartphones, will remain accessible and reliable throughout their outdoor exploration. The understanding that help is available in the event of an emergency causes a drain on Search and Rescue (SAR) resources who are called to rescue those people when they get into difficulties. As technology has enabled outdoor recreation users to change from being "passive information recipients" to "active information creators" (Choe, Kim & Fesenmaier, 2017, p.431), the smartphone has become an essential tool for recording experiences. It often replaces alternative communication devices such as SPOT and inReach GPS devices which rely on satellite signal rather than cellular towers, which causes problems for hikers if they get into difficulties in a location with limited cellphone service.

Hiking can be defined as "walking over long distances (preferably a scenic, natural setting) for pleasure or exercise. For many, hiking has meant backpacking, or going on extended outings carrying a backpack" (Deeg, 2018, para. 2). Before hiking trails were created by National Parks and other organisations for recreational purposes, the main participants in hiking were mountaineers, trappers, hunters, and prospectors, as well as First Nations people, all creating maps where before there had been none. From those trailblazers who created the paths and then the maps, came recreational hikers, who, similarly to the definition here, went hiking mainly for pleasure or for exercise. It is from this branch of hikers that the majority of participants belong to today.

Due to the appeal of hiking as an activity that is easy to access, the proliferation of affordable hiking apparel, the ease of transport to trails, and the development of technology to assist their explorations, the number of people hiking has increased to its current volume, discussed further in Chapter 2.

As a local example, data showing the increase in volume can be seen from the trail count statistics for the Baden Powell Trailhead in Deep Cove, from the District of North Vancouver's Parks department (P. Murry, personal communication, November 11, 2019). Their trail count shows:

Table 1: Trail usage from Baden Powell Trailhead in Deep Cove, 2016-2019

Year	Annually	Daily average
2016	535,000	1,400
2017	550,000	1,450
2018	630,000	1,500
2019	630,000 (projected using average trail counts)	1,500

This trail is one of the lynchpins in the North Shore hiking trail system; the trail from Deep Cove to Quarry Rock is one of the most visible and visited photo sites in Vancouver, and has been the focus of a lot of attention as to how many people have been drawn to it by the supposed 'Instagram effect' described below.

Having lived and worked on Vancouver's North Shore for more than seven years, the ability to hike in the local mountains has always been important to me. It was an activity that was easily accessible, providing peace from the rigours of work in the city and an opportunity to experience a taste of wilderness so close to residential areas. Over those seven years, and in the years since, the impression that I received from my own observations, and one that was believed by local residents I spoke to, was that the increase in people and the increase in incidents was at least partly due to social media, and also how the use of smartphones were being relied upon as methods of communication.

I wanted to find out if the impression that many people, including myself, had is correct, that social media use has increased the volume of people on the trails, and that the use of smartphone technology has affected hikers' perception of risk, and the effect that has had on Search and Rescue resources.

1.2. Selfies, social media and smartphones

Selfies have become a modern phenomenon, so popular that in 2013, 'selfie' was chosen as the 'Word of the Year' by Oxford Dictionaries ("Selfie", 2013). Dictionary definitions specify that the purpose of such a shot is "especially for posting on social networks" (Merriam Webster, u.d.), and a Google search for 'Quarry Rock Selfie' today produces in the region of 1,110,000 results. On social networks, those images can reach vast numbers of followers, inspiring people to emulate the image, and head to the destination to take and post their own version. This trend is colloquially known as the 'Instagram effect.' While completing the interviews for this project, the reach of the Quarry Rock image in general was demonstrated in an anecdote where the Communications Director for District of North Vancouver (DNV) was flying back from a vacation, and there was an image of it on the front of the *Air France Magazine,* shown below.

Figure 1: Cover of Air France Magazine showing image of Quarry Rock, April 2015.

The taking of a selfie, and even inspiring others to do the same, is itself perfectly innocuous, but it is where the phenomena has led to incidents where SAR teams get involved that it can take on a more insidious nature. It is natural that followers would want to emulate beautiful images that portray a certain quality of life and adventure, and encouraging more people to enter the outdoors and experience the benefits can only be

a good thing, but where SAR teams are finding difficulties is that those followers are sometimes not prepared or experienced enough for the journey necessary to get to the location, and when they get into difficulties they are necessarily calling for assistance. The first issue caused by this is that the images, and posts that accompany them, do not always give a realistic idea of the effort needed to achieve the shot. This shorthand for immediate gratification which omits the labour necessary to achieve the images is exacerbated by articles often shared on social media, such as the one pictured below that appear in online magazines such as 'The Daily Hive' and 'Vancouver is Awesome.' These magazines promote the closeness of easy hiking trails, purportedly prompting Vancouver residents to enter the wilderness in greater numbers than ever, and often with less understanding of what might be involved. In order to understand the extent of the problem, the interviews conducted asked key stakeholders what their experiences have been, and if this was true.

Figure 2: Example of Daily Hive article promoting hiking.
Image: Galyna Andrushko.

The second issue follows the first; that all users are more frequently relying on smartphones as a method of navigation and as a means of contact while recreating, not just the inexperienced. In the city and while driving, the omnipotent Google Maps is an

incredibly useful app that can tell you the quickest route to get to your destination, taking into account real-time traffic information. However, its accuracy and its availability can be unreliable when taken out of an urban environment. Smartphone apps that use mapping technology such as Google Maps often do not provide as accurate trail information as local topographical maps that are kept up-to-date, and when relied upon as the sole means of navigation, users can become lost. It has become so ingrained that smartphones provide accurate information that this belief transpires to wilderness situations, and the surveys conducted of generally experienced hikers sought to confirm these behavioural trends.

For many city locations in the world, this would not be a problem because challenging hiking conditions are not found close to urban environments. However, Vancouver is in the fortunate position that it is relatively easy to access really wild hiking conditions and remote trails. Some of the most challenging trails in BC can be accessed via public transport, a feature which is one of the reasons that so many people come here to visit and live. This proximity of wilderness to a highly urbanized population can give users a false sense of security that their usually reliable technology will be available at any point they might need it. When looked at in detail, the maps included at Appendix A, which show the coverage for Rogers, Telus, Bell and Freedom of Vancouver's North Shore mountains, reveal how sporadic that coverage can be. Therefore, if users are relying on their phones for maps in a similar way to how they would in the city, when their signal fails, or battery loses charge, they have no means of either navigating, or for calling for help. The gap in the decision making process from a lack of ability to perceive this as a risk is arguably a consequence of this reliance on smartphone technology, and it is here that we now turn to one of the leading theorists to what constitutes risk perception, and what affects our ability to detect it.

1.3. William Leiss and concepts of risk perception

When evaluating factors that contribute to incidents of search and rescue, analysing the decision making process that led to the event is imperative to understand the subsequent behaviour. There are inevitably some circumstances which cannot be avoided, and accidents do happen to even the most prepared, risk-averse, and knowledgeable people. In understanding how risk perception works in theory, we can

apply that theory to the real-world scenarios being encountered by hikers, and how communications technology affects that process.

William Leiss is a risk specialist who has written literature that continues to inform risk perception theory today. His early work in the 1990s focused on public risk perception, and what made for effective risk communication for managers, with one seminal report in 2003 that analysed Parks Canada's avalanche warning systems (O'Gorman, Hein & Leiss, 2003). It is this work that informs much of the theory below as it refers to some of the many behavioural traits as exhibited by hikers.

Leiss defines risk perception as "a function of hazard plus exposure" (Leiss & Chociolko, 1994, p.28) and later adds that it is the *exposure* to risk that differentiates between what is a hazard and what is a risk (O'Gorman et al., 2003, p.16). One has to have been able to *perceive* a hazard as a risk in the first place, before *assessing* how it will impact on the activity going forwards. Leiss built on theory first defined by Slovic in 1987 who "popularized the term "perceived risk" to describe this [process of evaluating contributing factors as a] kind of assessment of hazards" (Chamarro, 2019, p223). The clarification between risk perception and assessment is a small but important one to make, and one that does make a difference when assessing behaviour. Risk perception is often determining the chance of loss, or gain, made by performing a certain activity, and it is usually the chance of loss that will impact a decision, because when making assessments, people focus on what worries them most about a particular outcome (O'Gorman et al.). However, when considering a risky activity, we are often already invested in that activity, so Leiss suggests that we apply a bias, often subconsciously, towards a 'go' decision, and therefore try and downplay the risks and emphasise the benefits (O'Gorman et al.).

Further, it has been observed that people underestimate familiar risks, and overestimate unfamiliar risks (O'Gorman et al., 2003, p.28-9). We can observe this in our own behaviour; when considering the chances of a driving accident, we often overestimate our own competence, erring on the 'it'll never happen to me' mentality while driving, and therefore do not spend considerable time concerning ourselves about the risks despite the chances of an accident being quite high. Leiss describes outdoor recreation activities such as hiking, skiing and snowboarding as familiar, therefore our risk perception is similar to considerations about driving accidents.

When evaluating even a familiar activity, our perception of risk and the subsequent risk assessment, leads us to a conclusion as to what we consider acceptable, and whether we are going to undertake a certain activity or not. Leiss and Chociolko (1994) refer to acceptable risk as a "small but non-zero probability of an untoward event of some sort occurring, below which level the general population is willing, tacitly or explicitly, to accept a risk" (p.33). In trying to influence what constitutes an acceptable risk, it is the role of managers to produce effective communication about the risk itself. This can be challenging, as entrenched views are hard to redirect, there are many factors beyond their control as to what influences risk perception, and information provided about risk can be frightening (Leiss & Chociolko, 1994). A balance has to be struck between warning and informing, and in the context of hiking in Vancouver, educating the public as to the necessary considerations is of paramount importance due to the volume of people hiking, and their knowledge, or lack thereof, of the conditions to be faced.

The Leiss report on avalanche risk prescribes three components for assessing if risk communication is effective: "(1) whether or not the least-sophisticated user comes away with (2) an adequate awareness of the risks (3) at the time when the activity is about to be undertaken" (O'Gorman et al., 2003, p36). Further, when determining appropriate wording, following Leiss, Boholm, Möller and Hansson (2016) researched the impact of the words "Risk, Safety and Security" and how their use in risk management can be used effectively (p.332). They found that their adjectival and adverbial forms are often used as comparative formats: less safe, safest, pretty risky, riskier for example, and that when used like this, it undermines the absolute values and the messaging be easily misconstrued. In producing effective risk communication for people hiking, all of these factors need to be taken into account, and in producing this research, elements of what can be done to create impactful messaging will be suggested in its conclusions.

1.4. Pope and Martin, 2011

The second informative study for this research was Pope and Martin's 2011 study, "Visitor Perceptions of Technology, Risk, and Rescue in Wilderness". It became a touchstone for this research, as their work focused on a number of the same issues. Their concerns focused on scenarios where technology such as cell phones, satellite

phones or personal locator beacons (PLBs) were brought into the wilderness, and whether they were more likely to be used to request rescue (Pope & Martin, 2011, p.19). Their study used a trail in the King Range National Conservation Area in California as their area of particular focus, and they surveyed all adult visitors along the trail at particular times during the summer hiking season of 2009. The area is one that requires prior experience in order to hike as it is challenging, so the people surveyed self-selected level 6 on a 7 point scale on experience of general backcountry skills (p.23). In following Pope and Martin, as technology has progressed dramatically since their study, and as I have a different locus of interest, I felt that there was enough distance and difference between the two studies to make this research relevant, and useful.

One of the contributing factors Pope and Martin identified as to why people become lost while hiking, and therefore need to call for rescue, is the premise that reliance on technology has negatively impacted their ability to perceive risk. In addition to Leiss' theories discussed above, Pope and Martin suggested that while technology may be used with great effect when necessary, it also acts as a barrier to engaging with the surrounding environment, which contributes to changes in behaviour, underestimating dangers, and overestimating availability of rescue (Pope & Martin, 2011). In designing my research, I therefore wanted to gather evidence that could be assessed to determine if this same behaviour was being encountered in this time, and in this place. Due to my desire to produce useful recommendations that could help SAR teams and reduce resources, Pope and Martin's theories regarding estimations of rescue have been particularly formative. They describe this expectation as being formed when underprepared hikers have technology with them capable of requesting assistance, and that as a result they may be less likely to turn back when lost, seeing the technology as a safety net rescue (Pope & Martin, 2011).

Pope and Martin's study was conducted prior to the beginning of widespread social media use, so its impact on numbers of people hiking and risk perception was obviously not a factor in their research. The influence of Instagram on image-taking that my study suggests could not occur until after October 6, 2010 when the application was launched. In the years since Pope and Martin's study, there have been enormous leaps in technological development, but the question of how technology affects risk perception certainly still has resonance today. In particular, the conflation of the reliability of technological devices in the front and backcountry can be seen today in the reliance on

frontcountry applications such as Google Maps, and how they lack the same functionality in wilderness scenarios.

1.5. Role of Search and Rescue

SAR operations have been an integral part of the Canadian Outdoor Recreation pantheon for decades, with North Shore Rescue (NSR) being one of the earliest SAR teams established formally in Canada, in 1965 (M. Danks, personal communication, June 14, 2019). Their mandate is to work with other SAR organisations within fire rescue, police, the military and Parks Canada to provide SAR services to members of the public in difficulty, in areas that other emergency services are not trained to reach. SAR teams nationally are staffed by 18,000 trained volunteers, with some of the busiest teams in the country located in BC. There are 80 teams comprising the BC SAR Association (BCSARA), grouped into 13 areas, responding to over 1700 incidents per year. Appendix C is a map showing the different SAR regions in BC. The area focused on in this study is the South West Region, also known as the Sea to Sky Region. It encompasses the area from Kent Harrison in the East, to Powell River in the West, and from Surrey in the South to Pemberton in the North. There are 15 teams included in total. In summer 2018 (1 April – 30 September), SAR teams in the region responded to 317 incidents. In addition, the City of North Vancouver, and Districts of West and North Vancouver Fire Departments also take responsibility for rescue incidents occurring closer to urban environments; the District of North Vancouver responding to approximately 150-170 incidents per year (B. Hutchinson, personal communication, December 2, 2019). In comparison, Yosemite SAR as part of the National Parks Service in the US, averages 200 incidents a year (Friends of YOSAR, 2019). Analysis of SAR incident numbers over a 20 year period has been conducted by Coquitlam SAR Team Leader Michael Coyle (Coyle, 2017) drawing the conclusion that the number of incidents is inversely proportional to population growth, and there has actually been a “50% increase in number of tasks per 100,000 people” (para 6).

It is impossible to comprehend how the outdoor recreation community would function without the services of SAR teams. Their willingness to voluntarily risk their own lives to save others is an invaluable service. According to a study in the USA, “without the presence of NPS personnel trained and willing to respond to SAR situations, almost 1 in 5 of all those requiring assistance could be a fatality” (Heggie & Amundsen, 2009,

248). One of the main goals of this research has been to provide valuable information about behaviour that can be used by SAR teams to reduce resource-spend where possible. SAR teams in BC consist of volunteers, and are supported operationally through provincial funding, but also rely on private donations to provide additional funding.

The risk that SAR teams put themselves in while performing their vital services was emphasized while this thesis was being written, when a volunteer with West Valley SAR in Southern California was killed while searching for a missing hiker (West Valley SAR Facebook, 2019). If anything can be done to reduce the numbers of potentially risky searches currently being undertaken by all SAR services, it would be a great accomplishment, and this thesis aims to produce meaningful recommendations to support their efforts.

1.6. Research questions

The preliminary research and creation of my thesis led me to the following Research Questions:

RQ1. How has the increased use of smartphone technology affected the behaviour of people hiking close to Vancouver?

1. How has the use of social media, either on smartphones or elsewhere, affected the number of people hiking?

2. How has the use of smartphone technology affected experienced people's hiking behaviour, particularly with regard to the reliance on smartphones as opposed to GPS or satellite linked technology?

3. How has the use of smartphone technology affected people going hiking's perception of risk?

RQ2. How has the increased use of smartphone technology affected the rescue practices of Search and Rescue services?

RQ3. What can be done to improve the education of the public on the benefits and limitations of smartphone technology while recreating outdoors?

These research questions aimed to reach an understanding of the behaviour of outdoor recreators with regard to the use of social media and smartphone technology while hiking, focusing on whether perception of risk has been affected by the ubiquity of the technology available.

1.7. Methodology overview

To complete my research, I firstly conducted a review of the literature written about risk perception, outdoor recreation and technology, and Search and Rescue techniques. The review helped to frame my ideas and hone my focus on the relevant issues. Once those were identified, I then conducted in-depth, semi-structured interviews with key local stakeholders to assess the perceived impact of smartphone reliance, and identify any additional concerns that may be relevant to the study. Thirdly, I conducted online surveys using the Survey Monkey platform, specifically targeting people already interested in hiking, who were mainly sourced using social media. The full list of organisations and groups approached is included at Appendix D. Finally, I analysed SAR incident reports from 2014-2019 to quantify search activation numbers and information as to the type of responses that were required by SAR teams in the South-West region.

1.8. Significance

Previous ethnographic approaches to research on risk perception and the use of technology in wilderness situations (Borrie, 2000; Creyer, 2003; Haegeli & Probstl-Haider, 2016; Pohl, 2006; Pope & Martin, 2011) explore the expectations for rescue that users may have with smartphones, and studies of “Wilderness 2.0” (Stinson, 2016; Wageningen, 2018) give a fair representation of the positive and negative aspects of connection with nature. Recent social science research (Wood, Dixon, Rizzo, Schuback & Thamer, 2018) concerning public safety messaging and other forms of risk communication also examines methods to motivate people to take action to reduce personal risk, and makes recommendations for effective harm prevention.

By following an ethnographic research tradition this study builds on this literature by providing regionally specific information about the impact of smartphones on risk perception behavior towards outdoor recreation, as well as evaluating the impact of smartphone use on local Search and Rescue services. This has resulted in the creation

of recommendations for local outdoor recreation users, as well as the provision of information to SAR services and to other organisations that may impact the content of their staff training or public information, as well as their understanding of public safety needs.

1.9. Scope

The research undertaken for this project has been purposefully geographically limited, to specifically address the unique position of Vancouver with regard to its proximity to highly challenging hiking areas. Canada prides itself on its attraction to tourists and residents alike with its incredible landscapes and stunning vistas, and in Vancouver, the close proximity of the city to these picturesque activities means a large number of people can access them. By narrowing my focus to Vancouver, I have been able to identify a number of issues which are unique to this area.

Further, I have focused on hiking particularly. Other activities such as skiing, trail running, mountain biking and horse-riding utilize the same geographical locations, but as described above and supported by data from Stats Canada, hiking is one of the most popular activities for Canadians. One study that focuses on risk prevention for hikers particularly states that “we focused on hiking because it is typically found to be the most common activity associated with outdoor recreation injuries and illnesses” (Kortenkamp 2017, p.68-69). As an activity that requires very little equipment to be able to enjoy, it is one that almost everyone can do, resulting in much higher participation rates than something like mountain-biking which involves significant investment.

This study focuses on the impact of social media and smartphone technology on outdoor recreation behaviour. It has not included in-depth analysis of other factors that may have increased volume of people on trails, such as: increased tourism; the encroachment of urban areas into wilderness along with higher urban population; or funding cuts. These factors may all be sources of increasing pressure, but were beyond the scope of this research.

I focused my interview and survey questions around day-hikes, which I estimated would be the most popular type of hiking, and also can include varying degrees of difficulty within them. Anecdotally, it has also been people who are on day-hikes that are

perceived to be the most prolific exponents of the 'Instagram effect', because the hikes that produce the most popular images are usually accessible from Vancouver within a day's return, such as Quarry Rock, Tunnel Bluffs, or Joffre Lakes. Day hikers are also more likely to require assistance from SAR teams, as they require less equipment and therefore less preparation than for longer, multi-day hikes, and therefore are less likely able to manage if difficulties are encountered.

The scope of the online surveys provided a much larger data set than could have been reached by in-person surveys at trailheads. More information regarding the methodology for data collection is contained below, but in summary, I contacted local Facebook and online groups related to hiking, and asked them to share the survey with their members or on their Facebook pages. By utilising online surveys I received over 1200 responses. One of the benefits of this is the ability to draw more accurate conclusions, as the results should demonstrate more supported behavioural trends. The participants are also from a wide geographic sampling site, favouring hiking locations across the Lower Mainland, from Pemberton to the Coquihalla region. The wide scope will support conclusions inferred from behaviour that is not just localised to the North Shore, giving more credence to the behaviours exhibited if they occur at other locales. In addition to this, the geographic focus means that the data analysis of incidents includes all of the South West SAR teams.

Finally, the method for eliciting survey responses meant that contact was made with a wide number of organisations, Facebook groups, and services. The survey response demonstrated widespread support for research around hiking, in particular to aid in improving knowledge for SAR teams, and created an opportunity to share the results of the research project with the same organisations contacted to request assistance, sharing any recommendations for changes in behaviour or tactics to a very wide community. In fact, a number of organisations made sure to request the results of the project as it had sparked such connection with relevant issues, and I will be sharing the results where requested.

Chapter 2. History and Literature Review

2.1. Background

In the era of post-industrialisation in the late 18th and early 19th centuries, outdoor recreation was more formalised as the 'wilderness' was less accessible, so for the majority, activities were closer to the cities in gentle countryside (Elliott, 2006; Hansen, 2019). National Parks were first created in the US in 1872 with Yellowstone, followed in Canada in 1887 with the Rocky Mountains Park Act (now Banff National Park). These legal protections were methods to protect these areas of outstanding natural beauty from industrial development, and in Canada, areas of wilderness are contained within them, and are not separated by legal definition. In the US, it was necessary to extend National Parks to include the further protection of wilderness itself against the machinations of expansion, namely the motor car, to create "sanctuary" and to encourage conservation (Friemund & Borrie, 1998, p.21). This, and the creation in Canada of the National Parks Act maintained the original premise of outdoor recreation, that it be an escape from the rigours of city life. The US Act describes wilderness rather poetically as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (The Wilderness Act, 1964, 1131 (c)). This legal separation of man from nature has been key for the preservation of such areas, and creates this 'sanctuary' away from urbanisation. Shultis and More (2011) found that at the time of the creation of the National Parks, US and Canadian governments wanted to increase attendance in Parks, because they believed it would lead to public appreciation, which in turn would lead to increased political support (p.111). This promotion by governments of the lure of National Parks proved successful in the first half of the 20th century, but in the latter half, the numbers went into decline.

One of the reasons given for this decline has been the influence of technology. Originally during the industrial revolution this meant the moving of the population from the countryside to urban centres, and more recently has encouraged people then to remain at home, one theory suggesting that this was due to the appeal of television and video games (Richardson, Hussain & Griffiths, 2018). In this century, the portrayal of nature in the media changed through the 1960s where it was presented as a resource which could be "controlled and exploited," to the 1990s which amended the discourse to

represent it as “fragile, but also potentially vengeful, and as deserving of respect and protection” (Hansen, 2019, p.110). This rhetoric was particularly prevalent in films by Disney, which “essentially reinforced and reworked the romantic view of nature from the 18th and 19th centuries to engage with, accommodate and reinforce American cultural values of the 1950s” (Hansen, 2019, p.118). In combining these analyses, perhaps the attraction of watching nature documentaries on television offers one explanation as to why Park visitation dropped in this period. Another reason could also be the development of indoor recreation opportunities and community parks in areas of high urbanisation. The suggestion that in general, people are less likely to connect with nature as a result of media technology; that they would rather watch television than go out for a hike, is an interesting one in the face of the position that has now been understood, that technology is inspiring and enabling people to pursue outdoor recreation, and demonstrates how quickly public opinion can change.

Data from Parks Canada somewhat supports this general downward trend in the 1980s and 1990s, as shown in Table 2 of visitation numbers to National Parks:

Table 2: Visitor numbers to National parks from 1990/91 to 2008/09.

Year	Canadian Population	Parks Visitation
1988/89	26,795,383	12,390,775
1989/90	27,281,795	12,703,666
1990/91	27,697,530	12,516,778
1991/92	28,031,394	13,693,354
1992/93	28,366,737	unknown
1993/94	28,681,676	14,169,843
1994/95	28,999,006	15,319,761
1995/96	29,302,091	15,385,828
1996/97	29,610,757	14,684,145
1997/98	29,907,172	14,904,140
1998/99	30,157,082	15,696,158
1999/00	30,403,878	16,260,557
2000/01	30,689,035	unknown
2002/03	31,021,251	12,576,695
2003/04	31,676,077	11,967,806
2004/05	31,989,454	12,355,521
2005/06	32,299,496	12,911,531

Table: Data from Shultis & More, 2011, p113.

This table shows that there were high points for visitation in the early 1990s and in 1999/2000, but that for the next nine years that visitor numbers dropped. In a wider context, Shultis and More (2011) refer to other studies that confirm that this trend was

not limited to Canada, and "concluded interest in parks and nature had declined worldwide" (p.112).

In reviewing available data from the last 13 years, similar fluctuations have occurred. Combining statistics from Parks Canada and BC Parks specifically since 2006/07 show the following visitor numbers:

Table 3: Visitor numbers for Canadian National Parks, BC Parks, and South Coast BC Parks specifically.

Year	National Parks[1]	BC Parks[2]	South Coast[3]
2006/07	13,050,538	16,942,850	6,279,242
2007/08	13,141,831	17,081,091	5,956,414
2008/09	11,921,251	17,067,285	5,982,337
2009/10	12,282,172	17,532,494	6,301,665
2010/11	12,548,933	17,132,601	5,294,655
2011/12	12,529,627	16,813,262	6,096,412
2012/13	12,722,828	18,215,709	7,123,245
2013/14	12,723,434	18,692,209	7,454,135
2014/15	13,520,886	18,573,802	6,715,298
2015/16	14,469,008	20,882,051	7,663,351
2016/17	15,449,249	21,890,900	8,742,210
2017/18	16,833,896	22,789,300	9,538,518
2018/19	15,898,110	23,015,600	9,700,000

Data from Parks Canada (2019) and BC Parks (2019) for April 1 – March 31 each year.

This table shows that for National Parks, 2007/08 was a high point, then numbers reduced until 2014/15, and since then increased steadily to the high point of 2017/18. Parks Canada's Departmental Plan (2019) confirms that, since "2012, visitation to Parks Canada places has rebounded following a decade of decline...With free admission offered during the Canada 150 celebrations, visitation reached a record high in 2017–18 with 27.2 million visitors" (para 35). It can only be expected that after that high point that in 2018/19 visitor numbers decreased again, but only slightly.

In comparison, BC Parks has seen a steady increase in visitors, excepting 2011/12. In considering the South Coast region specifically, which aligns with the Sea to

[1] National Parks include: Banff, Jasper, Yoho, Kootenay, Waterton Lakes, Mount Revelstoke, Glacier Mountain Parks, and Fathom Five, Saguenay-St. Lawrence Marine Conservation Areas.

[2] BC Parks include all regions in BC: Kootenay Okanagan, Nirthern, South Coast, Thompson Cariboo, and West Coast. Figures are for Day Use Attendance.

[3] South Coast Region includes 48 BC Parks from the Coquihalla to Pemberton areas, and the Sunshine Coast. Figures are for Day Use Attendance.

Sky BCSARA region, numbers have increased steadily, apart from a small fluctuation in 2014/15. Apart from these irregular fluctuations, it is fair to concur that the trend in visitor numbers in BC Parks have been steadily increasing.

One of the reasons for this increase, and one of the key premises of this study, is the impact of smartphone technology. In a study on the effect of technology on outdoor recreation, Ewert and Shultis (1999) describe the five stages of experience as "anticipation, transportation to the site, on-site activities, transportation from the site, and recollection" (p.3), which can be applied to any experience, at any time. They clarify that "[e]ach of these stages have been indelibly affected by technological change. Recognizing this, we believe technology influences backcountry recreation participation in five distinct yet interrelated categories: access and transportation, comfort, safety, communication, and information" (p.3). When considering the impact of technology on outdoor recreation, these five areas are therefore key for identifying the effect of the behavioural changes of visitors, to be discussed further below. Ewert and Shultis' model of the role of technology on outdoor recreation, at Figure 3 below demonstrates how technology affects each stage of the activity.

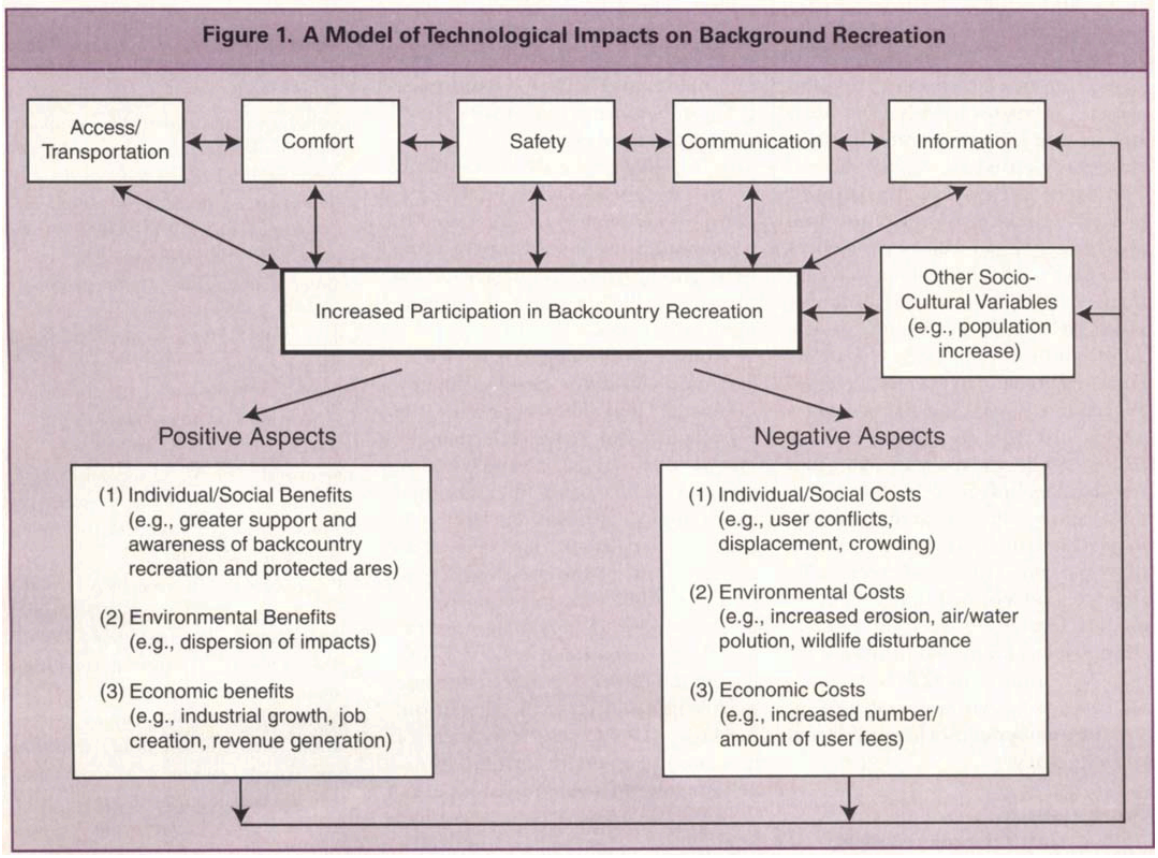

Figure 3: Model showing impact of technology on background recreation
Image: Ewert & Shultis, 1999, p 7.

If we imply smartphones as the technology here, its role in every aspect can be seen to increase participation. Access and transportation could include mapping applications, car sharing applications, and the ability find locations. In studies that took place before the advent of smartphone technology, the reliance on technological equipment to ensure success was demonstrated in an extreme example; summiting Mt. Everest. This study by Berger and Greenspan in 2008 reviewed a blog produced by a Canadian team attempting to summit the highest mountain, and revealed that the dependency on technology such as Blackberrys, both allowed for the team to make the attempt and record it, but also that the dependence on the technology was like an “addiction” (p.102). Tellingly, the analysis also suggested that “tourist climbers” with access to funds to purchase the equipment were able to reach the summit, when before technology such as satellite phones, lightweight climbing gear and oxygen tanks were available to them that they would otherwise not be able to be even remotely as successful (p.99). This demonstrates that technology is allowing for inexperienced people to access areas that previously would be out of reach.

Many studies in the 2000s focused on the potential negative impact of the cell phone on outdoor recreation, which were mainly Blackberrys. One study, which reviewed a ten year period of SAR incidents in Yosemite, found that calls for rescue were increasingly conducted by cellphone in the period from 1990 to 1999, which gave SAR members concern over the rise of ‘‘cell phone vigilantes” (Hung & Townes, 2007, p.114), reminiscent of the description of callers as ‘Yuppie 911’ referred to previously. At this time, first and second generation cell phones did not have GPS technology which made it challenging for emergency responders to determine the caller’s identity and location, relying on satellite towers to get some idea of where they might be. The belief that, due to technology, the ability to call for rescue instantly has increased the calls for rescue, in some circumstances which would otherwise not require it was one of the main drivers for Pope and Martin’s study, and this research follows in this tradition.

In 1998, questions about the potential of emerging computing and cellular technologies at the time have real poignancy for this study today. Questions such as “How will the wilderness experience change as a result of increased technology?…Will there be a place in 20 years’ time where one can completely escape from industrialized society?...Will people be held accountable for the absence of a cell phone if an emergency arises?” (Friemund & Borrie, 1998, p.22) have all informed this research. As we are now past the 20 year time period since their research, this project seeks to answer some of those questions. As these researchers were looking at the implications for the future, we are now here, and so now turn to review the current position.

Much of the current debate on the effect of technology on wilderness, asks to what extent it can still be ‘wild’ if we are so supported while exploring it. For example, hiking the Pacific Crest Trail (PCT), known as one of the most remote and challenging trails in North America, has been hugely altered by the use of technology. The balance between using technology as a tool to facilitate a safe and supported hike while on the PCT, and it becoming a distraction from the hike itself, is seen by some researchers as being the responsibility of Park Managers. Martin (2017) demands that they “embrace such technology as long as it serves to enhance visitor experiences, but guard against technology becoming the focus of the experience to the point of visitors not engaging directly with the natural and cultural resources that are supposedly the reason for their visit in the first place” (p.100).

Martin's challenge to managers, if not directly, then by necessity, has been taken up by Parks Canada. Their mandate states that they are attempting to make it easy for visitors to access information about planning their visit to the Parks, through apps and a website which includes a plethora of information Their reason is to "foster the stewards of tomorrow—people who know and care about these irreplaceable treasures" (Parks Canada Mandate, 2017). In embracing the opportunities available in using technology, Parks Canada is encouraging visitors who engage with technology to visit, and thereby maintain the increase in number of visitors to the Parks as discussed previously. They are relying on one of the great benefits of technology; an easily accessible means to find useful information. By capitalising on that and encouraging users to participate using their app and website, Parks Canada can encourage a combination of the inevitable use of technology and with the health benefits that come with engaging with nature to maximise Parks visitors. Parks Canada's mandate continues to refer to their focus on embracing technology, as a future goal in their marketing, as stated in their 2019-20 Departmental Plan:

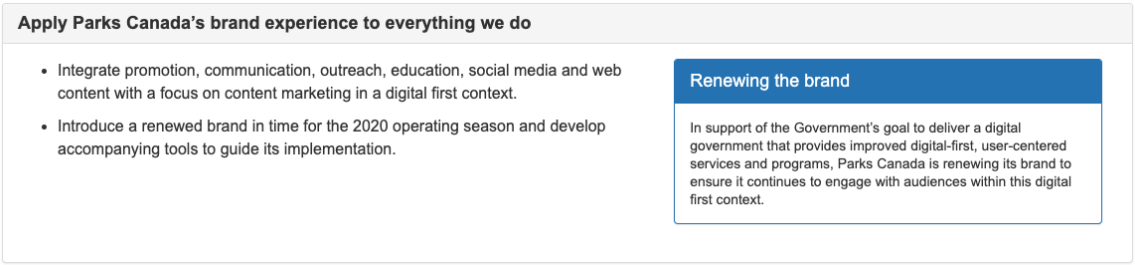

Figure 4: Screenshot of section of Park's Canada Departmental Plan.
Parks Canada Departmental Plan, Departmental Result 3

In reviewing the literature regarding the background to technology and outdoor recreation, trends in behaviour indicate that technology is having significant change in outdoor recreation, seen in the number of visitors to Parks, and interactions with the wilderness encountered. Once people are recreating outdoors, their subsequent behaviour is also affected by technology, and we will now turn to discussions as to how that behaviour impacts risk perception.

2.2. Further risk perception theory

We have already reviewed some of the foundations of risk perception theory, but here we look further into where risk perception, technology and outdoor recreation intersect. Some of the key elements of risk perception while recreating are cultural, social, and experiential factors (Chamarro et al., 2019). The cultural positioning of an activity itself is often a contributing factor to the choice to partake in it, and as such, the decision to go hiking may be related to it as a "publicly acceptable activity", and not something highly adventurous (Ewert & Hollenhorst, 1997, p.23). With certain hiking destinations being highlighted through the 'Instagram effect', the public acceptance factor is increased, and therefore it becomes more attractive to people as an activity, with less risk perceived as being associated with it. Leiss and colleagues referred to this as 'familiarity' (O'Gorman et al., 2003, p28-9), as discussed earlier in section 1.3.

Beyond the idea of familiarity is that of aspiration, where idealistic images create a desire in the viewer to emanate the same experience. In these scenarios, the influence of mass media on risk perception can manifest in rather dramatic ways. Skydiving, for example, has been cited as one way that people can add drama to their lives to live up to a desirable life, created by "the mass media, social specialization and technology" (Creyer, Ross & Evers, 2003, p.242). When Creyer and her colleagues were writing in 2003, the mass-media of movies, books and television was compelling enough, and I believe it is logical to now extend the assessment to include social media. In an aspirational way, for any activity, seeing it be glamorized and producing positive emotions can incite the viewer to wish to copy that behaviour, be it skydiving, or hiking. To exacerbate the effect, the labour needed to achieve the image is often downplayed, producing images that appear effortless. While this may be a tactic employed in many advertising campaigns to increase the apparent value of the subject, when it is applied to the images produced about hiking destinations, the impression is given to the follower that it is easy to attain a similar image, as suggested earlier. As an area for further investigation this offers a myriad of interesting avenues for communications studies, as well as psychological and behavioural fields.

Hiking may be seen as less risky than skydiving, but a ten-year review of SAR incidents in Yosemite concluded that the perception of hiking as 'safe' is actually somewhat of a fallacy, as "from a SAR standpoint, ''safe'' activities such as hiking have

a higher case fatality rate than rock climbing and scrambling" (Hung & Townes, 2007, p.115). The gap between the view of hiking as safe, and the reality of the dangers associated with it can also be compensated for by other factors, such as the social context. One study on the reasons that hikers ignore warning signs attributed group activity as influencing behaviour, that if the hiker sees rule violators ignoring rules, they are more likely to follow, even if the violators are strangers (Kortenkamp, 2017), the social context therefore allowing for rule-breaking. We probably all remember parental admonishments such as 'would you jump off a cliff if your friend did?' This research shows that yes, you probably would. Further, following Leiss, Graffy and Booth (2008) refer to the modern phenomena of public participation in decisions that affect them as having impact on risk perception (p.135). In resisting being told how to behave and what to do, i.e. by warning signs or boundary ropes, people are rejecting scientific and authoritative advice as being not relevant to contemporary social problems, and therefore blanketing all warning messages as optional. While that probably isn't true for all people going hiking, it may factor into why some individuals choose to ignore warning signs and boundary lines, something confirmed later in the analysis of interviews at section 4.1.2.

One factor that contributes enormously to the perception of risk is the amount of experience someone has with the activity. Studies have demonstrated that the more experience a person has with an activity, the more aware they will be of the risks associated, just as the opposite is true. Risk perception therefore is a learned behaviour, acquired rather than known innately (Creyer et al., 2003). As a result, experience can increase confidence, which also can be said to factor into a person's ability to perceive risk. Whether the confidence arises from valid grounds or not can only be determined on a case-by-case basis, but according to research of expert climbers, in less favourable conditions, confidence remains high because of their experience, but perception of risk *increases* here due to the decline in conditions (Chamarro et al., 2019). Where dangerous situations can arise is where false confidence reduces risk perception, at even the most innocuous of circumstances. Where technology is used as a substitute for experience, confidence is increasing in a false way. For example, where the hiker is following a trail on a smartphone application instead of using traditional wayfinding skills, when the technology fails, the person is found to be ill-equipped to manage the consequences.

One of the assumptions about the demographic affected most by relying on smartphone technology is that they are mostly millennial generation or younger, who are familiar with technology and use it naturally. Canadian mobile usage statistics support this, as 18-34 year old's spend the most on internet and mobile communication services compared to older generations, although admittedly only by a small percentage (Canadian Radio-television and Telecommunications Commission (CRTC), 2019). As younger people grow up as 'digital natives', there is a propensity to understand technology as increasing their degree of safety, which gives them confidence. A 2013 study on young people (13-19 years old) in the UK and USA explored questions as to the effect on behaviour having a cellphone with them has, particularly whether they are more or less likely to explore beyond their familiar surroundings (Leyshon, DiGiovanna & Holcomb, 2013, p.590). Researchers found that having a cellphone equipped with GPS encouraged 80% of their dataset to feel comfortable exploring beyond their home because of the reassurance of a "lifeline" that the cellphone offered, as they would then always know where they were. It is clear that as technology is ubiquitous, the younger generations in particular need to be educated about the consequences of it failing or being less reliable in outdoor recreation scenarios. It is beyond the scope of this study to determine the degree to which smartphones are being used in wilderness by young people; the surveys conducted were restricted to adults, but an area for further study could be to review the degree to which smartphones are used while recreating outdoors according to age. For example, a scale from just using the phone's functionality to navigate, to using it to record the experience, to listening to music while hiking etc, could produce greater understanding of this issue.

One useful suggestion on how to produce effective risk communication involves framing the risk as the "decision maker's conception of the acts, outcomes, and contingencies associated with a particular choice" (Creyer et al., 2003, p.241), while recognizing that these are all context-dependent. Messaging therefore needs to be effective for the potential decision maker around the use of technology during outdoor recreation so that the process of risk perception is still achieved and completed by the user, as discussed earlier in the study by Leiss (O'Gorman et al., 2003, p36). In so doing, one of the key areas that exists as having potential for influence is in social media.

2.3. Social media influence

In creating this research project, one of the premises was that social media, and the 'Instagram effect' has had significant impact on the numbers of people hiking near Vancouver. When reviewing the available literature, the primary texts are from either a resource management perspective, or focus on tourist behaviour which demonstrate how social media and outdoor recreation relate. One study on land management epitomises the positive and negative aspects of social media representations of outdoor recreation succinctly:

> People use social media to share their wilderness experience, which results in people learning about the beauty, adventure, and fun wilderness experiences as well as probably bringing more visitors into wilderness. Social media is also used to organize trips into wilderness by groups, sometimes spontaneously. However, social media has also led to a number of problems for wilderness managers. For instance, social media posting of "amateur" videos may blur the line between appropriate information sharing and commercial use that must be evaluated for its role as the "minimum necessary" to meet the purposes of a wilderness. (Wick, 2016 p.415-6)

There are certainly parallels that can be drawn with the area in California focused on by Wick, and that in Vancouver, as the behaviour observed anecdotally is similar. Firstly, Wick acknowledges the positive repercussions of the use of social media, and frames it as a learning opportunity. He also concurs with the premise that social media has brought more people into the wilderness, confirming that this behaviour is observed in another part of the world as well as in Vancouver. Interestingly, the negative effect that Wick sees is the effect that videos posted have on the status of the area as 'wilderness.' The study elaborates that this statement is in response to videos being posted of advertisements being filmed in the wilderness to showcase products for sale, which is seen as detrimental to the character of a location as wilderness (Wick, p.416). The philosophical debate about what constitutes a wilderness is discussed below in section 2.4, and the questions raised with regard to the role that social media plays in it are really fascinating, especially as smartphone technology becomes so much a part of people's experience of it.

When looking at the rationale for people using social media as a part of outdoor recreation, one of the motivations for doing so is the value of representing your experiences after the fact on social media, as discussed earlier in section 1.2. Studies

have referred to the representation on social media as authorizing and authenticating the experience for the participant, making it *more* real (Kane & Tucker, 2004, p.231). Social media widens the reach of our interactions and facilitates the sharing of experiences beyond our existing social circles, which heightens the degree to which those times are validated. If the reality of the experience is only fully realized in comparison to other people's reactions as Kane and Tucker theorize, the appeal of sharing such times on social media is understandable. Previously, this could take the form of either writing about it in a letter in the 18th century to our relatives, but now it is by posting pictures of the experience on social media and waiting for the appreciation to flood in. The role of social media in qualifying our experiences of the world is certainly one of the most valuable roles that it plays, and understanding that it is so goes some way to explain why it is such a motivation for people to travel to beautiful destinations to get the images that will elicit the validating response from their audience. One of the more recent updates to Instagram included the removal of the number of 'Likes' a post has received (Paul, 2019). It will be interesting to see in future research how the removal of those numbers affects a user's motivations to post, and also the feeling of validity accomplished.

One aspect of social media data that is useful for research is its use as a replacement for other means of data collection. There are a number of studies which have tested the validity of social media use as a proxy for visitor numbers, with successful results of using Twitter, Instagram and Flickr when compared to testing in-person (Hausmann et al, 2018; Palomino, Taylor, Göker, Isaacs & Warber, 2016; Richards & Friess, 2015). One of the benefits of this includes less resources spent conducting in-person surveys, and therefore more time evaluating how use impacts the area itself, but also it allows for comparison of similar sites or phenomenon around the world. A more complete analysis of data can only lead to more accurate conclusions, and so the potential for this element of social media is far-reaching. There are also a number of studies that focus on social media's use in emergency warning systems and evacuations, but these are beyond the scope of this study.

As stated at the beginning of this section, the role of social media in outdoor recreation is not a widely studied area in communications studies, however the research that arises from resource management and tourism studies are key indicators for a communications perspective on how social media is used, specifically how the use of technology impacts the experiences of outdoor recreation.

2.4. Impact of technology on outdoor recreation

Firstly, the differences between forms of technology on experience is necessary to clarify here, as not all technological impact is the same. In considering the differences between using smartphones and having a lighter backpack for example, Dustin, Beck and Rose (2017) suggest that "unlike other backpacking equipment, smartphones do not bring hikers closer to nature. On the contrary, they make it easier for hikers to distance themselves from nature even as they are immersed in it" (p.29). For the purposes of this study, the focus is on the impact of smartphones specifically, and not the technology of modern equipment such as lighter tents, more efficient stoves and similar modern conveniences that also often augment the wilderness experience.

Studies show that time spent in nature is restorative (Kaplan, 1995), and if people are focusing on their technology rather than the experience itself, the benefits of that restoration could be compromised. In a recent study of people attempting the Pacific Crest Trail, it was found that on average, hikers spent "3 hours 23 minutes" (Amerson, Rose, Lepp & Dustin, 2019, p.11) on their smartphones per day, prompting the concern that, by spending that time on their devices, what experiences are they displacing on their journey?

One of the more controversial suggestions that some researchers have made involves enforcing some kind of limit on technology's use, suggesting that it reduces the 'traditional' or 'authentic' wilderness experience (Shultis 2012; Wick, 2016). The studies are specific about the form of technology they refer to: Shultis (2012) defines technology as "recreation technology…such as cell and satellite phones, GPS units and web-based applications on wilderness recreation" (p.110), and Wick (2016) as the technology used while recreating outdoors such as cameras, websites containing information about the area, and mapping applications (p.415), i.e. technology available through use of a smartphone. Both recognise the safety benefits that technology can add as one of the reasons why it would be difficult to enforce a reduction in technology, but denote that it creates problems too. Wick suggests that the use of social media for promotional reasons by influencers changes the very meaning of 'wilderness' (p. 416), and Shultis (2012) poses that recreation technology creates a barrier between the user and an authentic experience of wilderness. Both ascribe to a deterministic view of how technology is creating a new relationship between society and nature, neither positive

nor negative, but clearly forging new ways for people to experience nature and wilderness that has not been possible before.

In suggesting a way to limit the effect of technological determinism for outdoor recreation, Pohl offers the following:

> In distinguishing between essential and diminishing technologies, we need to examine a device's potential impact on our experience, and choose only those technologies which help us pursue the goods internal to the practice of backcountry recreation. Our decisions shape our immediate experiences and also affect our ability to exercise the virtues inherent in the practice of wilderness recreation. (Pohl, 2006, p.157).

Pohl's reference to the 'virtue inherent' in outdoor recreation refers to the idealistic notions surrounding the activity as a refuge from modern life. The resistance to smartphone technology's potential to enhance the wilderness experience is fascinating, and offers an insight into the difference between generations that Leyshon and his colleagues (2013) had identified, as the more mobile forms of technology are immediately seen as antithetical to a wilderness experience by Pohl.

One of the common themes in the criticism of technology is how it reduces our ability to use traditional skills. In significant work on how the use of GPS affects brain function, Javadi and colleagues (2017) found that the function of the hippocampus is reduced when not stimulated by wayfinding, and that the brain does not then learn to predict future paths when faced with unfamiliar routes (p.7). The repercussions for relying on smartphone navigation, and our expectations regarding responses learned in the city to the backcountry is one of the key reasons that SAR teams are required more frequently now, and have led to some clear divisions as to the positive and negative aspects of technology's role in outdoor recreation. Similarly, and here I am alluding to other forms of technology but with a similar reasoning, Borrie (2000) makes the suggestion that, by relying on fuel stoves rather than building campfires, visitors are "losing the desire and ability to deal with the uncertainties of wilderness on its own terms" (p.87). Further, Pohl (2006) suggests that when using a gas stove to cook rather than a campfire, users are exchanging the "patience and creativity" necessary for adapting to cooking over a fire, for "quicker results and easier solutions" in using technology to perform the same task and in doing so, "our sense of personal accomplishment becomes compromised" (p152). This could be said to be one of the

widely acknowledged motivations for undertaking outdoor recreation in the first place, and therefore extrapolating the replacement of campfires with stoves to maps with smartphone technology, technology is clearly reducing some of the benefits that outdoor recreation experiences can provide.

For young people in particular, "[r]oad maps, once commonly available at gas stations, have been made obsolete by map applications such as MapQuest and Google Maps. These digital versions were viewed by the young people as 'more up-to-date', scalable, 'free'…and 'more easily accessible' than the traditional paper versions." (Leyshon et al., 2013, p.596-7). While Leyshon's study looked at road maps it seems logical here to include topographical maps typically purchased for hiking, and the same effect occurs that these paper maps are becoming scarce as they are replaced with online versions. The same study describes that "the revolution in mobile technology has caused the 'death of distance' and created a borderless world through space–time compression. This emphasises Russell's (19, Falmouth, UK) point that ''with a GPS mobile phone, you're never really lost,"" (Leyshon et al., p.600). Presumably, Russell from Falmouth has never had to contend with that mobile phone running out of battery while in a wilderness scenario. However, the 'death of distance' referred to resonates with the instantaneity created by smartphone technology.

In considering whether there is a way to reconcile the dichotomy represented by wilderness and technology, the resistance to the presence of smartphones in outdoor recreation seems futile. Shultis describes some of the key contradictions here:

> In our consumer society, there seems to be a discord between the discourses which portray recreation technology as wholly positive, necessary accoutrements to the modern wilderness experience, enabling recreationists to pursue activities, settings and experiences beyond the current reach of visitors in greater safety, comfort and ease; at the same time, the love-hate relationship between society and technology is brought into the wilderness, and the wilderness becomes both a refuge from technology and an experience activated and maintained by increasing amounts of technology. (2012, p.116).

The differences between pro-technology and anti-technology attitudes were recently compared in two studies, and found that "visitors largely viewed the use of technology in pursuit of outdoor recreation favourably. Most subjects in both studies said that technology…increased feelings of safety and security" (Martin, 2017, p.99). The

safety element of new technology is key to people's positive attitudes towards it, particularly the comfort for both user and family at home to be in contact. One of the reasons that technology has become synonymous with outdoor recreation is the safety element and reassurances it brings to those who do not have the skills, enabling them to enter the wilderness when they previously would not have felt equipped to do so. However, where the technology stands in the place of learned experience and survival skills, when it breaks down, again the user is left needing help, potentially with no means to obtain it.

The appeal of smartphone technology can also be understood as enabling a higher degree of experience, that in "one sense, while many recreationists use technology to visit the back-country, an increasing number of recreationists visit the backcountry to use their technology" (Ewert & Shultis, 1999, p.8). This has been a historical trend where previously painters and photographers would enter into wilderness to record their experiences in those mediums, but now as smartphone technology allows anyone to take higher quality pictures the access to presenting experiences this is so much wider. As suggested in the introduction, Choe and colleagues define smartphone users as "active information creators" (Choe, Kim & Fesenmaier, 2017, p.431), and this change from passive to active is having a great impact, as the numbers of people pursuing outdoor recreation are increasing, and as a consequence, so are the number of SAR incidents.

So far, the benefits of using technology have been focused on the individual, the user, but there are also benefits for Park Managers. For example, improving "poor cell phone and internet connection" will appeal to new audiences, and encourage increased visitation in Parks (Gimple, 2014, p.3). As described earlier, increased visitors mean increased support for Park Services, so there is a clear rationale for wanting to retain those existing visitors, and entice more to come. Gimple goes on to refer to the benefit directly for Park Managers, as "[i]ncreased technology in the parks can also curb the unruliness of visitor behavior, as was the case when park visitors were caught urinating in Old Faithful due to cameras installed nearby" (p.3). The benefit therefore from having cameras installed, as with any kind of surveillance system, activities can be monitored from a central place, meaning Park Rangers can be directed where they are most needed, saving resources.

As well as increasing connection, there are other examples of Park Services using interactive technology to appeal to visitors. Parks Canada has developed two apps, one of which is designed to facilitate camping experiences and includes information on 'Camping Basics,' and another which acts as a Digital Tour Guide, which needs to be downloaded prior to entering a park. However, the reviews do not suggest either app is very popular. This may be a consequence of there being limited connection in parks, but regardless of uptake, the fact that the apps exist demonstrates Parks Canada's willingness to enter the smartphone technology arena and participate.

This dialectic between nature and technology is an ever-increasingly complicated one, as "technology has become conceptualized as the 'opposite' of wilderness despite clearly being a *sine qua non* of wilderness use" (Shultis, 2012, p.112). Shultis demonstrates the paradoxical relationship between the two; it would not have been possible to enter the wilderness at any point in history without some form of technology, it is just that the technology today is so very different than in earlier times, that it seems to represent more of a departure from nature than ever before.

One of the concepts central to the use of smartphone technology in any part of society, not just outdoor recreation, is how it changes us, and our behaviour to each other and to the world. Shultis (2012) refers to this function of technology, that "[u]ltimately, increased use of technology may change the very nature and meaning of the wilderness experience…What we want to do is changed by what we can do—technology never simply does what we tell it to, but modifies our notions of what is possible and desirable" (p.112). It is up to us to determine what is possible and desirable for our relationship with nature or wilderness, and how smartphone technology, in augmenting our outdoor recreation experiences, both achieves and disrupts that.

2.5. Nature connectedness

The health benefits of spending time in nature have been studied extensively since the 1980s (Schutte, Bhullar, Stilinovic, & Richardson, 2017; Ulrich, 1984), but predominantly from a Behavioural Science or Environmental Science framework. In reviewing the available literature on how smartphone use has affected time in nature, or recreation outdoors, we can understand the impact of such technology on our relationship with nature. In first establishing the basis of the relationship without

technology, one of the concepts suggested to explain this connection with nature is 'biophilia,' a concept introduced by E.O. Wilson in 1984. He suggested that since people originally evolved in nature, and that it is only recently that we have been so separated from it, that people still have an "innate need to affiliate with other living things" (Nisbet & Zelenski, 2011, p.1101). If we support this hypothesis that there is an 'innate need' to connect with nature within humans, we can also understand why the people are always drawn to nature as an 'escape' from their everyday pressures. Regardless of whether we support the hypothesis of 'biophilia,' it must be generally acknowledged that, for many people, the relationship with nature is a strong one. The implications for the benefits of such a connection are many, but primarily, those who do experience a connection feel a greater need for environmental protection and conservation (Amerson et al., 2019, p.10-11). I referred earlier to the benefits for National Parks that are associated with increased visitation, so for both an environmentalist, conservationist and cultural education standpoint, increasing connectedness to nature is vital.

In determining the extent to which smartphone technology impacts environmentalist and conservationist tendencies, there is little research evidence, presumably because the technology is so new (Richardson, 2018, p.109). There are a number of recent advocates for the benefits of smartphones, who counter long-held views that 'technology is bad' by equating a GPS navigator with a map and compass (Hitchner, Schelhas, Brosius & Nibbelink, 2019, p.355-6). However, their reasoning somewhat simplifies the issues, because while the use of either a map and compass, or GPS navigator can be said to be different versions of the same tool, it is the ease of access to both that is dramatically different. While anyone *could* buy a map and compass, reading relevant information on a map is not the same as using a GPS navigator on a smartphone. The map and compass demands skill and knowledge by the user for navigation, an active process, whereas a GPS navigator tells the user where to go, and where they are located, a much more passive process. It is this element of the smartphone technology that is so different from previous forms of technology and how the Communications studies-specific critique is so vital.

There are certainly some elements of more recent developments in technology including smartphones that have a much more easily demonstrated impact. Cameras are one of the primary examples, and taking pictures of outdoor recreation experiences is now much easier to do using smartphones. One of the benefits of this has been on the

environmental impact that hiking has, as taking pictures does not involve removing potentially sensitive wildlife as memorabilia (Wick, 2016, p.415). The 'leave no trace' movement and its principles of "Take only pictures, leave only footprints" (BC Parks, u.d.), have been widely advocated for across North America, and seem to resonate with outdoor recreationists. The extent to which new users adopt these same principles is unknown, but many parks and hiking trails use signage which emphasise these ideals.

When referring to the use of cameras particularly, and as the title of this thesis implies, it is the taking of selfies that is anecdotally one of the motivators for people to enter nature in increased volume than ever before. Richardson's study refers specifically to how selfie-taking affects nature-connectedness:

> "Looking more closely at nature connectedness and smartphone use, there were significant negative associations with time spent daily using a smartphone, selfie-taking, and [problematic smartphone use]. Regression analysis demonstrated that frequency of selfie-taking was the strongest predictor of lower nature connectedness, being significant alongside the known predictor of age. However, it should be noted that the selfie-taking data were significantly skewed by some more obsessive users. This compares with the frequency of taking nature photos, which was a significant predictor of increased nature connectedness. Time spent using smartphones everyday was a marginally non-significant predictor of lower nature connectedness." (Richardson, 2018, p.113)

Disappointingly, Richardson's conclusion here therefore, is that selfie-taking does not necessarily increase feelings of connectedness to nature. The repercussions of this for Park Managers in favour of increasing internet connection to entice visitors who wish to post-selfies during their activity, in the hope of encouraging support for the Park, are not positive. This certainly presents an area for further study.

The effect of smartphone technology on feelings of being connected to nature is a relatively recent area of study, and offers many opportunities for influencing its use and direction to a positive outcome. As this review has shown, scholars are often in debate about the merits and pitfalls of using technology, but they are all in agreement about its uptake and use by the vast majority of people recreating outdoors. The crux of smartphone technology's impact on outdoor recreation is its potential for being used effectively, without creating damage to either the environment or to the person using it.

2.6. Conclusion

This comprehensive literature review presents a substantial position on the current state of research about risk perception, smartphone technology and outdoor recreation. From early papers that foresaw the difficulties that technology might bring to the outdoor industry, before cellphones were as ubiquitous as they are now, to current research on the ways that social media enables connectedness to nature, this review sets a bright stage for this unprecedented research. Whilst academic study is beginning to focus on smartphone technology and its effect on outdoor recreation practices, the limited literature on the subject makes for exciting possibilities for new ground to be uncovered, and for this research to offer new insight into global trends.

Chapter 3. Methods

3.1. Rationale

To reiterate the rationale behind this study, the initial impetus came from first-hand and anecdotal experience of how behaviour of people hiking in Vancouver seems to have changed in recent years as a result of the increased use of smartphone technology and influence of social media. I wanted to find out if the impression that many people, including myself, had is correct, that social media use has increased the volume of people on the trails, that the use of smartphone technology has affected hikers' perception of risk, and the effect that has had on SAR resources.

In considering how best to answer the research questions laid out above in section 1.6, I needed to include input from the key stakeholders in the field, the hikers themselves, and data of SAR incidents. I determined that a mixed methods approach would be best. By applying both qualitative and quantitative strategies, I believed I could gain confirmation of the actual issues at play, and achieve an understanding of the size of the problem, ultimately resulting in recommendations to key stakeholders.

3.2. Previous studies

The seminal literature that informed this study, Pope and Martin's paper "Visitor Perceptions of Technology, Risk, and Rescue in Wilderness" from 2011, involves surveys of visitors to the King Range Wilderness National Park in California. As my research aimed to obtain a similar understanding of behaviour as Pope and Martin did, surveys were a natural choice for methodology. The geographical area that Pope and Martin focused on was a challenging area to hike in, leading to the survey participants being of an experienced category of hikers already. This resonated with my desire to understand behaviour of hikers in a similar demographic. A dissertation by Linford (2016) presented hypothetical scenarios to 524 students at Brigham Young University to determine if decision making in the backcountry was affected by having a cellphone. While his research found that there was *not* a significant difference if people had a cellphone with them or not, I wanted to examine behaviour of people actually hiking rather than hypothetically, and surveys were my preferred method to do so.

Studies by Boore and Bock (2013), Heggie and Amundsen (2009), and Heggie and Heggie (2008), provided data analysis models for analysing SAR statistics in Yosemite, Glen Canyon, and Zion US National Parks. Boore and Bock's study in particular contacted as many people who had been subject to an SAR call out as was possible, and requested information as to their impressions of the incident after the fact. This approach was beyond the scope of this project, but the statistical analysis of incidents was inspirational for the analysis of the available data as collected by BC Provincial SAR teams. Further, Hung and Townes' study in 2007, also of Yosemite, categorized incidents by year, month and day, by demographic, and locations to determine incident spread across a 10-year period. This categorization also framed the statistical analysis of SAR incident reports conducted.

3.3. Interviews

3.3.1. Interview procedure

The first action in the design of my research was to confirm that the impressions that I had from my own personal experience, and if the many anecdotes I had heard over the years from local residents and other hikers, were reflected by the key stakeholders in the field. Semi-structured interviews are an effective method for obtaining relevant data, allowing for the interviewee to elaborate on areas they have particular knowledge of (Babbie & Roberts, 2016). In using this method, I could draw on the knowledge and experience of experts in the related fields. In considering the main areas that I believed to be affected by the subject of my research, I interviewed representatives from emergency response organisations such as SAR and Emergency Management BC (EMBC), local authority jurisdictions such as Metro Vancouver Regional District (MVRD) and the District of North Vancouver, and public information providers such as AdventureSmart.

Due to my previous work experience, I had contacts with a number of these individuals already, and through my Senior Supervisor Peter Anderson, I was able to make contact with others. Further, in meeting with the representatives directly, I also asked if they had any suggestions for additional people I should speak to, a method known as 'snowball sampling', and if possible I also contacted those people. The people interviewed were therefore:

- Andrew Morrison - Search & Rescue Specialist, Emergency Management BC
- Mike Danks – Team Leader, North Shore Rescue
- Michael Coyle – Team Leader, Coquitlam Search & Rescue
- John Howe - Regional Director for BCSARA Sea to Sky Region, Chair of the Technical Sub-Committee, and Search Manager for Squamish Search & Rescue
- Sandra Riches - Executive Director & BC Coordinator for AdventureSmart
- Eddie Wood – General Manager for Mt. Seymour
- Dawn Hanna - Visitor Services Specialist for Regional Parks for Metro Vancouver
- Susan Rogers - Parks Manager, District of North Vancouver
- Wayne Maskall, Section Manager of Parkland, District of North Vancouver
- Patrick Murry – Park Ranger, District of North Vancouver
- Brian Hutchinson – Fire Chief, District of North Vancouver Fire and Rescue
- Representative from BC Parks
- Mike Andrews - Acting Director of North Shore Emergency Management

These interviewees were selected on the basis of either being experts in the field of Search and Rescue, of having direct contact with the issue at hand with day to day interactions with hikers, or having experience within BC Parks and local jurisdictions, and therefore would all be able to speak authoritatively and with direct knowledge of the area of research.

3.3.2. Interview protocol

The prospective interviewees were contacted via email. In each case, I emailed the subject introducing the topic of my study, gave some information about my background in the field, what I was hoping to achieve with the interview, and ultimately with the research project itself. I made the consent form available to them, the answers to my questions formed the documentation of consent. Once an interview was arranged, I sent examples of the types of questions I would be asking, and also explained that as a semi-structured interview, the format would be flexible so that additional questions might

be forthcoming, and also that there would be opportunity for the interviewee to raise any issues or concerns that they had at any time in the interview.

On arrival at the interview location, I asked for permission to record the interview, and set up the recording on my smartphone. I introduced myself, and the research project, and then worked through my list of questions, an example of which is included at Appendix E. I made handwritten notes, as well as recording the conversation. After the interview was complete and I had asked if they had any additional concerns or thoughts, I thanked the interviewee, and reiterated that if they had any further ideas that they could contact me again. Since the interviews, I have contacted all participants confirming their consent for quotations to be included.

3.3.3. Interview design

When interviewing, it is necessary to structure the questions in a manner that builds rapport with the interviewee, and allows for them to expand where necessary (Kvale & Brinkmann, 1996). The questions that the interviews were based around were largely the same for all interviewees, but were tailored where necessary to take into account different jurisdictions, or the different roles within the organisations. The interviews were relatively fluid, and as the conversations evolved I adapted the questions to cover all the areas of interest.

The first questions I asked were around the operation of the particular organisation that the interviewee represented, including their personal role, an overview of their operations, and how they either worked with SAR if they were not from a SAR team, or how their SAR team worked with other provincial teams or organisations that they interacted with. I then asked their opinions on behaviour of hikers, and if they believed there had been a change in the last five years. If the discussion did not already include it, I asked what they attributed any changes to. My next questions revolved around technology, and how they had seen the impact of smartphone technology affect people's hiking habits. Further, I asked them to consider if smartphone technology had affected their resources, how public-facing organisations were reacting to changes, and whose responsibility they believe it is to give information to the public.

I probed for their thoughts on rescue incidents, asked for data if they referred to statistics, and for their impressions on what had changed about the nature incidents in the last five years. I asked if people's expectations of rescue were realistic, or if there was a gap between the expectation and the reality, and while recognizing that they have a local focus, I asked if they believed Vancouver to be an atypical location for hiking behaviour, and if so, what they attributed that to.

Finally, I asked if there was anyone further that they suggested I should include in the interview process, and if there were specific questions that they would like me to include in the surveys. The questions often led to further discussions, and the interviews usually took between 30 minutes and an hour.

3.3.4. Interview data analysis using Nvivo

Following data collection, the interviews were transcribed and the content entered into the NVivo qualitative data analysis software. In order to identify key themes and areas of commonality across the interviews, a process known as 'coding' was applied. According to researchers, a code is "a word or short phrase that symbolically assigns a summative, salient essence-capturing, and/or evocative attribute for a portion of language-based or visual data qualitative inquiry" (Saldana, 2009). Nvivo is a useful tool for identifying codes across large datasets as it allows the user to create files with relevant themes, and to add, for example, quotes from all interviews to that file, known as a 'node'. In sorting the data this way, similar issues and trends can be easily identified, essential for achieving a deeper understanding of key concepts and concerns.

3.4. Surveys

3.4.1. Survey design

Surveys have long been utilised as a tool for collecting data from larger populations where it is challenging or too time consuming to observe directly, and can be effective for generating information about public attitudes and behaviour (Babbie & Roberts, 2016). As such, I deemed it a necessary technique for determining typical behaviour amongst people who hike, using information collected during the interviews conducted with key stakeholders. In following Pope and Martin's study (2011), I wanted

to examine behaviour of people with previous experience in hiking to determine technology usage, attitudes towards risk, and typical behaviour whilst hiking, so the questions were framed with an assumption that the respondent had previous hiking experience.

The design of the surveys aimed to frame the questions in a way that would not lead the respondent to a particular answer, but one that gave unbiased and accurate representations of behaviour. I used the information from some of the interviews to inform the surveys that would then indicate if the theories on behaviour recorded were what was actually being performed by hikers in reality. I included questions that required different types of responses in order to keep the survey interesting so that the respondent would be engaged throughout, and also gave room on some questions for the respondent to elaborate on their answer further in the form of comments (Babbie & Roberts, 2016).

SFU offers the ability to use Survey Monkey, a user-friendly and attractive-looking survey platform. I chose to use this platform because it is a popular survey-provider so respondents may have been familiar with it, and also because the program facilitates the design of effective questions, and includes the option to allow for comments to be added by the respondent.

3.4.2. Initial plan and change in methodology

I had initially planned to recruit participants in person, by standing at four trailheads in North and West Vancouver and asking questions directly. I had planned to use the trailheads for Quarry Rock, Lynn Headwaters, the Howe Sound Crest Trail at Cypress Mountain, and The Lions at Lions Bay. These were chosen to include trails of varying difficulties, with different methods of transport available, and anecdotally would attract varying types of experienced hikers from first-time and tourist hikers, to mountaineers. Specifically, I aimed to reach the differing demographics that could be hiking Quarry Rock, a 4km out and back hike to a popular picturesque view of Deep Cove and those hiking The Lions trail, a 16km very steep out and back trail to a challenging destination. By using this method, I would hopefully reach a cross-section of the hiking population.

However, circumstances meant that I was unable to complete any surveys in person, as I travelled to England for a family emergency at the beginning of July 2019 where I remained for four months. This included the entire period that I would have obtained a lot of data, summertime being the optimum time for hiking, and therefore I opted to conduct the surveys online.

3.4.3. Survey participants

To recruit participants online, I decided to utilise the very tool that I was researching; social media. I used Google to identify groups, clubs and organisations related to hiking in the Vancouver area. This included Facebook groups, Meet Up groups, and other organisations that had web presence. Organisations that I contacted and asked to share the survey link are listed at Appendix D. I emailed these groups, or used the messaging function on Facebook, explained the purpose of my research, and asked them to share the link for the online surveys to their group members via social media posts or email newsletters. I also emailed existing contacts in the industry directly, such as a number of the interviewees I had met, as well as my previous employers who I was aware had an email distribution list to ask for their assistance in sharing the link to the survey. In order to not fall foul of the Canadian Anti-Spam Legislation, I did not email any of the lists directly, the link to the survey was shared by administrators or members of the various groups and organisations. I also offered two prizes of $100 Mountain Equipment Co-op (MEC) vouchers if participants chose to submit their email addresses as an incentive to complete the survey, which most of the people sharing the survey highlighted in their posts and emails.

This method for recruitment proved to be very successful. I received a tremendous amount of support from the contacts I reached out to, and was amazed at the size of the response from participants. The survey was open from 23 August 2019 to 13 September 2019, and I received 1,254 responses, of which, around 1,150 were complete responses to the questions. I attribute a large number of responses to the support received from North Shore Rescue, who have a relatively large Facebook following. Their post on Facebook (NSR Facebook, 2019) sharing the link (shown below at Figure 5) was ‘Liked’ by 110 people, was shared by 37 people, and garnered 10 comments.

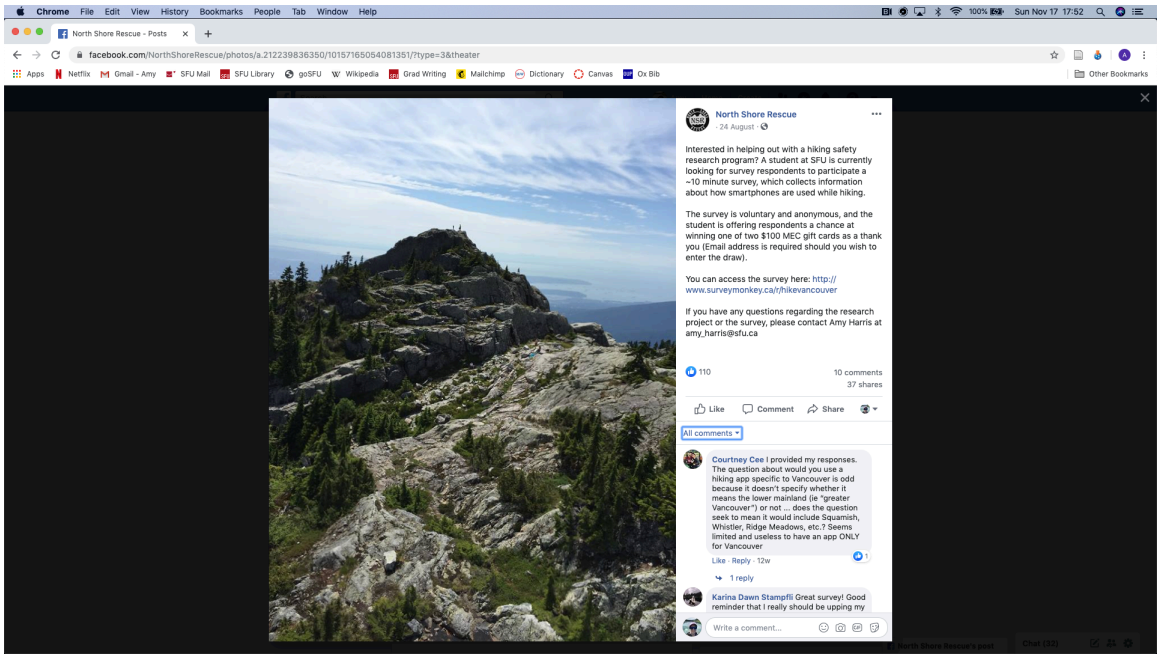

Figure 5. Facebook post from NSR sharing link to online survey.

Michael Coyle from Coquitlam SAR also shared the link to the survey on the popular social news sharing site Reddit, on a subreddit at reddit.com/r/vancouverhiking/ which furthered the reach of the survey.

3.4.4. Survey protocol

Once a respondent had clicked on the link to the online survey, they were firstly asked to confirm their consent. There followed 24 questions, ending with the option to enter their email address for the prize draw mentioned above. The full list of survey questions and responses are included at Appendix F. Once completed, the respondent was directed to a webpage expressing thanks for their participation.

3.4.5. Survey questions & reflection

Question 1 was to confirm the participant's consent, and answering 'Yes' was necessary before going forward to the survey questions themselves.

Questions 2, 3 and 4 were to establish demographics, in terms of where the participant lived, how old they were, and their gender. The answers to these questions enabled analysis in terms of location of popular hikes compared to where respondents live, their preferences for particular technology, and their risk perception.

Questions 5 to 9 were to establish hiking habits such as frequency, location, group size, and motivation. Within location, I asked for two answers – where the respondent hiked in a season allowing multiple answers, and also where they hiked the most, giving popular hiking areas in the lower mainland as pre-populated answers. These answers allowed comparison with locations from the SAR incident reports. The answer options to the location questions also allowed for an 'Other' option, which requested a specific alternative. This was helpful to show which other locations were popular, so could also be used as comparison with SAR reports. The answer options to the question about motivation for hiking allowed for a number of options that I deemed appropriate from my personal experience, and then also gave the option for comments for the participant to expand if necessary.

Questions 10 to 13 were regarding methods of communication, and use of technology to give information as to what forms are being used as primary communication, and also as back-up. For the latter, I gave the most popular forms of communication available as options, but also included an 'Other' selection and requested specifics to understand if there were other devices that I had omitted.

Question 14 asked respondents to self-select how much hiking experience they have on a scale of 1-10, with a guide of 1 being no experience, 5 being 1-2 years of hiking experience, and 10 as a highly trained mountaineer. This was partly included as a useful guide for my study, but also as it had been noted by Martin and Pope (2012) that asking such a question was an omission in their study. They had included a question split into separate skills such as First Aid, survival skills, navigation and general backcountry skills, but not an overall assessment.

Questions 15 and 16 were about navigation practices while hiking, and also included the 'Other' option with the inclusion of the specific alternative.

Questions 17 to 20 were about safety precautions that are taken by respondents while hiking, and typical behaviour related to technology and safety. The comment sections here were some of the most prolific, and this was clearly a subject that many people had opinions on. The aim of these questions was to encourage respondents to consider their behaviour, without being suggestive with the options available.

Question 21 was taken directly from Pope and Martin's study (2011). It asked "While on any kind of hike and you encounter a problem, would you be more likely to use a smartphone to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?" It only allowed for a Yes or No answer, but there was the option of adding a comment, which also received a large number of responses. I chose this question in its entirety as it seemed to be the one to focus on the most relevant concern for the SAR teams following my interviews with them. Their shared belief that inexperienced hikers using smartphones as their primary navigation and communication device were more likely to request assistance in less than emergency-level circumstances was key in choosing this question.

Questions 22 and 23 were regarding the influence of social media and other forms of media on behaviour, and Question 24 was about the potential desire for an "all-inclusive" smartphone app that could provide pertinent information for hikers such as safety information, current conditions etc. The aim of this question was to see if there was an opportunity here to develop an app that could be of use to all hikers, appealing to both inexperienced and experienced respondents, and mitigating some of the negative behaviour being exhibited.

Question 25 requested a response as to the respondents level of familiarity with SAR Services. This aimed to be an indicator as to how successful SAR's visibility is to the hiking community, and had been suggested in the interviews conducted.

Now that the process is complete, I was incredibly happy with the number of responses I received, and if I were to design the survey again I believe I would do it in a very similar way, but perhaps would ask for clarification in some questions. I had assumed via testing that the survey would take around 10 minutes to complete which is the duration that was suggested while marketing it to encourage participation. However Survey Monkey analytics show that the average time spent was 6 minutes and 38 seconds. As the participants were clearly willing to answer a 10 minute survey, indicated by the number of responses I received, I could therefore have included additional questions to take longer than the average time spent.

In considering this, I could have included further questions about the role that social media plays in hiking, and also probed further into the extent of knowledge of SAR

services. However, I was very happy with the level of responses received, the engagement of the respondents in the questions where comments were available, and how the responses can be analysed to support or challenge my thesis, and the theories provided by the stakeholders.

3.4.6. Prize selection

Once the survey was closed on September 13, I exported the data to excel, and to select the prize winners I created a new tab for just the email address entries. These were aligned with a column of numbers. I used Google's random number generator to select two numbers, and then contacted those people by the email address provided to inform them that they had won. I purchased the two $100 MEC Gift Cards online, and sent them to the winners via email.

3.4.7. Data analysis

Following the closure of the survey, I first of all reviewed the summary of responses as presented by Survey Monkey on its platform. It summarises the responses and that data is as contained in Appendix F. The majority of responses such as demographics, hiking behaviour, and safety practices were used as raw data, not requiring further analysis.

Where further analyse of the data was conducted to show correlation between certain responses, the data visualisation software Tableau was used. I downloaded the raw data from Survey Monkey, and uploaded it to Tableau, linking answers from unique respondents, as identified by an anonymized Respondent ID. The software allows for comparisons to be created between certain questions. These are described below in section 4.2, but in particular I correlated:

1. Experience level selected with whether the respondent had a contingency plan if their smartphone fails (Questions 14 and 20).
2. How new trails are navigated with age given (Questions 3 and 15).
3. Methods of communication taken on day hike with if a smartphone makes the respondent feel more secure (Questions 13 and 19).

4. Gender with if a smartphone makes the respondent feel more secure (Questions 4 and 19).

5. Familiarity SAR services (Question 24).

3.5. SAR data

The final stage in the research for this thesis was to analyse the existing data on SAR incidents to support and give support to the data already collected. In examining existing statistics, historical context can be given, patterns indicated, and using logical reasoning, trends analysed (Babbie & Rubin, 2010).

Data pertaining to the number and nature of call outs that SAR undertake is publicly accessible information, available on the EMBC website.

3.5.1. Data selection

SAR incident reports are collated by EMBC, and were available publicly on their website as weekly reports for the BC region for the years 2014 to date. These are updated weekly, and they show a summary for the numbers of reports across BC, as well as the date of each individual incident, which teams were activated, the number of SAR team members involved, the number of members of the public involved, and a short summary of the incident itself. Table 4 shows an example of an entry from 11 August 2019.

Since my research started, EMBC has reduced the years available online to 2017 to the current date. Since my research focuses on Vancouver and surrounding areas, these are included in the SouthWest Region, shown in the reports as “SWE” and it is these numbers that I focused on. Within the SWE region there are 14-15 teams; the number fluctuates as for some periods the Powell River SAR statistics are included in the Vancouver Island region.

Table 4: Screenshot of SAR incident report for 11 August 2019 for BC region.

SEARCH AND RESCUE INFORMATION - WEEKLY PERIOD: 5 AUG 19 TO 11 AUG 19

DATE/TIME INCIDENT #	EMBC REGION	INCIDENT	ELT/ #VICTIMS	# EMBC VOL	LOCATED ALIVE	DEAD	NO	COMMENTS
11 02:30 190708	SWE	LAND	1	8	1			8 Surrey SAR members responded to locate a despondent teen in the North Creek area of Surrey. After search yielded negative found no signs that the subject is in that area and were stood down. The subject's whereabouts are still unknown.
11 11:19 190709	SEA	LAND	1	8				8 Columbia Valley SAR members responded to assist with an injured camper at Apple Bee Campground Bugaboo Provincial Park. Patient and located and handed over to BCAS.
11 12:54 190710	VIR	LAND	1	17	1			17 Campbell River SAR responded to assist an injured hiker on the Ripple Rock Trail. Patient was packaged and passed to BCAS for transport to hospital.
11 14:19 190711	SWE	LAND	2	12	2			12 Kent Harrison SAR members responded to assist with two lost hikers on the Campbell Lake Trail. The subjects were located and escort out by SAR.
11 14:29 190712	VIR	LAND	1	1	1			1 Comox Valley SAR members responded to locate a lost hiker on the top of Comox Glacier. SAR was stood down when subject was located by friends.
11 20:46 190713	NEA	LAND	1	2	1			2 West Chilton SAR members responded for a missing mushroom picker past the Clearwater Resort in Ahahim Lake. SAR was stood down after subject was able to self rescue.
WEEK TOTAL		6	7	48	6	0	0	ELT - 0
YEAR TO DATE		**713**	**890**	**7976**	**808**	**29**	**46**	**ELT - 15**

Table source: EMBC, 2019.

3.5.2. Data analysis

In analysing the data, I reviewed every weekly incident report from 2014-2019 from April 1 to September 30, being the summer months where the majority of hiking takes place. This is also the period that I referred to as a ‘summer season’ in the online survey for respondents to consider their hiking behaviour. I tabulated the results using excel, and tallied the number of incidents that each team was called out to, how many SAR team members were involved, and the result of the incident. I tallied the results of the incidents into one of eight categories: person rescued by helicopter, person handed to BC Ambulance Service, person escorted out and no further assistance needed, person self-rescued, if the call out was unresolved, if the SAR team was stood down, if it was a false alarm, or if the person was deceased. In comparing the years with each other, the types of incidents and their locations, I could give statistical information to support any hypotheses.

While tabulating the data, I necessarily had to make a number of assumptions where the data was unclear. On some occasions, two or more teams were stated to be

involved, but the split of team members was not specified. For example, under 'Comments' the report would state "35 Pemberton, Whistler and NSR SAR members responded to an incident at Tenquille Lake…" On these occasions I split the count evenly between the teams specified, and if there was an uneven number I included the higher number for the team or teams that were mentioned first. In the example here my count would therefore show 12 Pemberton, 12 Whistler, and 11 NSR members engaged.

Further, for the number of incidents reported per team, if there was more than one team involved as per the above example, my count would record for the closest located team. In this example, it would be included in the incident count for Pemberton.

On some occasions the count for the month of September would not end on a specific week end. For example, the weekly report would be from September 28 to October 4. In these instances I would use the specific dates in the report to include only incidents up to and including September 30.

Finally, if an incident involved more than one outcome, for example there were two casualties and one was airlifted by helicopter and one was escorted out, I would only record the first outcome. In this scenario the count would be for helicopter, to ensure the number of incidents tallied with the number of outcomes for ease of comparison.

I believe these assumptions maintained a fair representation of the data recorded. The data for 2019, and the comparisons completed for all years are included at Appendix G as an example of the analysis completed.

Chapter 4. Results

4.1. Interviews

The first stage of the results analysis was coding of the interviews with stakeholders to determine if people involved in the outdoor recreation, SAR, and Emergency Management fields were observing the same behaviour that I had hypothesized. The final interviewees confirmed that I had consulted with a comprehensive sample of people involved, as they could not suggest anyone further that I should be approaching.

After transcribing the interviews, I uploaded the content to Nvivo, a qualitative data analysis software, to facilitate determining common trends and areas of similarity across the interviewees. They had been asked similar questions, and while responses were different, there were a number of common themes that emerged, which are discussed below. One feature of Nvivo that allows for graphic interpretation of the data is a word frequency search. In conducting the search across the transcripts for the thirteen interviews, the top 100 words are shown below:

Figure 6: Top 100 words used by interviewees.

Image produced using Nvivo

The size of the word in the picture reflects how frequently it is used, so 'people' was the word used most by interviewees. It was used 320 times, second to which was 'trails,' used only 134 times, so 'people' was definitively an area of high focus for the interviewees. Its high frequency demonstrates how focused the interviewees are on the subjects that are in their care, and that they wish to protect. The third most used word was 'calls,' used 122 times, and, while the subject of some of my questions, also indicates how prevalent the issue of communication is for all interviewees.

4.1.1. The effect of social media on number of people hiking

While it may not be the *only* factor increasing the volume of people hiking, the overwhelming response from interviewees was to concur that social media has dramatically increased the number in the last five years. Specifically, I had detailed conversations with Susan Rogers, Wayne Maskall (personal communication, June 12, 2019) and Pat Murry (personal communication, November 15, 2019) from the District of North Vancouver, with Sandra Riches (personal communication, June 10, 2019) from AdventureSmart BC, and BC Parks (personal communication, December 16, 2019) with regard to the 'Instagram effect,' and how it has changed what they have been seeing in a number of areas of North Vancouver. BC Parks confirmed that there "is definitely a correlation between Parks that are seeing increased social media presence and beautiful shots with increased visitation" (personal communication, December 16, 2019). When pressed, one specific area identified was Joffre Lakes, where BC Parks is working on the visitor use management strategy for that area as it has received a large influx of visitors in recent years following increased visibility on social media.

Susan Rogers, Wayne Maskall and Pat Murry referred to the immense strain that the "Quarry Rock selfie trend" had had on their resources as a District, in terms of trail maintenance, safety, and advertising (personal communications, June 12 and November 15, 2019). Pat Murry's statistics on trail count are shown in Table 1, and illustrate the increase of people using the trail since they started recording statistics. All three *directly* attribute this increase to the effect of social media, specifically where photos of Quarry Rock are posted by users of Instagram, Facebook and Twitter. Taking photographs at beautiful locations has obviously been a common practice for decades, but the

difference with social media is how much bigger an audience that those posts can now reach. Further, Pat Murry also referred to the impact that the attraction of the village of Deep Cove has, and how he has identified many visitors that are “coming for the donut, and they want to get that shot” (personal communication, November 15, 2019). The double attraction of a unique delicious snack, and a beautiful destination is apparently a compelling combination.

Sandra Riches also referred to this same phenomena, but how she had seen it manifest at Cypress Mountain, on occasions where she has been present with the AdventureSmart team performing safety demonstrations and education for hikers (personal communication, June 10, 2019). She described how she has been approached by people who had no knowledge of how to reach their destination and “a lot of them pulled out their phone, showed me a picture of someone on St Mark’s, or Hollyburn, or Eagle Bluffs, or First Lake, wherever, [saying] we want to go here, how do we get here?” (S. Riches, personal communication, June 10, 2019). While this behaviour may seem surprising, the responses from the interviewees suggested that it is becoming worryingly frequent, and suggests that the premise that this study was created for, is definitely happening in reality.

One element of social media use also discussed is the increase of group meet ups, and their lack of regulation. This was referred to by John Howe, as to what he described as the “group heuristic factor” (personal communication, June 17, 2019), where someone initiates a group meet up online and offers to lead a hike, but there are no qualifications required for that leader, and no liability or insurance provided either. In an incident on 29 September 2019 this exact scenario occurred in North Vancouver, and the group actually abandoned one of their members who got injured (NSR Facebook, 2019). The examples from both Sandra Riches and John Howe show direct experience of where social media has increased the number of people hiking. Other interviewees mentioned similar behaviour at places such as Joffre Lakes, Mt. Fromme, and more generally.

4.1.2. Behavioural changes as a result of the use of smartphone technology

The discussions of the types of behaviour observed by the interviewees resulted in the most interesting, and shocking, anecdotes. I have separated the discussion into the following: lack of preparedness; reliance on technology; negative behaviour; and positive behaviour.

Lack of preparedness

By far the most common factor cited as a cause for many of the SAR incidents reported was lack of preparedness. Eleven of the thirteen interviewees referred to it as one of the biggest threat to hikers while out on the trails, which confirms how much of a problem it can be. In terms of attributing that lack of preparedness to the use of smartphone technology, often it was the use of hiking map apps that were at the heart of the behaviour. Dawn Hanna of MVRD, cited numerous cases of people attempting the Hanes Valley Trail without being fully prepared, “people who show up with their smartphones, and most of the time they don’t know where they are going, who want to do Hanes Valley Trail and have no idea where it is on a map, or how far it is” (D. Hanna (personal communication, June 11, 2019). This is a 16km highly challenging trail, which involves 1,320 metres of elevation gain, and takes approximately 8 hours to complete. She described how the Park Rangers in Lynn Headwaters, where the trail starts, had encountered people in running shoes and with only a small bottle of water trying to attempt it. Numerous examples of such behaviour were described, and the explanation was often that the hikers had read about the hike on a website or trail-finding app, and decided to undertake it without understanding the need for appropriate equipment or skills to be successful. One of the contributing factors to this is the accessibility of these challenging trails; the Hanes Valley Trail is accessible by public transport, and Dawn Hanna, amongst others, described how people often do not have the same level of respect for challenging trails when they can reach them so easily.

Another factor that influences lack of preparedness is where the information about the hike originates. A number of the interviewees referenced the promotion of Vancouver, and often the North Shore specifically, in various tourism and other advertising parties as particularly focused on the beautiful destinations here, such as the

Air France magazine shown in Figure 1 above. Susan Rogers and Wayne Maskall stated that they had requested that Destination BC and other tourist-focused parties cease promotion of these places because they were encouraging people who were not prepared for the conditions to attempt to reach them (personal communication, June 12, 2019). This has been particularly noticed at Joffre Lakes, where there is such demand for a photograph of the hiker on a particular log that there are reports of people queuing for hours. Interviewees suggested that the hike needed to get to the location is not often mentioned, particularly in social media posts (BC Parks, D. Hanna, S. Rogers, personal communications, December 16, June 11 and 12, 2019) and that there are consequently numerous people who attempt the hike in inappropriate clothing and footwear as a result. Brian Hutchinson (personal communication, December 2, 2019) confirmed that this behaviour is also observed at Grouse Mountain for the Grouse Grind, and in Deep Cove for the Quarry Rock trail. In these locations he referred to the valuable job that Park Rangers are performing there by actually stopping people who may potentially get injured and warning them of the trail conditions that they might encounter and suggesting an alternative route. He reported that this had reduced the number of incidents occurring in both places. Eddie Wood, General Manager at Mt. Seymour (personal communication, June 11, 2019) confirmed that while they do use attractive imagery to draw people to the resort, that they do also include suggestions around safety best practice.

Additionally, BC Parks referred to the environmental damage that can occur from people who are not prepared for backcountry experiences (personal communication, December 16, 2019). They cited that there have been increased instances of people leaving their garbage at campsites, going off trail, camping outside of designated campsites, or leaving a tent in the backcountry because they don't want to carry it out. This creates further work for Park Rangers as they have to subsequently rectify the problem, and also causes hazards for wildlife, not only in the physical items left which may be dangerous, but also in the increasing exposure to people, and their food. BC Parks confirmed that one role of Rangers was often to educate the public as to the need to leave no trace, and the risks associated with not adhering to such a philosophy.

While writing this thesis, there have been developments from the BC government that they are actively looking at solutions for issues such as overcrowding on trails, and have been seeking the public's input (Luymes, 2020, para.2). While it is clearly very

early in the process, the evidence of the initiative from the Outdoor Recreation Council of BC demonstrates how the issues identified in this research have a wide reach.

Reliance on Technology

One of the other prevalent themes that arose was how many incidents interviewees had encountered where a reliance on technology had been to blame. Three of the interviewees cited the same incident, where a British hiker had become so lost on Crown Mountain that he had to be long-lined out by helicopter, because the SAR team could not safely reach the ledge he was ensconced on. He had reportedly been following a hiking map app that was incredibly inaccurate, and instead of questioning why it was directing him to a very precarious path, he followed it and found himself in a very serious situation. The three interviewees were astounded at such blind-faith in the smartphone technology, but this resonates with the literature discussed earlier about how technology affects risk perception. Michael Coyle of Coquitlam SAR (personal communication, June 10, 2019) had his own explanation as to why this sort of incident happened with frightening regularity, describing the lack of context obtained by viewing a map on screen, compared to on paper. He claimed that when viewing a paper map of a whole area, “your knowledge of where you are is more complete,” (M. Coyle, personal communication, June 10, 2019) as opposed to the complexity of seeing the same area but by scrolling, panning and zooming on a screen. Mike Andrews also confirmed this from an emergency management view, stating that “nothing will give you comprehensive situational awareness like a good map” (personal communication, January 28, 2020).

The consequences of not using a good map were alluded to by Brian Hutchinson and Mike Danks, who referred to the use of map apps to find new trails that previously would only have been known about by locals (personal communications, December 2, and June 14, 2019). Brian Hutchinson cited an instance from summer 2019 where a hiker had attempted the ‘Flint and Feathers’ trail on Grouse Mountain, a trail that he described as far more challenging and remote than the highly travelled Grouse Grind or BCMC trails. The person in question was visiting from the States and had read about the trail on the AllTrails app, had seen that it had received a great review, and decided to attempt it. The description of the trail on the app is seen in the screen shot below, and accompanied by a map which shows contour lines and elevation. While acknowledging that this is an “unmaintained” and “unmarked” trail (Alltrails, 2019, para.2), the lack of

any further safety or risk information does suggest that it is a routine trail. The ease with which a user can find a trail using apps such as AllTrails is a feature of smartphone technology that has changed compared to how people used to find trails; generally it was by speaking to locals who had prior knowledge, or by reading hiking books. Either way, these methods contained a lot more specific information pertaining to conditions, wayfinding and risks than are contained on the apps. It is this immediacy of access that is such a key feature of smartphone technology again that resonates with the literature reviewed previously (Leyshon et al, 2013).

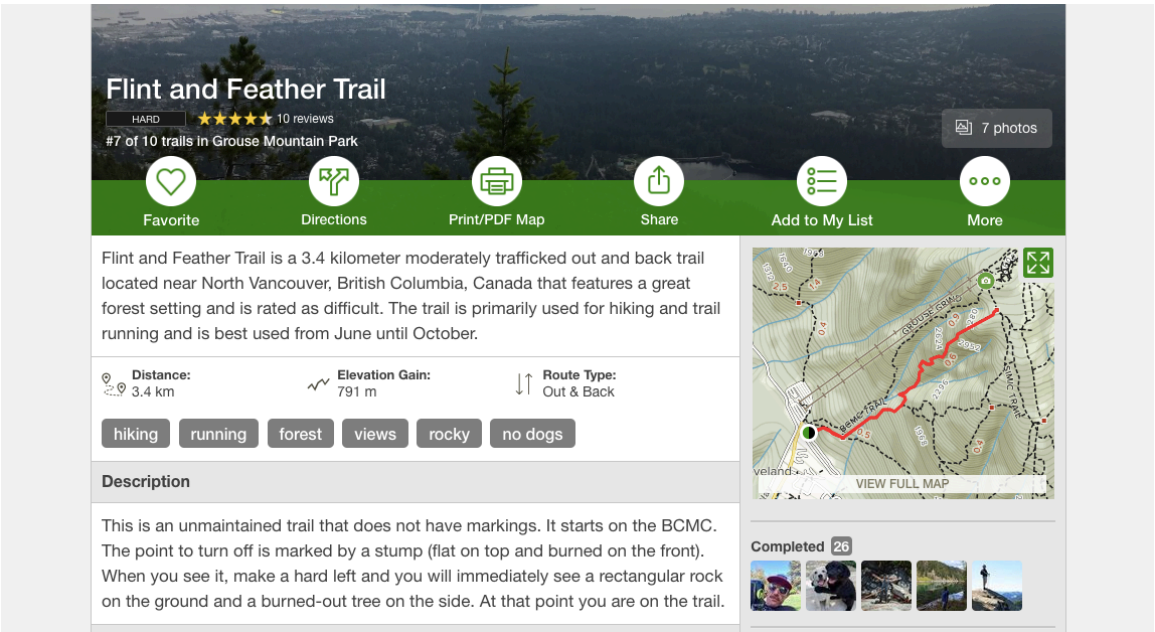

Figure 7: Screen shot of AllTrails website showing Flint and Feather trail detail.
Website: alltrails.com

The use of apps such as AllTrails also has an effect on people's awareness of the environment around them. Pat Murry and Dawn Hanna stated that they had observed many people not reading the signs at trailheads and just walking by them, "people aren't reading signs anymore, they're looking at their phones" (P. Murry, personal communication, November 15, 2019). The signs at trailheads are often the most visible way that Park Managers and Park Rangers can communicate messages to hikers without being present, and if they are being ignored, they are likely to miss vital updates on trail conditions, wildlife alerts, or trail maintenance. However, there are some scenarios where the technology is acting as a useful resource. John Howe, Sandra Riches and Dawn Hanna all gave examples where websites and apps were providing

useful and accurate information, and also promoting risk awareness and safety concerns such as Mountain Project (J. Howe, personal communication June 17, 2019), Hikes near Vancouver, Peaks and Creeks (S. Riches, personal communication June 10, 2019), Vancouver Trails and Outdoor Vancouver (D. Hanna, personal communication June 11, 2019).

One of the obvious pitfalls of relying on a smartphone as a means of navigation as well as for communication is the limited battery life. Michael Coyle referred to how quickly a phone can run out of battery when it is being used for multiple functions; as a phone, camera, or map primarily, but for other functions too. He described how it would often be late in the day when a person would get into trouble and need to call for help, by which time they have very limited battery remaining (personal communication, June 10, 2019). There are policies that he and other SAR teams have in place to prioritise location finding once a person has made a call to 911, but he stated that often the caller's battery would die before they could find them, which would complicate the rescue. At least in those instances they have been able to place a call to initiate the response.

Further, being able to rely on a smartphone also depends on it having a reliable signal connection, something that is not often a certainty in the North Shore mountains. As referred to in the introduction, cellphone coverage in the North Shore mountains is very sporadic as a result of the many valleys and cliffs that block direct signal. While a number of trail apps allow maps to be downloaded to a phone so that they are still accessible if signal is lost, but this depends on the user having the foresight to do so. If the smartphone is being used as the primary means of navigation and communication, once the signal is lost, so is the ability to navigate and call for rescue if it is needed, something that interviewees cited as a primary factor for people needing to take other technology with them such as GPS or PLBs. At best this results in a long, challenging rescue, at worst it can lead to fatalities.

In efforts to analyse this behaviour further, a number of interviewees suggested that it was in part due to the proximity to the city that causes people to rely on technology. As Dawn Hanna and Mike Danks suggested, at any of the local North Shore mountains, the city where "millions of people are" (M. Danks, personal communication, June 14, 2019) can be seen directly, so people tend to have the same expectations on

the efficacy of technology as they do in the city. Sandra Riches also explained it by describing how easy it is to get to Deep Cove, compared to somewhere that “they had to travel two hours in their car, and then go down some other country road to get to that canoe and kayak shop, they would think differently, without even thinking they’re thinking differently” (S. Riches, personal communication, June 10, 2019). Brian Hutchinson explained this behaviour succinctly, that “because we’re so close to the urban centre, I think a lot of people look at our frontcountry as being park-like. As opposed to frontcountry, which it is,” (B. Hutchinson, personal communication, December 2, 2019). Above, Dawn Hanna described the accessibility of the Hanes Valley Trail as contributing to the number of people travelling to it, but Brian Hutchinson also described it as contributing to why some trails are such popular tourist destinations in particular: “[w]hen a person can get off a cruise ship in downtown Vancouver, take a bus to the base of Grouse Mountain for the Grouse Grind, they think ‘how hard can it really be?’”

Negative Behaviour as a result of Smartphone Use

One theme that was described by interviewees is how SAR and Emergency Services teams have seen the number of incidents increase as a result of cellphone use. One example described by Brian Hutchinson occurred in winter 2018/19, where two women called 911 for support because they were cold, wet and tired three-quarters of the way up the Grouse Grind, between 6.30 and 7.00pm (personal communication, December 2, 2019). As he observed, being cold, wet and tired at that point should probably have been anticipated. Frustratingly, after the women were encouraged to keep going up the trail to keep warm and they arrived at the Grouse Mountain Lodge to warm up, they needed no further assistance. However, by calling 911, they had initiated a response that involved three fire-trucks and the BC Ambulance Service. He, and others when describing similar scenarios, explained this recent phenomena of people calling for help in non-emergency situations as a result of having a cellphone with them. Prior to having the ability to call, people in similar situations would just have kept going, because they didn’t really have a choice, and there wasn’t a medical emergency occurring.

Dawn Hanna described the negative change of people not wanting to share their information on the hiker registration forms that they use at Lynn Headwaters (personal communication, June 11, 2019). These slips of paper ask for information such as phone number, make and model of car, destination, group size, clothing etc. She explained that

this lack of willingness seemed to accompany the data protection concerns online that have become commonplace in recent years. As smartphone technology demands passwords for entering apps, people have become more wary of sharing such information. It does not appear that the safety element of the hiker registration forms is reason enough to share such information. A potential solution for this was suggested by Mike Andrews, when he referred to the potential for using a QR code or bar code system at the trailhead considered to have a "high traffic entry point" (personal communication, January 28, 2020). This would involve the person scanning in at the start of their hike, and then out again at the end. He acknowledged that this would not catch everyone, but may add accountability, and would be less time consuming and more user-friendly than the paper version.

One element of smartphone use that is not so much related to safety, but is having a detrimental effect on people's experiences on trails, is the user's ability to play music, by connecting to small speakers that can be incredibly loud. Pat Murry reported that the District of North Vancouver Park Rangers are having to monitor noise complaints as a result. The encroachment of technology on nature in this way is a very tangible effect, which still holds to the 'leave no trace' philosophy, but certainly is disruptive to those other users who wish to hear nature sounds rather than the latest pop music.

Positive Behaviour as a result of Smartphone Use

Many of the interviewees referred to the fact that smartphones and the use of technology had a double-edged sword duality as to the effects they cause. A number of the negative consequences have been discussed above, but there are also positive repercussions that are being experienced. By far the most cited example was the possibility to generate GPS coordinates using a smartphone, which has dramatically reduced rescue times for simple incidents. When speaking to dispatchers, callers can now send specific coordinates instead of trying to describe where they are to someone with little or no local knowledge. In the years prior to cellphone technology, rescuers may not have been alerted to a lost person or group until hours after they had gone missing as a result of a car remaining in a car park, or if a family member or friend failed to return at an agreed time (M. Coyle, personal communication, June 10, 2019). Now, as long as the person in difficulty has a) signal and b) battery, it is possible to determine exactly

where they are located using the smartphone mapping technology. Michael Coyle has even designed software that can be easily communicated to the person in difficulty by text message, who, by clicking on the link in the text message, automatically sends the location back to him and the SAR team, although there are still numerous reasons this could fail to work, even with internet access (personal communication, June 10, 2019). Even without this technology, it is now relatively easy for a user to send their GPS coordinates to rescuers, which removes much of the 'search' element from the rescue, and has resulted in incidents of this type now being much quicker to resolve. John Howe stated that rescues "used to be 8 hours to two day searches, now our average response is 4 hours" (J. Howe, personal communication, June 17, 2019). In some cases the SAR teams have even been able to resolve issues over the telephone, meaning less SAR resources being deployed, and therefore being available again for the next incident.

4.1.3. How the rescue practices of SAR teams have been affected.

The one overriding response received during interviews around this area was how incredibly adaptable the SAR and emergency services are to change. All of the affected interviewees described how their responses have changed in conjunction with changes in technology. It has been described above how the benefits of smartphone technology have decreased search times for incidents, but that the number of incidents are growing, and in speaking with Mike Danks of NSR he described how his team has had to adapt. In previous years, the whole team would be involved for a single call, however now it is more efficient to have smaller numbers respond initially, so that there are sufficient members remaining in the event of another incident occurring. He described how the team has become more specialised, and that there are medical professionals now included on responses where consultation may be necessary. He also described how helicopter resources are managed, by balancing the needs of the person needing to be rescued, with how long it might take a team to assemble, reach the patient, and how much risk it might put them in, compared to the cost of the helicopter at $2,400 per hour (M. Danks, personal communication, June 14, 2019).

The increase of incidents has also meant closer collaboration between agencies. There is a mutual aid agreement in place between different SAR teams, and in reviewing the incident reports, there were numerous joint responses throughout all the years reviewed. In addition to this, the emergency services are also involved with rescue

responses, particularly the North Vancouver Fire Department. In terms of job sharing, they have an agreement that they will respond to incidents down a trail that they can reach within 30-45 minutes; anything further than that and they will involve NSR. This ensures that they manage incidents that don't require the more specialised trained SAR resources, but that they can involve them when necessary.

The role of social media in communication has meant that more resources have to be dedicated to maintaining presence and engagement, including reporting incidents, current conditions, raising awareness of their role, encouraging donations, public education, and more. Many interviewees reported that social media played an increasingly large role in their budgets, either financially or in terms of time spent. One of the ways that they are able to utilize that engagement is for the swift recovery of missing persons. Mike Danks and Michael Coyle (personal communications, June 14 and June 10, 2019) both reported incidents where their SAR teams had been able to find a missing person quickly by using social media and engaging the public, so those successes are worth the time spent to maintain the public's interest. Dawn Hanna also referred to another benefit of social media in that it allows for much easier sharing of information about agencies and teams to reach an even wider audience (personal communication, June 11, 2019). In a missing person scenario, that extra reach can have a huge impact on recovery time.

Another element of SAR resources that has been positively impacted by social media is the raising of their profiles to the public. This has the dual benefits of spreading messaging around safety and guidance to a wider audience, and also encouraging increased private donations. Mike Danks elaborated on this, particularly because NSR is the SAR team with the highest profile in BC. NSR has been able to fund new facilities, gear caches and command stations all across the North Shore to support the increasing amounts of rescues occurring (M. Danks, personal communication, June 14, 2019).

Even within these positive repercussions, there is a downside to raising profile, in that it is often the "glamorous" (A. Morrison, personal communication, June 13, 2019) side of incidents that are reported, including the helicopter rescues on news reports and on social media posts. It was suggested by several interviewees that people may be more likely to call for help if the SAR team is portrayed as commonly picking up rescuees by helicopter. NSR team leader Mike Danks clarified that they "are really doing

our best to educate the public that they should definitely call for help early but not to expect a flight out. In certain circumstances this is what needs to happen but if it's at all possible we will encourage them to toughen up and hike out. A crew will assist if needed" (personal communication, February 17, 2020). He and other SAR team spokespeople try to emphasise this message, but there are certain elements of media coverage that emphasize that element of rescue because it is the most dramatic. A large part of Sandra Riches' job is media liaison, trying to ensure that coverage stays within the ideal framework. She and Michael Coyle referred to the necessity of promoting positive actions taken by individuals in the event of a rescue, as opposed to shaming them for the behaviour that resulted in the incident (personal communications, June 10, 2019).

SAR teams have also been integral in providing support for Park Managers. Wayne Maskall from DNV described how NSR members had volunteered to support wayfinding on Mt Fromme, and how this was invaluable for keeping people on trails. Mike Danks from NSR confirmed this, and reported that the signage was provided by local schools. In addition to SAR practices being impacted by increased visitor numbers and behaviour as described above, one of the areas which has had huge impact on the amount of incidents is in the response of Parks Managers. The representatives for both MVRD and DNV referred to dramatic changes that had taken place as a result of the increased visitors, particularly at the Quarry Rock trail in Deep Cove. The trail sees on average 1,500 daily visitors during the sunnier months, or 630,000 annually according to DNV's predictions for 2019 (P. Murry, personal communication, November 20, 2019). The amount of erosion that this many people inflict on the trail is incredible, and also the potential for incident. To attempt to control the erosion and incident occurrence, the DNV performs constant trail monitoring and upkeep. If incidents were recorded as occurring in a particular spot, park managers would identify what the issue is as quickly as possible, and either remove the hazard, or create a bypass by "building up the trail, or installing a stairway or boardwalk" (P Murry, personal communication, November 15, 2019). This has led to more boardwalks and handrails along the path, which has unfortunately reduced the natural aesthetic of the trail, but has reduced incident numbers, as follows:

Table 5: Number of incidents recorded on Quarry Rock Trail from 2016-2019.

Year	Number of Incidents
2016	35
2017	21
2018	20
2019	11

Statistics provided by P. Murry, DNV (personal communication, November 20, 2019).

In addition, trail markers were also added along the trail in Spring 2017 which identify the specific location of the point on the trail. Patrick Murry stated that this had made it much easier to locate incidents to reduce response times (personal communication, November 15, 2019), and as a result, people's satisfaction with the time it took to reach them was very high. The high degree of trail maintenance combined with these location markers have both contributed to the reduction in incidents as reported above.

Overall, the interviews gave valuable insight into the issues that are most prevalent for SAR and emergency responders. While the findings coincided with the premises on which this research is built, the interviewees added context, demonstrated adaptations they have had to make, and provided information that is vital to the research at hand.

4.2. Surveys

As has been discussed above, the number of responses received to the surveys were much higher than I could have hoped for. My approach to contact clubs, groups and associations related to hiking and outdoor recreation was hugely successful, and the engagement suggests how relevant the subject of the survey is for people with interest in this field.

4.2.1. Demographics

The vast majority of my respondents are local to Vancouver, between 25 to 34 years old and female. Within this generalisation, there were several interesting points to note which may have bearing on the responses. More than 56% of people live in either the City of Vancouver or in North Vancouver, and 6% in Burnaby; of the remaining 38%, the responses were very widespread, with small percentages between 0.5% and 5% in

the other 18 locations. The fact that the results were so concentrated close to central Vancouver confirms that the participants were from the specific target demographic, locals to Vancouver who hike in the local area.

With regard to the ages of respondents, 38.5% were between 25 and 34 and 26.5% between 35 and 44. The majority of respondents are therefore millennials. In order to respond to the online survey, participants had to be familiar with technology, and for them to have received notice of the survey they would have to have been either part of an email list or Facebook group, or follow a Facebook group or similar according to how the survey was distributed. As my survey involved some questions around the use of technology while hiking, this demographic was ideal. However, this means that the scope of my survey was necessarily limited to those with access to technology and other views are not reflected.

62.8% of respondents were female. This is a higher percentage than expected. According to a 2016 Statistics Canada survey[4], 43.2% of females hike, and 45.1% of males, when surveying the whole population, therefore a more even split of respondents male to female would have been expected. The reason for the higher female responses could be that the likelihood of responding to surveys is higher in females (Curtin, Presser & Singer, 2000; Moore & Tarnai, 2002; Singer, van Hoewyk & Maher, 2000), or that women are more likely to be part of a group on social media, (Stratton, 2018). For the bias that this may give the results, it should also be noted that women are generally thought to be more risk averse than males (Haegeli & Pröbstl-Haider, 2016), therefore responses could be more likely to show a tendency for risk aversion. Gender bias in this way is not being tested in this study.

4.2.2. Hiking behaviour

The majority of responses to the questions on hiking behaviour were also fascinating. They showed that respondents preferred to hike a few times per month or once per week, mostly in Squamish, usually with one other person, and the reason was mostly to spend time in nature. The regularity with which respondents hike demonstrates that they have a vested interest in hiking, higher than the population in general, a

[4] Report: Participation in outdoor activities in the past 12 months by age group, sex, current employment status, and perceived health, Canada, provinces and regions. (Stats Canada, 2016).

conclusion supported by the average experience level of the respondents, which was 7. In fact, 822 respondents, or 72%, selected 7 and above as their level of experience. As illustrated in Appendix B, the Statistics Canada survey on Canadians and the Outdoors reported that 44% of the general population likes to hike, and perform the activity at least once per week (Statistics Canada, 2016). The high frequency of hikes undertaken by the respondents here compared to the average would suggest more knowledge, and therefore experience. One of the concepts of risk perception discussed above was that that the more experience a person has with an activity, the more aware they will be of the risks associated, and their risk perception heightened above that of the average person.

The destinations indicated for most hikers was also interesting. The results suggest that, despite the respondents living mostly in Vancouver and the North Shore, the majority prefer to hike in Squamish, which contains some more challenging hiking terrain than the North Shore. This was the case when respondents were asked to list all destinations they hike at, and also when asked to choose the one location where they hike most. Combining this preference for Squamish with the level of experience of respondents, suggests that experienced hikers are travelling to Squamish, and therefore that the high level of incidents on the North Shore are perpetrated by less experienced hikers, aligning with one of the key beliefs that was the impetus for this research to be conducted. Interestingly, the fact that Squamish SAR incidents are at a similar level to NSR suggests that experienced hikers in more challenging terrain need to call for assistance at the same proportion as less experienced hikers in less challenging terrain. However, further specific research would be necessary to determine if this suggestion can be confirmed. Further, in reviewing the 'Other' answers, I should have included the Chilliwack and Coquihalla areas, as well as the North Cascades and Washington as options, as they were both cited as other destinations in high enough numbers to warrant their own selection.

For these experienced people, the majority (62.5%) choose to hike either with one other, or with 2-3 others. Susan Rogers claimed that she had observed a lot of people hiking solo (personal communication, June 12, 2019), however only 19.5% of respondents suggested they hike alone. This could be because the respondents are more experienced, as they are aware of the safety benefits of hiking with at least one other person, and that the unsafe behaviour that Susan Rogers observed of people who

got into difficulties was exhibited by people with less experience. This also speaks to the social and cultural elements of risk perception, that participants are more likely to feel safe in groups (Chamarro et al., 2019).

Finally, when looking at motivations for going hiking, respondents were asked to select all options that applied. The majority of responses, from 1,018 out of 1,150 respondents selected 'spending time in nature.' While this may be an obvious response, it confirms that the main reason remains to engage with the natural environment. There were conclusive examples given by stakeholders discussed in section 4.1.1 that people they encountered were undertaking some outdoor recreation for the main reason of taking the selfie in the beautiful location. This could still be the case for those surveyed, but as only 59 people chose the response 'taking pictures for sharing on social media,' when they could have chosen this response in addition to the 'spending time in nature' response.' This could be explained by the respondents having a higher level of experience, whereas the suggestion that it was novice hikers who were going to just take the selfie. Perhaps they do not consider this a motivation for hiking, as when asked if they *do* post pictures to social media, 72% of respondents confirmed that they do, either on occasion or some of the time. This disjuncture is an area that warrants further investigation. Whichever the reason, the results show that nature is still the main motivator, and not fitness (670 responses) or adventure (478 responses). From the comments, I also could have included 'dog walking', 'family time', and 'photography' not linked to social media as options, as they were responses that recurred frequently enough to warrant their own selection.

4.2.3. Safety practices

Considering that the experience level for the respondents was relatively high, the responses around safety practices lead to some interesting conclusions. For example, the majority of respondents do tell someone else that they are going hiking, and almost all respondents took a smartphone with them, but the majority do not check coverage for signal, or take any other form of communication with them. The majority also rely on the smartphone as their main safety precaution, and most concerningly, 43% of respondents do not have a contingency plan if their smartphone fails.

In looking at this particular answer in detail, it was necessary to correlate the level of experience selected by particular respondents with the presence of a contingency plan, as shown in the table below. This firstly shows that there was a spread of experience across the respondents, and that they are skewed towards a higher degree of experience. The respondents with lower experience levels from 1-6 recorded that they are less likely to have a contingency plan, and that the higher levels of 8 and above are much more likely. This corresponds with the literature on risk perception, confirming that those with more experience are likely to be better prepared for emergencies.

Table 6: Comparison of how experienced the respondent is on a scale of 1-10, with whether they have a contingency plan in the event of smartphone failure.

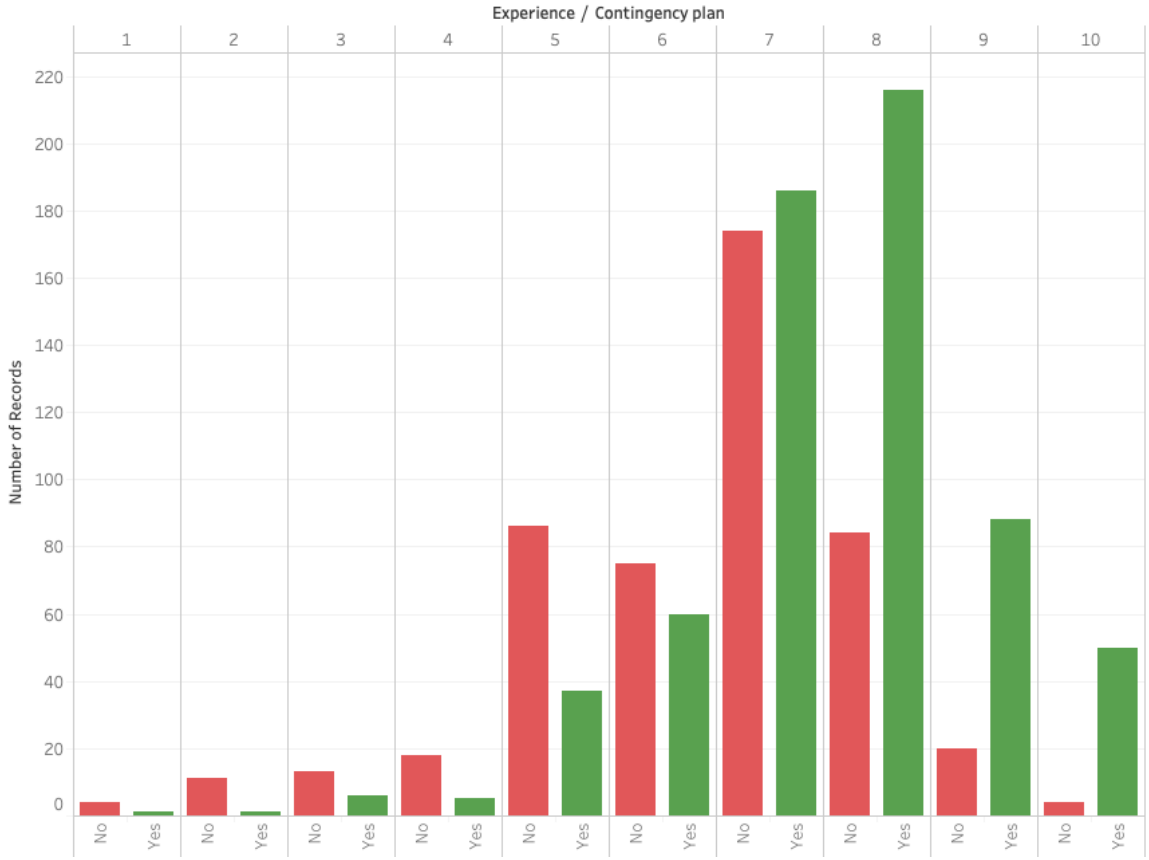

Table produced using Tableau. Question 14 in survey: On a scale of 1-10, how much hiking experience do you have? 1 = no experience, 5 = 1-2 years of hiking experience, 10 = highly trained mountaineer. Question 20 was a yes no response to the question: Do you have a contingency plan if an emergency happens and your smartphone fails?

However the respondents that selected 7, the highest response from 360 individuals, are much more balanced as to whether they have a contingency plan or not.

This suggests that it is within this group of individuals where there is a danger that their confidence in their experience, and the confidence in having a smartphone with them, results in the lack of a contingency plan (Chamarro, et al., 2019). As the SAR statistics analysis will show, incidents can affect even the most prepared person, and so this false confidence in not having any other form of communication suggests a gap in understanding that should be addressed.

The proportion of respondents who check smartphone signal coverage is one of the most concerning results from the survey as only 39% of people do so. Navigation practices will be discussed below, but while a number of trail and mapping apps allow maps to be downloaded to a phone so that they are still accessible if signal is lost, this depends on the user having the foresight to do so, which was not clarified in the survey. If the smartphone is being used as the primary means of navigation and communication, once the signal is lost, so is the ability to navigate accurately, and call for rescue if it is needed, something that interviewees cited as a primary factor for people needing to take other technology with them such as GPS or personal locator beacons (PLBs). The lack of signal coverage in the area around Vancouver has been referred to previously, and so these experienced hikers presumably have to rely on not encountering an incident, or being able to cope with an incident should it occur. This could also suggest that the respondents are not aware of the lack of coverage, but with the frequency of hiking reported, and the 98% who confirmed that they take their smartphone with them when they hike, it can be deduced that they are aware that signal is not to be relied upon as a result of common usage. As stated above, 85% do inform another person that they are going hiking, so perhaps this also gives them reassurance that if there was an incident and the smartphone fails that an alarm could be raised. This will be discussed further below.

One of the most informative responses regarding use of technology was in the response to whether the respondent took any other form of communication with them. 65% do *not* take any other form of communication, and of the remaining 35%, 20% use either InReach or SPOT GPS technology specifically. The questions in the survey directed respondents to consider their behaviour on day hikes specifically, and responses were not correlated with either difficulty of the terrain encountered, or the length of the hike, which could be factors in which safety practices respondents would choose to perform. Again, this could be an area for further research, but as deduced

above, the level of experience of the respondents and the frequency of hikes undertaken suggest that they would choose somewhat challenging hikes to base their responses on. As stated in the introduction, I focused my interview and survey questions around day-hikes, which I estimated would be the most popular type of hiking, and also can include varying degrees of difficulty within them. Anecdotally, it has also been people who are on day-hikes that are perceived to be the most prolific exponents of the 'Instagram effect', again because they require less equipment and therefore less preparation than longer, multi-day hikes.

Regardless of terrain or length of hike, a number of comments stated that other members in the person's group would have another form of technology even if the respondent would not, and also suggested that for day hikes around Vancouver that further technology would not be required. One respondent stated that "[w]e use offline maps so cellphone coverage is not an issue for navigation," which is fine for navigation, but does not suggest the existence of a contingency plan to call for assistance in the event of an emergency. Further, a number of comments included that they would have some form of ability to recharge a smartphone, either with an additional battery pack or a solar charger. Again, the contingency being for navigation, not for communication. Only seven respondents commented that they would take a non-technological signalling device such as a whistle with them. Perhaps this was assumed to be out of the scope of the question, however, the infrequency with which it was commented suggests that it is low on the list of forms of communication, which the question specifically asked for.

An additional consideration here is the cost of technology. Several comments referred to the prohibitive price of the InReach device compared to the relatively low costs of going hiking. In terms of risk perception and safety planning, comparing the cost of such a device versus the possibility of needing to use it seemed often to not be worth the investment.

The safety precautions that respondents confirmed they did take complements the above responses regarding means of communication. As stated above, 1,040 out of 1,148 take their smartphone as a safety precaution. 938 (82%) tell a friend, 507 (44%) confirm a return time with a friend. In terms of non-technological safety precautions, a First Aid Kit was a reassuringly frequent response (792 respondents, or 69%), and either

'Some of the 10 Essentials'[5] (661 or 56%), or 'All of the 10 Essentials' (389 or 34%) were included. In concluding that the majority of people do not hike alone, the safety precaution that they have a friend or number of friends to summon help in the event of an emergency can also be inferred from the responses here.

The responses regarding which advisories were checked prior to hiking was also illuminating. While the vast majority check the weather forecast (1,131 out of 1,147 respondents), only approximately half check trail information specifically (519), even less check wildlife warnings (249), and only 99 check the NSR website before going out on their activity. While the experience of the respondents may lead to the assumption that further checking of advisories would not be necessary for the day hikes they were asked to consider for this survey, this remains an area where further education could be necessary to ensure all hikers are similarly informed. There were comments that suggested numerous other advisories, such as Avalanche Canada, BC Forest Fires, signs at trailheads, Instagram, website for example Club Tread and similar forums, online trail reports, or trails apps are consulted, which is reassuring. However, the lack of consistency within responses here suggests that there is an opportunity for safety advisories to be located in a single location, specifically for hikers. While the AdventureSmart website covers a lot of safety information in general, it does not have a weather forecast or updates on trail conditions for example. The response to the question specifically focusing on this as a possibility also suggests that there is a gap here that could be filled by a smartphone app that included elements, such as trail information, weather advisories, wildlife advisories, current conditions, and safety information, which was location specific.

Finally here, the response to the question regarding if the respondent has a contingency plan in the event of an emergency did have a higher negative response than expected. 43% of people do not have a contingency plan if their smartphone fails. Responses to other questions imply that this is because their experience doesn't warrant one, that they have experienced people with them that they hike with, or that they have other methods of communication. As stated at the beginning of this research, accidents

[5] 10 Essentials = Flashlight, fire-making kit, signaling device, extra food & water, extra clothing, navigation & communication aids, first aid kit, emergency shelter, pocket knife and sun protection. Source: adventuresmart.ca.

can happen to even the most experienced and prepared people, but it was surprising that amongst experienced hikers that this was the response.

4.2.4. Navigation and wayfinding

The navigation questions also confirmed a number of preconceptions that stakeholders mentioned. Signage was recorded as the most popular method for navigating on trails that are new, very closely followed by a map. One thing that should have been clarified here is whether the respondent used a topographical map, or a map on their phone. The fact that only 3.22% of people selected Google Maps specifically suggests that respondents used paper maps, but this is too crucial an assumption to make. Regardless, the reliance on signage is very clear, and as the most popular response, it is therefore imperative that signage maintenance should be highest on the list of priorities of any park management.

The positioning of 'map' as second option for navigation is concurrent with the experience level of these particular respondents, whether it is a paper map or using an app on a smartphone. Either option requires some degree of skill to use for navigation, and while a smartphone map app is often used to see a route rather than to plot one from beginning to end, their use still suggests that some wayfinding skills are being employed, even if it is amongst these experienced hikers. As stated above, due to the unreliability of signal in the areas around the North Shore and Squamish, the reliability of online maps depends on the user having the foresight to download them prior to the activity, which was not clarified in the survey.

As shown in the discussion around the AllTrails.com description of Flint and Feather trail on Grouse Mountain above, hiking apps show routes, and have descriptions of trails, so their use here by a selection of relatively experienced people is an appropriate third most popular response. 20% of people responded that they use such an app, which resonates with the knowledge from stakeholders. Again, it would be have been more helpful to clarify here which exact apps are being used, in which case a content analysis of safety information could have been performed, but this is perhaps another area for further research. The over 75 age category who are less likely to use technology for such purposes, only selected hiking or trail book, but the fact that other ages also chose it as a method still demonstrates that less technological methods are

still being used and are fairly available. The table below shows the analysis of which mechanism new trails are navigated by each age group.

Table 7: Comparison of Question 15 regarding how new trails are navigated according to age demographic.

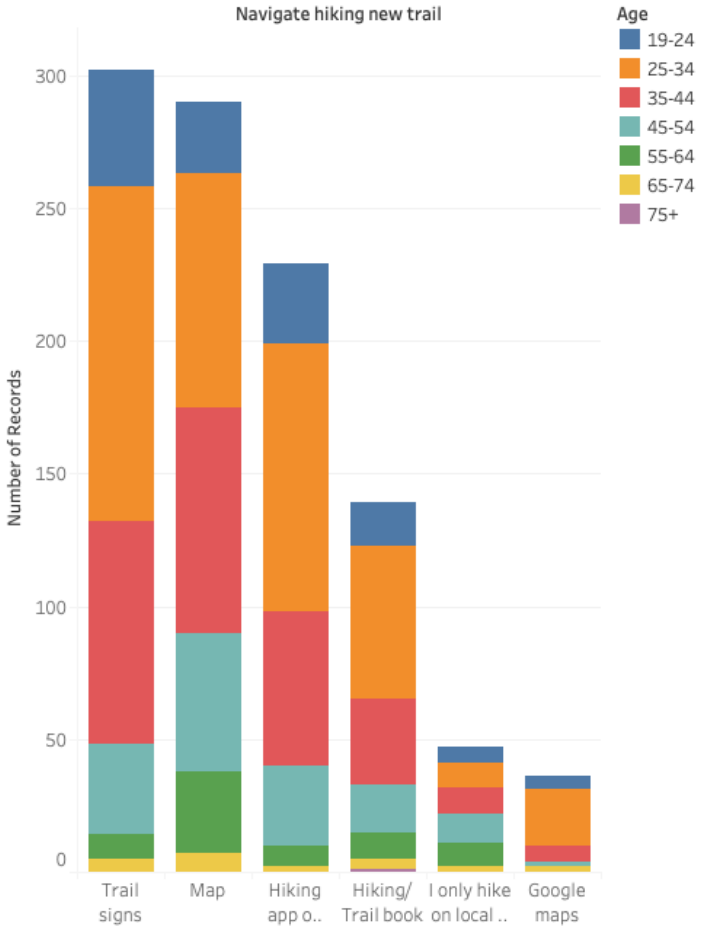

Table produced using Tableau. Question 15 in survey: How do you usually (more than 50% of the time) navigate while hiking on trails that are new to you? Respondents selected one of: Trail signs; Map; Hiking app on phone; Hiking/Trail book; Other; I only hike local trails & don't need navigation; or Google Maps.

The other responses here demonstrated that another option of GPS could have been added. Specifically, a number of respondents mentioned offline smartphone apps such as 'Gaia,' where users can download maps to their phone and use them even without signal. As before, the reliance on the smartphone for navigation offline here does not provide for the event of an emergency, or failure of technology, but the use of such maps and how prevalent their use is for day hikes and for longer hikes is certainly an area for further investigation.

In terms of where respondents find information about new trails, the majority use trail websites (943 out of 1,149) such as AllTrails, Vancouver Trails or Hikes Near Vancouver. As with the wayfinding question, a surprising number still use trail books, 687, and with such a strong response here this demonstrates that it cannot just be the older demographics using these methods. Word of mouth was the third most popular answer with 631, followed by Trail app with 498 people using this method. Interestingly, these responses show that social media is a popular method for finding trails, as 296 use Facebook, and 191 use Instagram. The magazine sites 'Vancouver is Awesome' and 'Daily Hive' are also used, if only by a small minority with 46 and 45 respondents using them respectively. I would speculate that this number would be much higher by surveying a less experienced demographic, but again, this has to be an area for further research.

4.2.5. Smartphone reliance

The question which asked participants to consider if taking a smartphone with them made them feel more secure raised some interesting as respondents were able to add comments here. 418 of them chose to do so, demonstrating how the issue of relying on the smartphone is a more complex one rather than a 'yes' or 'no' answer. Incidentally, 63.15% responded that 'yes,' a smartphone does make them more secure, a surprisingly low percentage considering 98% of respondents take a smartphone with them, and 65% do not take any other form of communication with them, as discussed above. Analysis shows that of the 'yes' respondents, 70% do not take any other form of communication with them, whereas of the 'no' respondents, only 56% do not, as shown in the table below. As smartphones are typically taken everywhere with everyone, and used for such a wide variety of purposes, it is natural that they would typically be taken with someone during an activity. It is where it is the *only* method of communication or navigation that this can become problematic.

Table 8: Comparison of answers to Question 13 regarding the methods of communication taken hiking, with answers to Question 19 if having a smartphone with you makes you feel more secure.

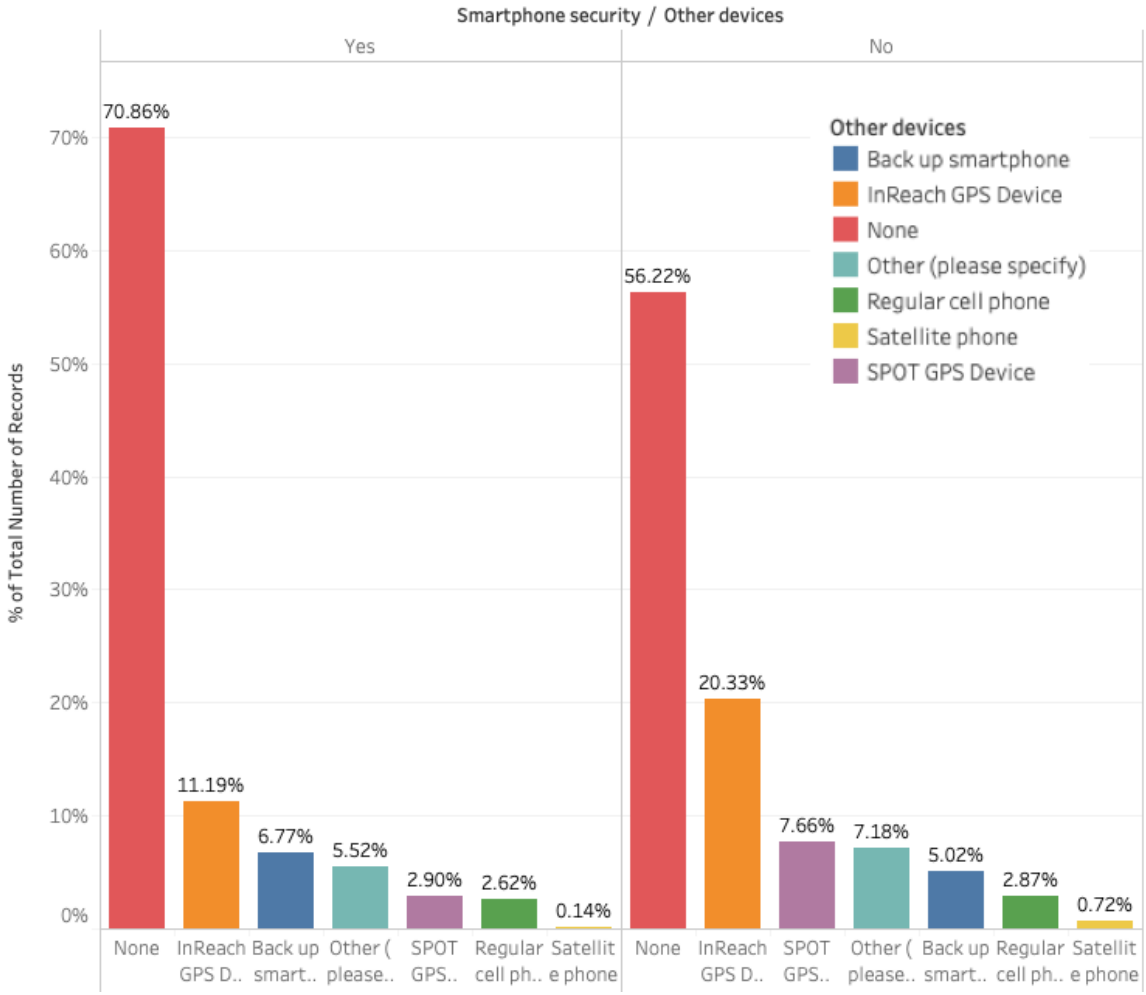

Table produced using Tableau. Questions in survey: 13: Do you take any other form of communication with you? Respondents selected one of: None; InReach GPS; Back up smartphone; Other; SPOT GPS; Regular cellphone; or Satellite phone. Question 19 was a Yes/No answer to the question: Does having a smartphone with you make you feel more secure?

As stated, the option to add comments was where respondents were able to explain their views on security in more detail. One respondent elaborated on their response which epitomises a sensible approach to the use of a smartphone:

> A smartphone is just another tool in the box. It should not replace good planning, or sound decision making. However, if I know an area has cell service, I trust the cell phone to be a better tool to make an emergency call than a 2-way communicator such as the Inreach. It is also faster to navigate using an app like Gaia than it is to constantly refer to maps. I would never rely just on my smartphone, but it can be a useful tool in the backcountry.

The concept that the smartphone is another 'tool' to utilise is one that I believe SAR and all practitioners in the field would appreciate, and this view was echoed a number of times in the comments to this question. Further, there were several responses that recognised that smartphones are susceptible to signal loss, and that the users did have contingency plans involving other members of the group, or only hiking in places where there are other people. This suggests that a certain number of respondents at least are using smartphones in an ideal way while hiking.

However, there were a number of responses that suggested that there are also a number of people who may not necessarily have the same approach. Several responses referred to the ability to refer to "Google maps" specifically if they got lost, even if they lost signal as it would still show their location, or that their partner tracked their location. Having personally tested the use of Google maps for hiking without signal, and tried to track others who did not have signal, the maps, which often do not show specific trails, lose a lot of the definition of the geographical features when offline, and while they may give users a general idea of the area they would be in, I do not believe it would be sufficient to navigate safely in all circumstances. When tracking, Google maps does show the users last known location when signal is lost, so in the event of an emergency that could be used as a starting point, but is not as reliable as a PLB or GPS device. This is not the case for apps that do allow topographical maps to be downloaded prior to the activity such as 'Gaia' but these responses that did specifically refer to Google Maps to be relied on were more concerning.

There were also responses that suggested that users did not consider the repercussions of either losing signal and or battery at all. Response such as "I can check for more info if im lost, i can contact friends if i need to, i can ask for help in remote areas in if there an unpredictable danger, i can use my phone flash light if i need to" demonstrate the lack of awareness of technological failure. Similar responses suggest that reliance on smartphones is based on being able to use them in the same way that they would in the city. This reflects the comments by young people in the study by Leyshon et al. (2013) referred to in Chapter 2 that ''with a GPS mobile phone, you're never really lost," (p.600). It is users such as these that should be the target for education about how to be active in the backcountry without the security of a smartphone.

Finally, one comment further warrants mentioning as it raised an interesting area potentially for further research, and that is of the different security needs depending on gender. The response was as follows: “Selected no initially. But as a woman, a phone always makes me feel more safe so I changed my answer.” The issue of security while hiking for women specifically is an area where limited research has been completed, and could provide useful data for SAR teams. In analysing the data from the surveys as shown in the table below, there was a very similar response between male and females as to whether taking a smartphone made them feel more secure, so perhaps this was a singular view.

Table 9: Comparison of survey respondents’ gender with their answers to Question 19, whether taking a smartphone made the respondent feel more secure.

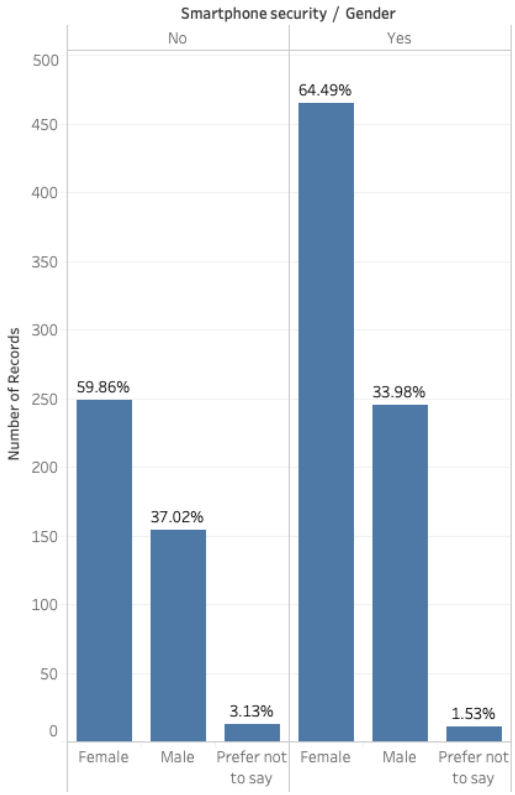

Table produced using Tableau. Question 19 was a Yes/No answer to the question: ‘Does having a smartphone with you make you feel more secure?

The question that prompted the most contentious and incendiary comments of the survey was regarding how participants believed they would act in the event of an emergency; if they would be more likely to call for help rather than endure a long and uncomfortable return hike. This question was taken directly from Pope and Martin’s

study (2011), although the response there was on a scale of 1-7 where 1 was measured as “not at all” and 7 was “a lot” (p.23). The majority of their responses were between 1-3, but not at as high a proportion as the respondents to my survey, with only 42.6% choosing a negative-scale response. 37.2% selected a positive scale response between 5-7, leaving 20.2% who were neutral. The respondents to my survey were much clearer on the negative scale, as 81.1% selected that no, they would not use their smartphones in such a scenario, preferring to self-rescue even if the process was much harder. In fact, it seemed a point of honour for some participants, as they elaborated in the comments with responses such as “I despise people who won't make the effort to get themselves out of trouble. I have cycled 12 miles with a fractured kneecap and walked myself off a mountain with a fractured wrist” or the concise “death before dishonour!” One of the key motivations for such responses was consideration for SAR resources, and ensuring that they would only call in the event of an actual emergency.

Some comments however revealed the confidence that respondents had for calling for help without the event of an actual emergency. As has been identified by some of the interviewees, the calling for help because the option is available was supported by some of the responses, such as “if there's phone signal I'd make contact and see if there happen to be resources available that feel like helping out.” The treatment of SAR in this way was not a recurring theme, but comments such as the previous one do reveal a more casual attitude towards the SAR teams.

More encouragingly, there were some comments that struck a balance between calling for rescue and not calling at all; recognising that it is better to call SAR to ask for guidance and to make them aware that there might be a problem before an emergency arises. Several comments in this vein reveal that there are sensible hikers with excellent risk perception and reasonable attitudes towards using SAR in appropriate times.

4.2.6. Media influence

In asking the question regarding items in the media that might affect awareness of risk, I was aiming to understand which elements of media coverage were visible and had impact on hikers’ behaviour. Interestingly, in a time when viewing figures for traditional news programs are decreasing, this was the most highly selected option, with 780 out of 1,148 choosing it. It suggests that the television media attention that SAR

receives is reaching an audience and that they are affected by the coverage, even amongst a mostly millennial demographic. From the interviews conducted, Sandra Riches of AdventureSmart confirmed this has been an area of focus for her, to increase that coverage in a responsible way (personal communication, June 10, 2019). Whilst this research is not going to include a full content analysis of news reports, the majority of television news stories about SAR incidents reviewed from 2019 from CBC, CTV and Global News *did* refer to safe practices and the necessity to be prepared. The volume of responses selecting this option also demonstrates that while stakeholders are redirecting resources towards social media, it is still important to devote time and resources to traditional news outlets as they are still reaching an engaged audience.

Social media coverage of SAR incidents was also selected by more than 50% of respondents, indicating that it is also a useful resource for information sharing for SAR teams. One of the initial premises for this research was the prevalence of irresponsible trail promotion, particularly by magazine outlets such as *The Daily Hive* and *Vancouver is Awesome*. One participant's succinct comment identified the key issues regarding social media and hiking promotion:

> I have seen that both the Daily Hive on Facebook and Vancouver Trails Instagram page are being more careful to warn of the difficulty of the trails getting to the idyllic photo that they are posting. And there is slightly more signage on trails now warning hikers of the risks. But social media is still a huge problem [in my opinion] for advertising places to unprepared unexperienced people who haven't done the necessary training induction to properly prepare etc and not get themselves in trouble.

The respondent acknowledges that positive changes are being taken, but that there is a lot more that could be done to improve the presentation of hiking on social media sites. Another respondent cited the Twitter accounts of Outdoor Vancouver and Vancouver Trails, stating that they "tweet stories of rescues" which has made them more aware of safety on the trails. By following some 'best practice' guidelines for how to report on hiking safety, more outlets could be sharing a more conducive approach to being prepared on the trails, with tangible results for outdoor recreationists and SAR teams.

The BC AdventureSmart program has been a huge investment for the provincial government in efforts to increase safety for people in all forms of outdoor recreation. According to Sandra Riches, the Executive Director, a significant amount of resources are put into having face to face contact with people spending time outdoors to give

information about safety and preparedness, be it hiking, biking, paddling, skiing, snowshoeing and more (personal communication, June 10, 2019). With regard to whether it is useful for increasing awareness of risk, the AdventureSmart option was selected by 283 respondents, and there were also comments made around the invaluable impact of face to face contact. One respondent stated that it was because of a face to face meeting at Cypress Mountain that they started carrying the 10 Essentials. Comments such as this support the investments made, and suggest that face to face contact as a method for reaching the target audience is highly effective.

4.2.7. Familiarity with SAR

The final question regarding familiarity with SAR services was included to gauge a general level of knowledge amongst the public. Combined with comments received for other questions, this survey confirms that the majority of people engaged in hiking previously do have some awareness of SAR teams and their role in outdoor recreation. Only 2.09% of respondents selected that they had no knowledge of SAR services, only 24 people from 1,148. While the majority of respondents were reached via hiking and outdoor recreation links, who I would assume would have at least some knowledge of SAR teams, there are clearly some people who responded that have no familiarity, but such a large proportion that do is encouraging, because, as confirmed by stakeholders, a higher profile results in better fundraising.

The majority of people selected the middle option for the scale given. As shown in the table below, ‘Somewhat familiar’ with SAR services was the most popular response, as 43.8% of people responded.

Table 10: Responses to Question 24 regarding familiarity with local SAR Services.

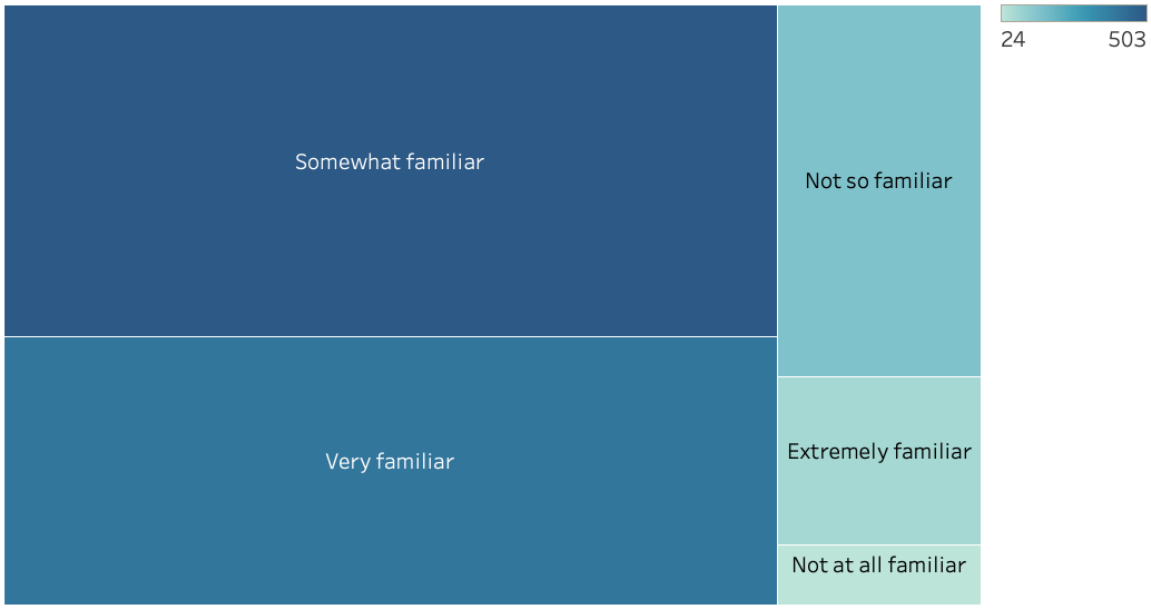

Table produced using Tableau. Question 24: How familiar are you with SAR services? Respondents could select one of: Extremely familiar - I am directly or indirectly involved with my local SAR organization; Very familiar - I am highly aware of how the local SAR organizations operate; Somewhat familiar - I have seen information about SAR organizations and know they are available for calls; Not so familiar - I am aware that there are SAR organizations locally but I don't know much about them; or Not at all familiar.

This suggests that there is still a need for significant communication to improve awareness. Further work could be construed to understand what exactly is known about SAR services; how to contact them, what services they can perform, where they are located, for example. With more detailed surveys or interviews of various demographics, a greater understanding could be reached for what is known about SAR services, and what could be done to improve awareness.

For the purposes of this study, the results for this question suggest that there is at least a basic awareness of SAR teams amongst people within the hiking and outdoor recreation community, but that there is still further work to be completed to increase their profile, something that I am sure is news to no one. However, with tight budgets and limited time for volunteer services and for BC AdventureSmart, this is not an easy task to accomplish. The recommendations from this research are intended to direct some of the efforts to be even more effective, with the understanding that resources are already stretched at what are increasingly demanding roles.

4.3. SAR Statistics[6]

When considering the statistics of SAR teams, one of the most striking aspects was the breadth of incidents covered. Even in the six-month period covered by my review each year, the teams were called to assist with all manner of scenarios; from missing elderly people with Alzheimer's, to ATV accidents, from downed hang-gliders to diabetes attacks on the Grouse Grind, from mysterious flashing lights on Mt. Seymour to investigating the sound of screaming coming from the woods, the volunteers have to be prepared for anything, anywhere, at any time. The incredible strain that some of the rescues have on the SAR team members psychologically is astounding, and I have been constantly amazed at the fortitude and stoicism that accompanied all the SAR representatives I have spoken to and read about, who volunteer their time and skills to help others.

As stated in the introduction, the area focused on is the South West Region, also known as the Sea to Sky Region. The years covered were 2014-2019, for the period 1 April to 30 September. Each year was analysed using the same methods, and the SAR reports were in the same format for each year, enabling easy comparison. As detailed in the methods section, there were some assumptions made in the numerical analysis, but the assumptions were consistently applied and in the spirit of representing the incidents in as accurate a way as possible.

4.3.1. Number of incidents

For the six years covered, the number of incidents can be split into two three-year periods of pattern. The first three years showed a dramatic increase in incidents for each year, from 234 in 2014, to 302 in 2015, to 352 in 2016. Thereafter the numbers reduced to 310 in 2017, but have been increasing at a more gradual pace to 317 in 2018, to 322 in 2019.

[6] All SAR data from Emergency Management BC, 2019.

Table 11: Number of SAR incidents overall for the South West Region for the years 2014-2019.

Year	Overall Incidents
2014	234
2015	302
2016	352
2017	310
2018	317
2019	322

Compiled by the author from Emergency Management BC reported statistics (2019).

When analysing these figures at the team level, there are no obvious correlations. Squamish SAR and NSR are the busiest teams in terms of both numbers of incidents reported and number of team members involved, but their records do not show the same trend as the number overall. Perhaps this is because of the spread of teams across South West BC, and the terrain and type of incident attended to varies greatly between the teams. Comparing Squamish and NSR individually, the highest numbers of incidents in an individual year were different; for Squamish both 2017 and 2018 had 66 incidents, whereas NSR had 74 incidents in 2016. This could suggest that in general, hikers moved location from the North Shore to Squamish in greater numbers in this year which may explain the increase in Squamish. The responses from the survey respondents certainly confirm that their preferred area to hike is Squamish, but there is not enough detail to conclude this decisively.

For both teams the number of incidents reduced in 2019, as Squamish recorded 59 incidents and NSR 53. This could be in part due to the weather, as the summer vacation months of July and August of 2019 had increased precipitation compared to the two previous years (Vancouver Weather Stats, 2019). However, in 2016 when these months had similar levels of precipitation, NSR had the highest number of incident responses at 74. The busiest weeks across all teams also varies across the years, although the busiest week is always in the summer vacation period. The table below summarises which weeks are the busiest for numbers of incidents and numbers of SAR team members involved:

Table 12: Busiest weeks for SAR Incidents from 2014-2019

Year	Busiest week for incidents	Busiest week for numbers of SAR Team
2014	July 28th - August 3rd	July 7th – 13th
2015	August 3rd – 9th	August 3rd – 9th
2016	August 15th – 21st	August 15th – 21st
2017	July 10th – 16th	July 10th – 16th
2018	July 16th – 22nd	July 16th – 22nd
2019	July 22nd – 28th	July 22nd – 28th

Compiled by the author from Emergency Management BC reported statistics (2019).

As can be seen, for the majority of years, the same week is busiest for both apart from 2014 when there was a particular demand for team members in incidents in a different week to the number of incidents in total. This again refers to the variety of incident across the region and across the teams themselves.

The quietest team in terms of numbers of incidents is Ridge Meadows[7], which includes the Golden Ears Park and recreation area. However, in terms of team members involved, in 2015 over 200 individuals responded, and in 2019 over 250, whereas other teams do not use over 150 members in a season. This suggests that although the numbers of incidents is lower for Ridge Meadows, the severity of the incidents is higher and requires greater numbers to respond.

The fact that both Squamish and NSR are the busiest teams by far, regardless of year or weather, indicates their popularity for outdoor recreation in the area. Despite there being many other areas of outstanding beauty in the region such as Golden Ears near Maple Ridge, which is a similar travel time from Vancouver to Squamish and has a similar urban population close by, there are far fewer incidents.

4.3.2. Type of incident

In analysing the types of incidents encountered, the reports were categorised into eight outcomes; a helicopter rescue, subject handed to BC Ambulance Service, subject escorted out by SAR, subject self-rescued, the incident was unresolved, SAR was stood down, the incident turned out to be a hoax or false alarm, or the subject was dead on

[7] Powell River has lower incident numbers than Ridge Meadows, but in some years it is included in the Vancouver Island region, so the incidents were not captured in the South West region statistics.

arrival. For most years according to my categorisation, the greatest number of incidents resulted in SAR being stood down, and this could be for any number of reasons. For example, the incident could be resolved by other emergency services, and this was particularly the case for missing persons, and where incidents occurred in close proximity to roads and access points. However, it does suggest that there is a possibility for the categorisation of incidents to be more accurately designated by emergency dispatch to avoid unnecessary mustering.

There were also a great many incidents where the subject self-rescued, across all years. This must be an area of great frustration for SAR teams, when they are called to an incident and then not be required. The occasions that this happens are not as many as where actual rescues are performed, but for the times that people call without necessity, or where they have simply not informed their emergency contact that they have returned, there may be an opportunity for education to reduce the needless strain on SAR resources.

For the incidents where the subject is either rescued by helicopter, transferred to BC Ambulance Services, or escorted out by SAR teams, this is where their expertise is at its highest value. The SAR teams require specific equipment and skills in order to perform these rescues. There is also a cost judgement made with rescues such as these as discussed earlier, regarding the use of the helicopter. The greatest number of helicopter rescues performed was in 2016, when 69 incidents required one to be deployed, but in the years since this number has reduced overall.

Overall, the number of incidents that occur, the number of volunteers involved in each call, and the type of incidents, reaffirm how essential this service is to the outdoor recreation community. The number of hoax calls, and times where the subjects self-rescue are relatively small compared to the tremendous number of skillful rescues that are performed. The fact that there are no real discernible patterns in the data show how adaptable the teams have to be, as they have no means of predicting when or where the next incident will arise.

4.3.3. Detail of incidents

Contained within the SAR incident reports are short summaries of the incidents. These concise notes only contain objective representations of the details, but are often more revealing in what they do not include. While reviewing the statistics I recorded some of the notable incidents, most of which are where NSR was the primary team, but some other incidents are included where relevant.

There are examples of each year which demonstrate how even the most prepared person can get into difficulty and need rescue. For example in May 2014 “18 North Shore Rescue members responded following a spot beacon sounding at Mount Seymour. The subject, a well prepared elderly male, was located, rescued and transported to the hospital with a fractured leg” (May 20, 2014). The inclusion of the description of the subject suggests that he was ‘well-prepared’ to be able to survive until the time SAR were able to reach him to rescue him, and also his method of communication of the spot beacon was used to good effect to contact SAR for assistance.

Frustratingly, there were also a number of reports where SAR teams had searched for missing persons, only for them to be “located by the RCMP in a hostel in Vancouver” (16 NSR members involved with search, June 7, 2014), “the subject 's father had received a text message advising he was back safe” (11 NSR members involved with search, August 1, 2015), or the “subject was found in a restaurant , alive and well” (30 SAR members from three teams involved with search, July 9, 2017). In these scenarios it is clearly necessary for SAR to be mustered in case the subject was not safe, however a lot of time and effort could have been saved had the subjects contacted friends or family on their return. Perhaps additional signage facing the direction of people returning could emphasise the importance of contacting friends or family to confirm their safe return.

One of the most egregious examples from 2014 is of a two day incident which occurred on June 15 and 16. A male hiker was reported as missing in the vicinity of the Lions, behind Cypress Mountain. On June 15, 2 Lions Bay SAR members and 10 NSR members started searching for him, which continued on June 16 with 10 additional NSR members searching. The report states that the “subject was located in the emergency

cabin near Magnolia Meadows. The subject chose to continue along the Howe Sound Crest Trail despite advice from SAR to come down" (June 16, 2014). It is unfortunate that such a large number of resources were spent in such an event. The report does not state who reported the hiker missing, but the detail that he was located in the emergency cabin again suggests that he did not have sufficient equipment to stay the night, but then refused help when he was found.

There are reports where cell phones are mentioned from 2014, but their frequency increases throughout the years. One incident in 2014 states that the subjects were "located in good condition in a remote area with no cell coverage" (July 22, 2014). While the cellphones were not of use here, the inclusion of such a statement suggests how cellphones were becoming more prevalent in SAR incidents. In 2015, the benefits of cellphone capabilities are highlighted in Squamish when "SAR was able to make contact with the subject via cell and walk the subject out to safety" (May 12, 2015). Here, only 3 SAR members were mustered, and the subject was helped remotely, which reduces the resources needed and the time spent on the rescue. However in the same year, the immediacy of contact that accompanies cellphones initiated a rescue, when "10 Sunshine Coast SAR members responded as requested by RCMP to search for a missing hiker near the B and K logging road in Roberts Creek. SAR learned after the hiker was located in good condition there was a problem with communications when cell phone battery had died and he was not actually lost or overdue" (August 28, 2015). Presumably here, the person who reported the hiker missing could not contact them, and so called SAR assuming that something had gone awry when in fact they were not in difficulty.

The numbers of incidents involving self-rescue also warrant mention. They occur across the teams and throughout the 6 month period reviewed. For example, in May 2017 "15 Squamish SAR members were called upon to assist the RCMP who had received a distress call from 7 exhausted hikers who were unable to find their way out from the Water Sprite Lake area of Squamish. SAR was stood down when the subjects advised that they were able to make their own way out unassisted" (May 16, 2017). This incident resonates with the details that Brian Hutchinson gave regarding a rescue he was involved at the Grouse Grind discussed above, where the subjects were not really experiencing an emergency but had called because they were tired and cold (personal communication, December 12, 2019). In both cases, the subjects were able to continue

hiking, but here SAR was stood down rather than in the previous example where the incident involved the BC Ambulance Service and three fire trucks. It would be useful in all of these scenarios if the subject was better prepared to avoid the effects of exhaustion, and therefore reduce the numbers of incidents where SAR teams are summoned needlessly.

In the instances where SAR resources had been needlessly expended, communication around behaviour and its repercussions could perhaps have reduced the incidents where SAR were ultimately superfluous. It is essential that their resources are sufficient to respond to clear emergencies, and it would be ideal if the general public could be educated to ensure this is understood. This will be discussed further in the final section below.

4.4. Conclusion

The results from the interviews, surveys, and statistical review reveal consistent beliefs about behavioural trends, empirical data which demonstrate those trends, and resulting incidents which show the consequences. The conclusions drawn and recommendations for SAR resources will be discussed below.

Chapter 5. Conclusion

5.1. Summary

Vancouver is a city that often tops the lists of 'Best Places to Live in the World,' and as the population continues to expand as a result of people choosing to live in such a desirous place, greater numbers of people are heading to local areas for outdoor recreation. In order to facilitate their recreation activities, it has been identified that people are relying on social media and their smartphones for finding destinations for recreation, and then to navigate while undertaking the activity. The intent of this research was to determine how smartphone technology is affecting the risk perception of people hiking, and how changes in behaviour subsequently affect Search and Rescue resources.

In creating methods to respond to the research questions that informed this work, I conducted interviews with key stakeholders in the outdoor recreation management field, had widespread success with online surveys created for respondents with experience hiking, and analysed SAR incident statistics.

The interviews demonstrated that anecdotal beliefs about the 'Instagram effect' behaviour being exhibited are indeed occurring, and that communications technology and social media trends contribute to more people on trails, who can be inexperienced and unprepared. For those people, their ability to perceive risk is impeded by social factors, and their lack of experience to perceive a hazard as a risk is one of the factors that has led to an increase of SAR incidents that is disproportional to other influences such as population increase. The surveys confirmed that smartphones are being widely relied upon as means of communication and navigation while hiking, and the reliance on technology has meant that it is increasing confidence, and replacing skills such as navigation and wayfinding. There are often no contingency plans if technology fails.

For the general public, where their experience levels are not as high, but interviews with stakeholders show that the same behaviour is being exhibited, education around appropriate risks involved could be improved and therefore reduce unnecessary SAR expenditure. The SAR statistics provided real-world examples where risky

behaviour has resulted in incidents, supporting the notions expressed in the interviews, and the behaviour suggested in the surveys.

5.2. Practical significance

One of the principle drivers behind the initiation of this research was to provide useful recommendations for SAR teams, collated from the literature review as well as the data received. By approaching the methodology with a wide lens, but applying specific focus to Vancouver, a comprehensive overview of key concepts has been presented, and tangible suggestions can now be made.

5.2.1. Education

Education is frequently cited as the most effective means of communicating messages to an audience, but it is imperative that those messages are specific, measurable, achievable, relevant and targeted. Researchers found that academic studies have recommended education, but not been specific about who should be responsible for that education, or how it should be delivered (Kortenkamp, 2017). As described earlier, the Leiss report on avalanche risk prescribes three components for creating effective risk communication: "(1) whether or not the least-sophisticated user comes away with (2) an adequate awareness of the risks (3) at the time when the activity is about to be undertaken" (O'Gorman et al., 2003, p36). In attempting to provide education that is effective, outdoor recreation managers, be they from SAR teams, park managers, or elsewhere, should ensure that the messages follow these three recommendations. One key element of achieving this is to encourage hikers to seek their own education, and then ensuring that the sources are accessible (Kortenkamp, 2017). Research has shown that where education is directly received from the American National Parks Service, particularly on safety and injury prevention that it is useful in 80% of cases (Boore & Bock, 2013). In a specific study in the US, researchers also found that:

> Educational information could be provided to visitors on entrance to the park and in the Visitor Center through direct, informal interaction with Park staff, educational displays and videos, and formal educational presentations. Special attention should be directed toward individuals who inquire about day-hikes near or within Yosemite Valley. Additional staff could be stationed at popular trailheads to provide further education,

> especially during summer weekends. In Grand Canyon National Park, staff members are stationed at popular trailheads to ensure hikers have enough food and water before proceeding down from the rim of the canyon. (Hung & Townes, 2007, p.115).

These specific, achievable targets are already being used around Vancouver, as interviews confirmed, but there is capacity for this messaging to be more consistent, and more uniform.

Signage

One area where stakeholders can work to provide consistent messaging is in signage. In the North Shore, there are three agencies that have jurisdiction; BC Parks, MVRD and DNV. However, as BC Parks identified, the general public who go hiking in these areas don't always know which jurisdiction they are in, so consistent messaging is essential to avoid confusion or providing conflicting messages (personal communication, December 16, 2019). For example, MVRD stated that they emphasise four of the ten essentials that hikers should take with them, whereas DNV signage recommends all ten. Whilst all messaging around safety is helpful, providing a consistent message is more impactful. Sandra Riches confirmed that the approach of AdventureSmart is to refer to "taking the essentials, and adding to them with seasonal and sport specific gear. We don't want people to 'stop at 10'" as it is dependent on the activity what essentials they will need (personal communication, January 31, 2020).

In terms of best practice to follow, John Howe suggested that the messaging that the Sea to Sky Gondola in Squamish have provided about how long the various hikes available take has been effective at giving people realistic expectations (personal communication, June 17, 2019). Further, the signage at the trailhead to Quarry Rock in graphic form showing items that hikers should take with them is very visible (S. Rogers, personal communication, June 12, 2019). Michael Coyle also referenced the signage at Lynn Canyon which emphasises the risk of fatality in a very clear format, conceding that while people do not want to be reminded about the dangerous side of recreation, that it is necessary to educate people on the risks involved (personal communication, June 10, 2019). In terms of reviewing when signage is less effective, Mike Danks stated that following a missing person, NSR will check on signage on the trail the person was lost on, and see if they can improve it (personal communication, June 14, 2019). As

suggested above, perhaps signage could also be erected on the return direction of the hike to remind hikers to contact friends or family and confirm they have returned. This may help to reduce the incidents of concerned family members instigating unnecessary searches. These examples should be used across jurisdictions, learning from the wealth of knowledge available from each area to improve circumstances across all.

Face to face contact

Signage can be a visual aid for hikers, but there is always the risk that hikers will not see a sign, despite its importance or visibility. It was widely acknowledged that face to face contact is the most effective means of educating people (B. Hutchinson; P. Murry; S. Richie; E. Wood, personal communications December 2, November 15, June 10 & June 11, 2019), and again, there are many options as to how this is delivered. Sandra Riches and AdventureSmart perform as many face to face trailhead interactions as they can, and their efficacy was referenced by a number of the interviewees (BC Parks; A. Morrison; E. Wood, personal communications December 16, June 13 and June 11, 2019). Their trailhead outreach points are staffed by volunteers, but their training is the responsibility of a small number of paid staff from AdventureSmart. By emphasising the effectiveness of these programs, it is hoped that more funding could be provided to increase the number of staff, subsequent volunteers, and therefore the reach of their education.

In many areas, face to face contact is in the form of Park Rangers, often trained by AdventureSmart or SAR, or the Fire Department (M. Danks; B. Hutchinson; S. Riches, personal communications June 14, December 2 and June 10, 2019). In uniform, the Rangers are a visible representation of the park that they are responsible for, and were cited frequently as reminding obviously unprepared members of the public to perhaps return more prepared next time, and to ensure that they have the Rangers' phone number (B. Hutchinson, P. Murry, personal communications December 2 and November 15, 2019). While BC Parks has increased the number of rangers in recent years in response to increased visitation, their vital role in preventing risky behaviour prior to it causing an incident could again be cited as support for even greater numbers, supported for example by AdventureSmart volunteers.

In terms of funding additional resources, there is scope for private companies to contribute to these costs. Brian Hutchinson referred to the huge benefit that Grouse Mountain receives as a result of being adjacent to MVRD land, where Park Rangers are currently funded by provincial budgets, and Eddie Wood indicated that Mt. Seymour as a private operator could take on a role providing some manpower if they were given appropriate jurisdiction (personal communication, June 11, 2019). By including private companies such as those at Grouse Mountain and Mt. Seymour, additional resources could become available.

Smartphone application

As smartphones are now ubiquitous in every aspect of life, it seems logical to include them as a method of education. In the research towards increasing safety in avalanche-prone areas, the possibility of apps that provide access to information regarding avalanche risk are receiving much attention (Charrière & Bogaard, 2016). In terms of raising awareness or in trip-planning, similar themes for hikers can be identified as for those recreating in avalanche-prone areas, so borrowing from the technology created for that audience creates an opportunity for a short-cut to effective education for hikers. Further, AdventureSmart has created a trip plan app that could be incorporated, and Parks Canada has an app that gives users information about the park that they are in. Again, borrowing the technology that is already available could mean that creating such an app is not beyond the realms of possibility.

The responses to Question 23 in the survey asking if a specific app for hikers was of interest demonstrates that there is a desire amongst hikers for such technology to be used, as 85.5% of respondents confirmed they would be interested in such an app. The survey question suggested it could include trail information, weather advisories, wildlife advisories, current conditions, and safety information, specific to Vancouver. In the interview with Eddie Wood, the idea was suggested about having an app that is similar to a ski resort app that shows current conditions, and he was hugely supportive of the idea (personal communication, June 11, 2019). If this concept was realised, Mike Andrews also suggested that when considering creating a useful map, “colours speak volumes” (personal communication, January 28, 2020). In continuing the similarities with the ski resort app, perhaps a universal trail marking system could be agreed, aligning colours of hikes similarly to how ski runs are graded. Black for most difficult, blue for

intermediate, and green for easiest. In this way the difficulty of the hike would be indicated in a clearer and consistent manner.

5.2.2. Preparedness

As stated previously, lack of preparedness was the most frequently cited threat to hikers safety by the interviewees, but there was a lack of consistency as to what the stakeholders believed was necessary in order for hikers to be prepared. The responses to the survey suggest that, even within a community of experienced hikers, the key items are not given the same regard across the respondents, with the exception of a smartphone. With regard to hikers, and day hikers here specifically, it is recommended that consistent messaging be applied to ensure that necessary items of safety gear are prioritised. As Dawn Hanna of MVRD stated, “people can only remember four things at a time”, the psychology of which is beyond the scope of this paper, but in her experience the most effective way to increase preparedness has been to reduce the ten essentials to four; water and a snack, an extra layer, have adequate ankle support, and a phone (personal communication, June 11, 2019). Her theory is supported by relevant research, in terms of only four essentials being necessary, but Boore and Bock (2013) suggest “appropriate footwear, sufficient water, sufficient food, and trekking poles” (p.6) to prevent the most commonly experienced injuries. If four essentials are therefore suggested as necessary, at least for day hikers, it should be agreed across agencies which are the definitive.

Carrying these items is clearly not the only way of preventing injury. John Howe epitomised what else is required in most cases to ensure proper preparedness as “Not just carrying the essentials but understanding what is involved – what you’ve got to take, what level of exertion is it going to be, what are some of the pitfalls that might happen in your proposed trip” (J. Howe, personal communication, June 17, 2019). One of the methods that these elements are discovered is by use of an accurate map, and ability to use it. Many of the interviewees and survey respondents recognised the necessity for some kind of map for navigation, be it a topographical version (less popular) or on a smartphone (more popular). Ensuring that maps are accurate was one element of map applications indicated as vital, and while it is beyond the scope of this research to perform a content analysis and accuracy review of map app services, one suggestion for further research or as part of a project for stakeholders would be to create a

recommended list of apps could be provided by SAR, AdventureSmart or other agencies. As it is inevitable that smartphones are used for navigation, a recommended accurate service may be one way to increase the use of a reliable source. Combining the use of a verified map app that can be downloaded prior to the activity, with education around the pitfalls of using inaccurate maps, and the dangers of the lack of reliable signal in the areas outside of Vancouver, could address a number of the gaps in knowledge identified in this research.

5.2.3. Communication

As referred to previously, ensuring that a consistent message is provided is important for effective messaging, but equally if not more important is an effective means of communicating those messages. I referred above to the importance of signage, and of face to face contact as a means of education, but in terms of communicating those messages to a wider audience using the tools available can also create dialogue and encourage safer behaviour.

Television media

The reportage of SAR incidents in the media has become a lot more effective in recent years, mostly due to the efforts made by key stakeholders. In previous years, the sensationalised stories emphasised the “sexy” side of SAR (S. Riches, personal communication, June 10, 2019), and television programs such as *Call Out* glorified rescues to make them seem glamorous (A. Morrison, personal communication, June 13, 2019). Television coverage more recently has been more focused on safety messaging. Sandra Riches, Mike Danks and Michael Coyle all referred to the emphasis that they place on positive reinforcement when interviewed about incidents, speaking to what the person did that was helpful, rather than what they did wrong. According to Michael Coyle, this is because viewers believe that they would not make the same mistakes as a lost person made, but they can identify with the preventative actions they took (personal communication, June 10 2019). A new television program is in production by Peg Leg Films which will be airing in 2020. Hopefully their messaging is effective and reflects the hard work that the stakeholders have already achieved to focus on positive reinforcement in preventing incidents.

Social media

A fascinating insight into the effective use of social media came from the interview with Brian Hutchinson. He confirmed that in 2018, the North Vancouver District Fire Department and DNV used social media to emphasise messaging around limiting numbers of visitors to Quarry Rock, even suggesting that they would be stopping people at the trailheads if the trail became too busy. This became widely reported, including on local news channels (Balca, 2018). Mr. Hutchinson revealed that the messaging had the desired effect of reducing numbers, and they never had to implement the management strategy to actually enforce such a policy. While this use of social media could not be replicated in many locations, it demonstrates how effective messaging can be used with tangible effect (personal communication, December 2, 2019).

Further, there is potential in utilising social media for research. It has been discussed how studies have demonstrated how social media has been used as proxy for visitor numbers (Richards & Friess, 2015; Palomino et al., 2016; Hausmann et al., 2018), and these models could be used with a small amount of research resources to great effect in Vancouver. The methodology used in this research to reach a wide audience for the online surveys showed how eager the engaged public are to assist with relevant research, and I am confident that SAR teams could elicit sponsorship to provide incentives similarly to the $100 MEC vouchers as reward for participation.

Physical barriers

Finally here, one additional method of effective communication was by employing physical barriers and reducing access to particularly affected trails. Brian Hutchinson referred to the DNV bylaw in Deep Cove that limited access to tour buses with permits to actually enter the village in the summertime (personal communication, December 2, 2019). This greatly reduced the visiting tourists to Deep Cove and Quarry Rock, decreasing damage to the trail itself, and preventing incidents. Further, in an effort that also benefited local residents, Panorama Drive, the road from which the Quarry Rock trail is accessed, was closed to visitors once the parking lot was full. This had the effect of limiting access to the trailhead, and encouraged visitors to go elsewhere. Again, this may be a tactic that is not practical in all scenarios, but its effectiveness was clear, and could therefore be applied in limited circumstances.

Similarly, Wayne Maskall referred to the DNV policy for parking lots with access gates, that they are closed at a particular time, which is well-signposted on all entry points (personal communication, June 12, 2019). He confirmed that this had the effect of giving people a time limit to return, and ensured that if they started their hike later in the day that they were thereby encouraged to return before the gate closed. These practical efforts where people are physically affected by limiting factors to their hikes could go some way to prevent both excess traffic on trails, and reduce the number of people that get lost after dark.

5.2.4. Collaboration

Round table/workshop event

One of the key elements for bringing all of the elements of recommendations together has to be collaboration between all stakeholders. The interviewees confirmed that there have been singular efforts which included some agencies or teams (BC Parks, M. Coyle, personal communications, December 16 and June 10, 2019), but so far there has not been an effort to bring all agencies and teams together. One of the outcomes of this research that would bring effective communication to all teams would be an all-agency round table workshop where elements of education, communication and preparedness could be discussed in a productive way. As one research study states:

> Institutionalising collaboration between the public and private sectors and the affected local communities is a goal that both governmental and industry actors should work toward. Ideally, such collaboration will take the form of multi-stakeholder planning and decision-making with regard to tourism strategies and master plans, in which all parties are given equal opportunity to participate. Master plans should include a broader sustainable development rationale and address both biodiversity and socio-economic considerations. (Kuenzi & McNeely, 2008, p.169).

I will be working with stakeholders to create such an event, which would provide such an environment, and ideally would create a dialogue that could continue beyond one meeting and become an annual event.

Improving SAR incident reporting and data sharing

One element that could also be considered is collaboration between SAR teams regarding commonalities across incidents. The EMBC statistics reviewed for this study are condensed versions of full SAR reports completed by the teams, where more information about each incident is recorded in much more detail.

The suggestions for ways to improve public education from the extensive reviews of SAR incidents in US National Parks conducted by Hung and Townes (2007), Heggie and Amundson (2009), and Boore and Bock (2013), are incredibly effective as they stem from a review of all full incident reports. These studies were therefore able to provide information about peak times and dates for particular activities, areas of high incident rate, and suggest improvements on the use of resources. Further, the most recent study by Boore and Bock (2013) was able to produce in-depth information following surveys of the individuals involved in incidents after the fact, asking them to reflect on what could have prevented the incidents from occurring. A similar exercise across SAR teams in the SWE region of BC would undoubtedly prove useful in identifying trends in reporting, underlying causes of incidents, areas of commonalities, and help with ensuring accurate and relevant communication about the issues affecting safety which can be used to direct effective education to the public.

5.2.5. Summary of recommendations

The aim of this research was to provide a useful list of recommendations for SAR teams and other related organisations to aid in reducing unnecessary resource expenditure. In concluding this section, the list is as follows:

- Ensure signage is consistent across jurisdictions.
- Increase face to face contact opportunities.
- Use avalanche warning technology as model for marginal conditions
- Develop a new all-encompassing app which is Vancouver specific and includes trail conditions, wildlife warnings, weather reports and safety issues.
- Recommend which of the ten essentials are essential for regular day hikes.

- Create a program for recommended hiking or mapping apps ‘approved by SAR’ validation.
- Reinforce positive behaviour in media reporting.
- Identify if any opportunities for social media manipulation regarding messaging.
- Utilise social media for research.
- Identify any opportunities for using physical barriers.
- Collaboration between agencies in a round-table workshop, and for a detailed review of SAR incident reports.

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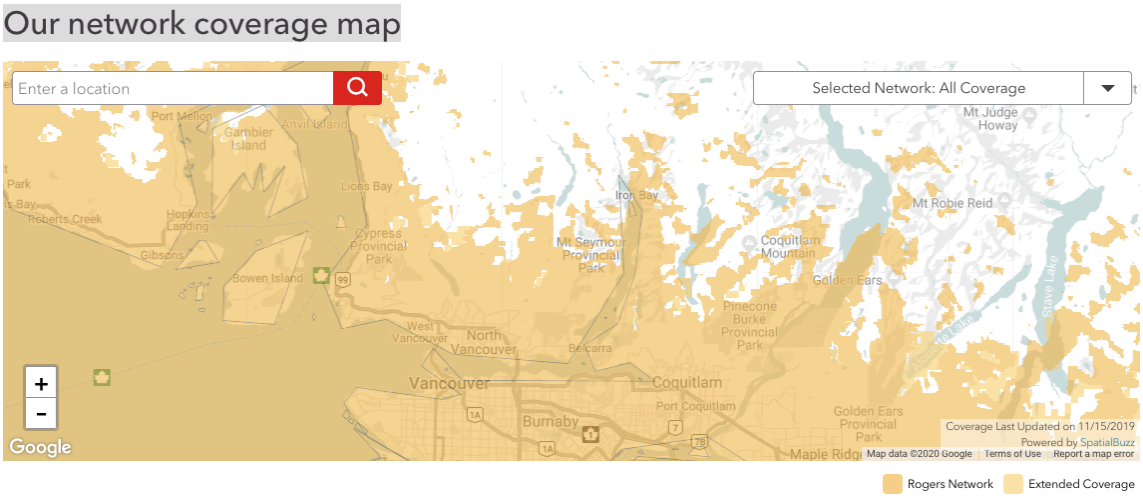
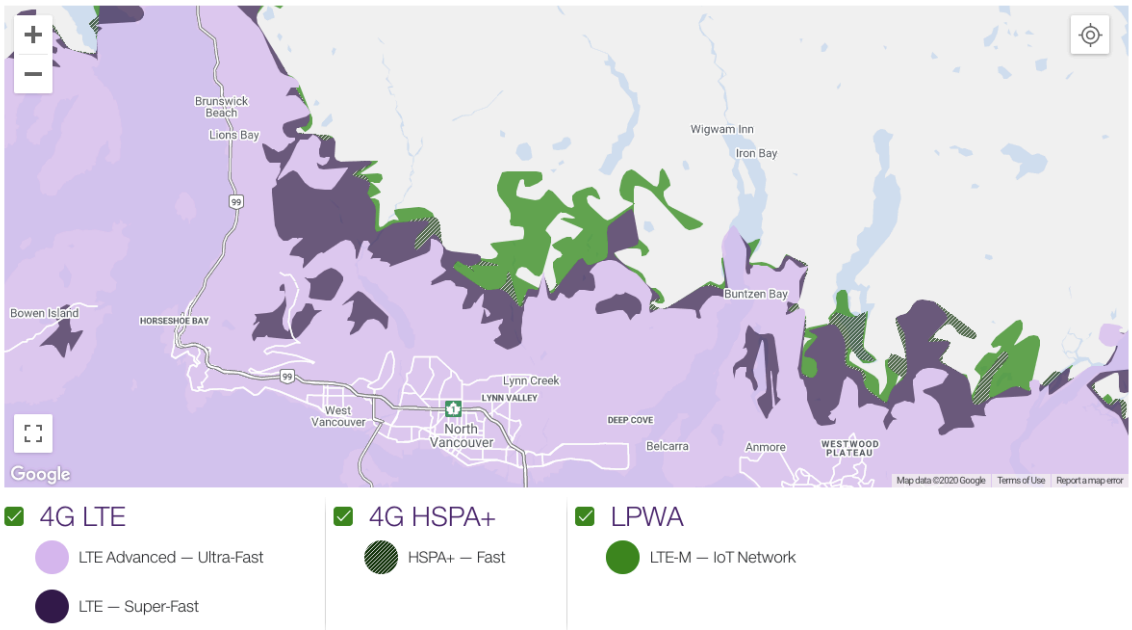
Appendix A. Maps showing network coverage of North Vancouver for Rogers, Telus, Bell and Freedom.

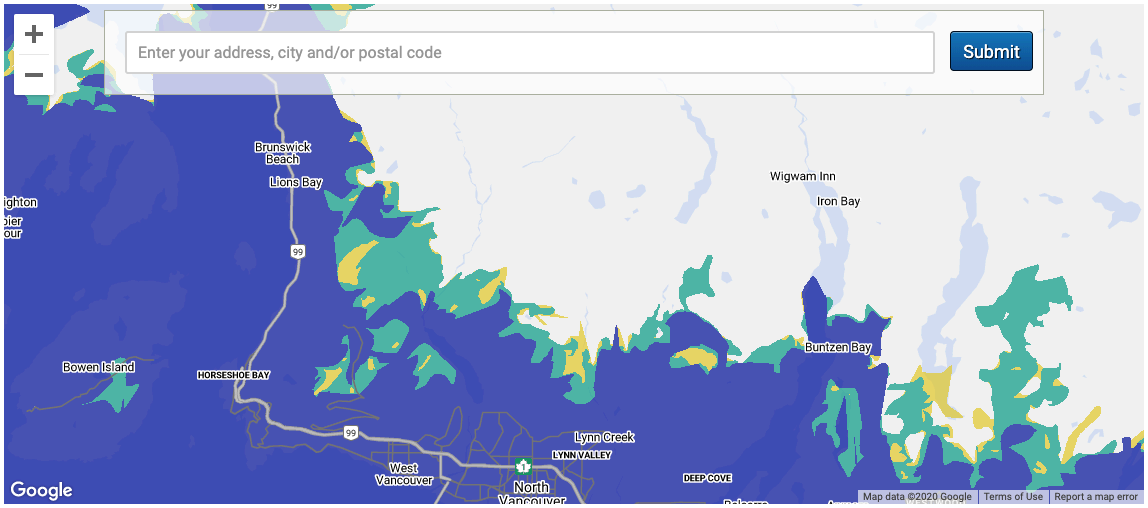


Above: Rogers



Above: Telus

Coverage map



Coverage shown is approximate and actual coverage may vary. Speed and signal strength may vary due to traffic, topography, environmental conditions and other factors, including Bell's Internet traffic management practices (e.g., priority access to emergency personnel and critical infrastructure personnel). See Bell.ca/ITMP

Select coverage type

LTE
- LTE Advanced (LTE-A)
- LTE
- Future

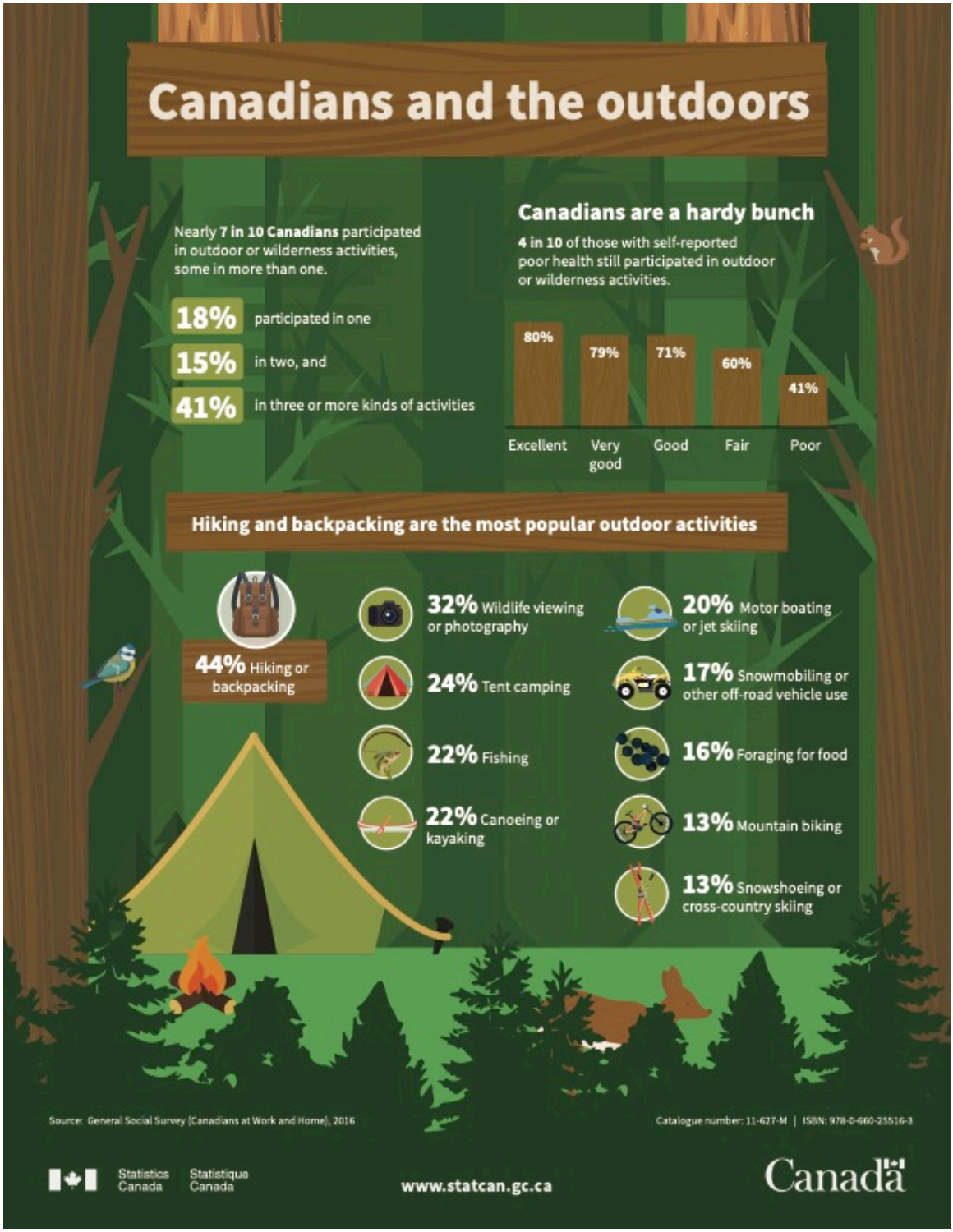
4G HSPA+
- HSPA+

LTE-M
- LTE-M

Above: Bell

Above: Freedom

Appendix B. Infographic from Stats Canada



Appendix C. Map showing regions of BC Search and Rescue Teams

Image from blog of Michael Coyle, Coquitlam SAR Manager.

Appendix D. List of Organisations Contacted to Share Link to Online Survey

- North Shore Rescue
- AdventureSmart BC
- Michael Coyle at Coquitlam SAR
- Metro Vancouver Parks
- Coast Outdoors
- Mt. Seymour
- Chasing Sunrise Facebook Group
- Wanderung Hiking Group
- Vancouver Trails
- North Shore Hikers Facebook Group
- BC Mountaineering Club
- Valley Outdoor Facebook Group
- Alpine Club of Canada
- Outdoor Vancouver Facebook Group
- Trails BC
- The Hiking Club
- North Vancouver Outdoors Club
- Burnaby Outdoor Club
- Association of Canadian Mountain Guides
- South Coast Touring Facebook Group
- Backpacking in BC Facebook Group
- SFU Outdoor Club
- University of BC Varsity Outdoor Club
- Bowen Island Trail Society
- Friends of Garibaldi
- Mounatin Mentors
- Hike BC

Appendix E. General Questions for Interviews

Pre-interview:

- My background, why I am conducting this study
- Want to make sure it is relevant and useful, so any further ideas or comments please share
- Confirm job title
- Happy to be quoted?

Interview:

1. Can you give me an overview of your organization's operations?
2. How are you funded?
3. How do you work with SAR organisations?
4. How have you seen the behaviour of hikers in Vancouver change in the last 5 years?
5. Do you think there are differences between those hiking in the North Shore and other jurisdictions? If so, why?
6. What would you attribute any changes in behaviour to?
7. How have you seen the impact of smartphone technology affect people hiking?
8. Where have you seen the most amount of rescues? Do you have data on incidents you can share?
9. Is there a gap between people's expectations of rescue and the reality?
10. Anything that can be done by ANY element of public interaction to counter that?

11. Do you think there is something about the uniqueness of Vancouver that creates specific problems, or is it universal?

12. How have your resources been affected by the reliance on smartphone technology by people hiking?

13. What would you attribute the increase in calls for rescue to?

14. Do you think they are directly correlated to increase in population?

15. Is there anything useful that could be done by public facing organizations that you can identify that would change this behaviour?

16. What do you see as the greatest threat to hikers' safety while out on the trails?

17. Whose responsibility is it to give hikers information?

18. Is there anything you think might be useful for me to ask or direct questions about when surveying in the field?

19. Is there anyone else you would recommend me to talk to?

Appendix F. Survey Monkey Online Survey – Questions and Results

Q1. Consent. Respondents had to select 'Yes' to the consent form to move to the body of questions.

Q2. Where do you live?

38% City of Vancouver
18.04% North Vancouver
6.04% Burnaby
4.9% Other BC
3.94% Surrey
3.24% Chilliwack
2.89% Abbotsford
2.54% Richmond
2.54% Squamish
2.45% Coquitlam
2.28% Langley
2.28% New West
1.66% West Van
1.49% Port Moody
1.49% Maple Ridge
1.23% PoCo
1.05% Other International
0.96% Whistler
0.88% Other Canada
0.79% Delta
0.7% Other Metro Van
0.61% White Rock

Q3. How old are you?

38.5% 25-34
26.5% 35-44
14.35% 45-54
12.07% 19-24
6.39% 55-64
2.1% 65-74
0.17% 75+

Q4. Gender

62.82% Female
35.08% Male
2.1% Prefer not to say

Q5. How often do you go on day hikes?

31.88% few times per month
29% once per week
16.24% few times per week
12.84% once a month
8.47% less than once a month
1.31% every day
0.26% once per year

Q6. Where do you go on day hikes in the lower mainland? Select all that apply that you would typically hike in one summer season, April-September.

Squamish 786
Lynn Headwaters 700
Cypress 689
Seymour 656
Whistler 547
Grouse 541
Howe Sound 469
Deep Cove/Quarry Rock 450
Buntzen Lake 408
Manning Park 388
Lions Bay 359
Ridge Meadows 351

Pemberton 334
Other (incl. Chilliwack, N Cascades, Coquihalla, Washington) 244
Sunshine Coast 201
Burnaby Mountain 170

Q7. Which area do you hike the most? Please select just one answer.

Squamish 210
Lynn Headwaters 207
Cypress 111
Other (incl Chilliwack, N Cascades, Coquihalla, Washington)
Seymour 92
Grouse 87
Ridge Meadows 57
Whistler 53
Manning Park 47
Howe Sound 39
Buntzen Lake 39
Deep Cove/Quarry Rock 31
Pemberton 31
Burnaby Mountain 18
Lions Bay 13
Sunshine Coast 11

Q8. When you go on day hikes, how many people do you usually (more than 50% of the time) go hiking with?

43.55% One other
29.53% 2-3 Others
19.51% Solo
5.49% 4-5 Others
1.22% 6-10 Others
0.7% 10+ Group

Q9. What are your primary motivations for going hiking? Select up to 3 that apply.

1018 Spending time in nature
670 Fitness
478 Adventure
398 Activity with friends
392 Explore new locations
319 Escape the city
288 Sense of accomplishment on completion
256 Challenge
160 Leisure
79 Meditation
59 Taking pics for sharing on social media
23 To make friends
Comments included other reasons eg dog walking, photography, work

Q10. When you go on day hikes, do you or someone in your group usually tell someone else where you are going?

84.7% yes
15.3% no

Q11. When you go on day hikes, do you personally take a smartphone with you?

97.73% yes
2.27% no

Q12. If yes, do you check the cell phone coverage in the area you are going hiking in?

39.21% yes
60.79% no

Q13. Do you take any other form of communication with you?

65.3% none
14.47% InReach GPS
6.10% back up smartphone
6.10% other (incl PLB, Garmin GPS, charger/battery for phone, resqlink, whistle, EPIRB, radio)
4.71% SPOT GPS
2.96% Regular cell phone
0.35% Satellite phone

Q14. On a scale of 1-10, how much hiking experience do you have? 1 = no experience, 5 = 1-2 years of hiking experience, 10 = highly trained mountaineer

Result average = 7

Q15. How do you usually (more than 50% of the time) navigate while hiking on trails that are new to you?

26.37% Trail signs
25.33% Map
20.19% Hiking app on phone
12.10% Hiking/Trail book
8.7% Other (GPS device, Gaia GPS, mix of the options, take pic of map at trailhead or equivalent, offline maps on phone)
4.09% Local trails don't need navigation
3.22% Google maps

Q16. Where do you get information from about new hiking trails? Select all that apply.

943 Trail website
687 Trail book
631 Word of mouth
498 Trail app
296 Facebook
191 Instagram
73 Tourist information
46 Vancouver is Awesome
45 Daily Hive
40 Only go on organised hikes

Q17. Do you usually check any advisories before a day hike? Please check all that apply.

1131 Weather forecast
519 Trail info on BC Parks or Metro Van District
249 Wildlife warnings on BC Parks or Metro Van District
230 Social media group
193 Local residents/personal contacts
99 NSR website

Q18. What, if any, safety precautions do you usually take before going on a regular day hike? Select all that apply.

1040 Smartphone
938 Tell a friend
792 First Aid Kit
661 Some of 10 Essentials
507 Confirm time return with friend
389 All of 10 Essentials
348 Additional battery for cellphone
249 GPS etc
139 Trip plan on paper
91 Back up cell phone
54 Trip Plan App

Q19. Does taking a smartphone with you while hiking make you feel more secure?

63.15% yes
36.5% no

Q20. Do you have a contingency plan if an emergency happens and your smartphone fails?
57.11% yes
42.89% no

Q21. While on any kind of hike and you encounter a problem, would you be more likely to use a smartphone to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?

81.13% no
18.09% yes

Q22. Has there been anything you've seen in the media or elsewhere that effects your awareness of risk, and what you need to know before hiking?

780 News coverage of SAR incidents
714 Personal observations
642 Social media coverage of SAR incidents
535 Word of mouth
404 Risks emphasised on hiking website
283 BC Adventure Smart program
54 None

Q23. Do you post pictures to social media?

38.7% Yes – on occasion
33.74% Yes – some of the time
14.35% Never
13.22% Always

Q23. Would you consider using an 'all inclusive' smartphone app for hiking that included trail information, weather advisories, wildlife advisories, current conditions, and safety information, specific to Vancouver?

85.53% Yes
14.47% No

Q24. How familiar are you with SAR services?

43.82% Somewhat
35.37% Very
12.89% Not so familiar
5.84% Extremely – involved
2.09% Not at all

Appendix G. SAR Data Analysis

2019 data analysis as an example.

SWE Overall Incidents		# Incidents per Location															
Week		**SQU**	**PEM**	**WHI**	**NSR**	**COQ**	**HOP**	**CHI**	**KHA**	**RMD**	**SUR**	**MIS**	**CFV**	**SC**	**LB**	**PR**	**INCIDENTS**
Apr 1-7	4	2		1	1												**4**
Apr 8-14	6				2	1	1		2								**6**
Apr 15-21	5		2	1		1			1								**5**
Apr 22-28	4		2	1							1						**4**
Apr 29-May 5	8	2	1		1			1	1	2							**8**
May 6-12	9	2			3			2		2							**9**
May 13-19	16		1	1	3	2		5	2		1				1		**16**
May 20-26	13		1		5		1	3		1	1		1				**13**
May 27-Jun 2	8			1	2	1	1		1						2		**8**
Jun 3-9	8			1	2	1	1		1						2		**8**
Jun 10-16	14	1	1		2	1		2		2			1	2	2		**14**
Jun 17-23	15	5		3	2			2		1		1	1				**15**
Jun 24-30	21	2		2	4	1	3		2	4				1	2		**21**
Jul 1-7	10	2	1	1	3			1				1		1			**10**
Jul 8-14	14	3		1				5	2	1		1	1				**14**
Jul 15-21	15	5	3		1		1	1	1			1			2		**15**
Jul 22-28	25	5	3	2	6		1	4	1	1		1			1		**25**
Jul 29-Aug 4	20	6	1			4	1	3	1	3					1	1	**21**
Aug 5-11	14	6	1	2	1		1		2		1						**14**
Aug 12-18	19	5	5	2	2		1	1	1					1	1		**19**
Aug 19-25	13	2		1	1	1	1	1		1		4		2	1		**15**
Aug 26-Sept 1	20	3		2	3		2	3	4	1	1					1	**20**
Sept 2-8	15	2	1	1	5		1			1	1	1			2		**15**
Sept 9-15	6		1			1		1		1	1			1			**6**
Sept 16-22	8	2			3	1	2										**8**
Sept 23-29	12	4		3	1		1	1					1	1			**12**
Sept 30	0																**0**
TOTALS	**322**	**59**	**24**	**26**	**53**	**15**	**19**	**36**	**22**	**21**	**7**	**10**	**5**	**9**	**17**	**2**	**325**

SWE Overall Incidents		# Team Members Involved															
Week		**SQU**	**PEM**	**WHI**	**NSR**	**COQ**	**HOP**	**CHI**	**KHA**	**RMD**	**SUR**	**MIS**	**CFV**	**SC**	**LB**	**PR**	**TOTAL SAR**
Apr 1-7	4	17		1	30												**48**
Apr 8-14	6				10	12	3	7	7								**39**
Apr 15-21	5		14	12		1			10	1							**38**
Apr 22-28	4		24	4							18						**46**
Apr 29-May 5	8	27	8		3			24	6	11							**79**
May 6-12	9	27			22			19		26							**94**
May 13-19	16		9	6	23	28		44	11	12	2		1		6		**142**
May 20-26	13		13		58		7	29		12	12		23				**154**
May 27-Jun 2	8	44	8			11	17	8						5			**93**
Jun 3-9	8			2	16	19	8		8						20		**73**
Jun 10-16	14	14	5	5	23	5		19		24			11	35	10		**151**
Jun 17-23	15	48		7	17			16		13		11	15				**127**
Jun 24-30	21	17	11	2	45	32	22	10	16	32				12	27		**226**
Jul 1-7	10	26	4	7	29			13		7		8	7	6			**107**
Jul 8-14	14	47		6				65	20	10		21	24				**193**
Jul 15-21	15	49	31		5		4	10	12			22			15		**148**
Jul 22-28	25	89	17	7	38	7	15	51	18	16	7	18	30		12		**325**
Jul 29-Aug 4	20	123	8			42	3	42	8	43					11	1	**281**
Aug 5-11	14	106	8	5	4	12	5	12	21		8						**181**
Aug 12-18	19	56	29	6	10		1	6	6					11	10		**135**
Aug 19-25	13	23		4	12		7	10		10		34	10	27	9		**146**
Aug 26-Sept 1	20	40		6	7		13	29	39	13	1					3	**151**
Sept 2-8	15	28	4	6	46		9	8		13	10	1	8		19		**152**
Sept 9-15	6		6		3	15		12		14	18			18			**86**
Sept 16-22	8	24			31	17	13				2						**87**
Sept 23-29	12	37		19	16		7	9	2				16	12			**118**
Sept 30	0																**0**
TOTALS	**322**	**842**	**199**	**105**	**448**	**201**	**134**	**443**	**184**	**257**	**78**	**115**	**145**	**126**	**139**	**4**	**3420**

	SWE Overall Incidents		Helicopter	To BCAS	Escorted	Self Rescue	Unresolved	SAR Stood	False Alarm	DOA
Week										
Apr 1-7	4			1	2			1		
Apr 8-14	6		1		2			3		
Apr 15-21	5			1	1			1	1	1
Apr 22-28	4		1	1				2		
Apr 29-May 5	8		3	1				3		1
May 6-12	9		1	3	1			4		
May 13-19	16		3		4	1		8		
May 20-26	13			3	4	3	1	1	1	
May 27-Jun 2	8		1	3	1			3		
Jun 3-9	8		1	2	3	1		1		
Jun 10-16	14		1	3	4			4	1	1
Jun 17-23	15		1	3	3	1		3	3	1
Jun 24-30	21		3	3	4	2		5	3	1
Jul 1-7	10		2	2	2	1		3		
Jul 8-14	14		1	2	3	2		4	2	
Jul 15-21	15			6	5	1		2	1	
Jul 22-28	25		4	5	6	3		5		2
Jul 29-Aug 4	20		4	6	1			7	3	
Aug 5-11	14		3	6	2		1	2		
Aug 12-18	19		4	3	2	4	1	5		
Aug 19-25	13			3	3	2	1	3		1
Aug 26-Sept 1	20		4	4	2	3	3	3	1	
Sept 2-8	15		2	2	7	1		2	1	
Sept 9-15	6		1	3		1		1		
Sept 16-22	8			2	1			4		1
Sept 23-29	12			7	2	1		2		
Sept 30	0									
TOTALS	**322**		**41**	**75**	**65**	**27**	**7**	**82**	**17**	**9**

Sample of comparison of data across 2014-2019 years

	SWE Overall Incidents	SAR Team #s	Helicopter	To BCAS	Escorted	Self Rescue	Unresolved	Stood Down	False Alarm/Hoax	DOA
2014	234	2548	40	47	40	27	2	48	18	12
2015	302	3207	53	47	68	31	2	64	29	8
2016	352	3682	69	44	80	30	7	81	27	14
2017	310	3310	39	65	87	27	3	60	24	5
2018	317	3034	50	59	66	26	4	77	30	5
2019	322	3420	41	75	65	27	7	82	17	9

Busiest Weeks	# Incidents	SAR Team #s
2014	Jul 28-Aug 3	Jul 7-13
2015	Aug 3-9	Aug 3-9
2016	Aug 15-21	Aug 15-21
2017	Jul 10-16	Jul 10-16
2018	Jul 16-22	Jul 16-22
2019	Jul 22-28	Jul 22-28
Busiest Team	**# Incidents**	**SAR Team #s**
2014	SQU	SQU
2015	NSR	NSR
2016	NSR	NSR
2017	NSR	SQU
2018	NSR	SQU
2019	SQU	SQU