NATURAL HAZARD RISK COMMUNICATION: EXAMINING THE FLOW OF KNOWLEDGE FROM THEORY TO PRACTICE

by

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Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Dedication Page

Dad, there is a piece of you in everything I do. Thank you for showing me the way.

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Abstract

This thesis examines the mobilization of knowledge from theory to practice in natural hazard risk communication. The main question this thesis asks is "to what extent are insights from literature on risk communication reflected in practice?" The thesis examines how communication practices from risk psychology are presented both in 'Best Practice Guides' for risk communication as well as in real-world communications in the Canadian context. This thesis reveals strengths in the translation of knowledge from theory to practice as well as barriers and tensions that communicators may encounter when implementing recommendations from risk psychology in practice. These findings have relevant implications for natural hazard risk communication and knowledge mobilization more broadly.

List of Abbreviations Used

DRR	Disaster Risk Reduction
UN	United Nations
IDM	Information Deficit Model
UNDRR	United Nations Office for Disaster Risk Reduction
NOAA	National Oceanic and Atmospheric Association
EPA	Environmental Protection Agency
AIDR	Australian Institute for Disaster Resilience
NHC	Natural Hazards Center
CDAC	Communicating with Disaster Affected Communities
IFRC	International Federation of Red Cross and Red Crescent Societies
NBEMO	New Brunswick Emergency Management Organization
TRCA	Toronto and Region Conservation Authority
AEMA	Alberta Emergency Management Agency
KMb	Knowledge Mobilization

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Chapter 1: Introduction

This thesis aims to examine how current academic knowledge about natural hazard risk communication is implemented in practice. The scientific consensus is that the earth is warming due to human activity (Intergovernmental Panel on Climate Change, 2022). Many of the anticipated consequences of anthropogenic climate change are already a reality, and, consequently, the need to develop and improve adaptation and mitigation strategies for climate change is increasingly critical. Natural hazards have increased in both frequency and severity because of climate change and will continue to do so (Lawrence et al., 2022). The potential intensity of tropical cyclones is growing as surface sea temperatures rise (Kossin et al., 2020). Anthropogenic climate change has also directly been linked to increased fuel aridity of forests (Abatzoglou & Williams, 2016). Anthropogenic climate change doubled the forest fire area in the Western United States between 1984-2015, and this is projected to continue to increase (Abatzoglou & Williams, 2016). Extreme precipitation events are also likely to increase in frequency and severity as temperatures continue to rise (Seneviratne et al., 2021). Evidently, anthropogenic climate change has—and will continue to—cause multiple natural hazards and extreme weather events to occur more frequently and with greater force.

The growing impact of natural hazards has led to a greater focus internationally on disaster risk reduction (DRR) as a critical aspect of climate change adaptation and mitigation, as well as sustainable development. While the frequency of natural hazards varies geographically, the impacts of natural hazards have a global reach. In 2022, 30,704 people were killed by natural hazards (Centre for Research on the Epidemiology of Disasters, 2023). Aside from the loss of life, the economic impact of natural hazards is

also significant. In 2021, the insured losses from extreme weather events were estimated to be 105 billion dollars (USD)—exceeding the previous ten-year average (Swiss Reinsurance Company, 2021). There are also losses that cannot be measured as easily as loss of life and physical damage to infrastructure. These indirect losses can include disruptions in supply chains, loss of education, and poor mental health impacts (United Nations Office for Disaster Risk Reduction [UNDRR], 2022). Improving the efficacy of DRR is critical to prevent the impacts of hazards from growing as the severity of hazards continues to grow.

1.1 DRR and Sustainable Development

Effective DRR has a critical role in reducing the negative impacts a natural hazard has on a community, such as death and economic loss. Even though natural hazards are increasingly frequent and extreme, evidence shows that DRR strategies are an effective form of risk mitigation. In the fifty-year period leading to 2021, natural hazards increased by a factor of five, yet—largely due to risk management—the number of deaths decreased by a factor of almost three (World Meteorological Organization [WMO], 2021). The significant reduction in loss of life is primarily attributed to improvements in early warning systems and in the transition from DRR as a technical discipline to an interdisciplinary practice (Briceño, 2007). Improvements to DRR such as more efficient risk communication thus play a critical role in international development as lives, economies, and cultures are increasingly at risk to the impacts of natural hazards as climate change's impacts continue to persist globally.

It should also be noted that 91% of the deaths caused by natural disasters occur in developing countries—as classified using the United Nations (UN) Country

Classification (WMO, 2021). Furthermore, while reductions in loss of life have been significant, the economic burden of natural disasters is growing and will likely continue to do so as hazards become more frequent and severe. There is an opportunity for disaster managers to mitigate the impacts of natural hazards by continuing to develop improved strategies for DRR and the implementation of these strategies on a global scale. This thesis focuses primarily on communications in the Canadian context, but, given the disproportionate impact hazards have in the Global South, adapting lessons about risk communication to greater contexts is a critical challenge for international development. While risk is context specific (Quigley, 2017), this thesis aims to identify barriers to effective risk communication, such as limitations in knowledge mobilization, that can be applied to the implementation of effective risk communication globally.

The need to improve strategies for DRR is recognized as a global necessity, given the ongoing economic and social cost of natural hazards. The UN included DRR in the eleventh sustainable development goal, which states that we must, "make cities and human settlements inclusive, safe, resilient and sustainable" (United Nations, 2015, p.14). As noted by the UN, DRR is integral for sustainable economic and social development (United Nations, 2015). In addition to the recognition of the need for DRR by the UN, the Sendai Framework also further demonstrates the relevance of improved risk communication globally. The Sendai Framework is a development agreement signed by 187 UN member states that advocates for "the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries" (UNDRR, 2015, para. 2). There are four priorities in the Sendai Framework—one of which is to

improve disaster preparedness and response (Sendai framework for disaster risk reduction 2015–2030, 2015). Under this priority, the framework calls for greater investment in disaster risk communications that are tailored to the needs of a specific audience and are socially and culturally relevant at national and local levels (Sendai framework for disaster risk reduction 2015–2030, 2015). The inclusion of efficient risk communications in the Sendai Framework is significant as it exhibits one of the many critical pieces of DRR.

1.2 Natural Hazards and Communication

Risk communication is a critical aspect of DRR because it can shape a community's willingness and ability to mitigate the impacts of a future hazard. Risk communication is understood as "a social process of information exchange between any entities in society on any form of risk (individual, social, political, environmental)" (Höppner et al., 2010, p. 6). The type of information shared in risk communications include how to prepare for a hazard, how to reduce the impact of a hazard, and how to protect oneself from either potential or impending hazard. As such, constructing effective messages for risk communication is important because it can inform how a community responds to a hazard and thus has a significant role in mitigating the impact of hazards on a community.

1.3 Information Deficit Model and the Evolution of Risk Communication

In the infancy of DRR, the Information Deficit Model (IDM) was the default approach to most risk communication—including natural hazards. The core belief of the IDM is that a lack of information and understanding is the main barrier to calls to action based on scientific knowledge. (Suldovsky, 2017). In other words, the IDM assumes that explaining scientific information about risks to individuals will motivate them to mitigate

the risk with appropriate behaviour changes. The critical insight from the IDM is that the most effective way to address skepticism and encourage sustainable behaviour is to provide the public with more information (Anderson, 2015). Accordingly, communication strategies shaped by the IDM are typically technocratic with communication that is both one-way and top-down (Abunyewah et al., 2020). Here, scientific experts on natural hazards aim only to inform the public of a risk on the basis that the knowledge of a hazard will be efficient in mobilizing individuals or communities to act in ways that will mitigate the effects of the risk.

However, a lack of information is rarely the main barrier to behaviour change. While presenting information about a risk is an essential aspect of communication, it is insufficient for motivating behaviour changes (Abunyewah et al., 2020; Esteban et al., 2016). In other words, while technical knowledge of risk is an important aspect of communicating risk, it is not necessarily enough to motivate individuals to make risk-mitigating behaviour changes. Accordingly, communicators are increasingly encouraged to take new approaches to messaging that are less focused on the technical aspects of risk.

A significant breakthrough in the evolution of risk communication is how an individual's perception of risk is not exclusively shaped by a rational assessment of technical risk information. Accordingly, there is a growing recognition that risk communication is more effective when messages are constructed with an interdisciplinary approach rather than a solely scientific focus (Kasperson et al., 2022; Balog-Way et al., 2020; Doyle et al., 2022). Examining risk communication from various lenses, such as psychological, sociological, political, and economic, can provide important insight into what elements of communication —aside from scientific information— motivate

individuals to act and why. This insight is critical in the field of risk communication, where overcoming the barrier from knowledge translation to action is fundamental in mitigating the social and economic costs of natural hazards. Unlike the IDM, which aims to convey scientific knowledge to communities in a technocratic way, researchers now encourage risk communicators to construct messages that achieve other outcomes such as improved trust and empowerment through strategies like two-way communication and storytelling (Doyle et al., 2022; Pidgeon & Fischoff, 2011; Kim, 2021). By incorporating an interdisciplinary approach for research on risk communications, risk communicators can better understand how to encourage behaviour changes.

The growing emphasis on an interdisciplinary approach to risk communication, however, is not without its ethical challenges. Communication aligned with the IDM is considered more ethical by some because it allows individuals to make decisions about risk based on objective facts (Buck & Davis, 2010). For example, risk communication that utilizes insight from psychology might use techniques that aim to motivate behaviour changes by appealing to emotion (Markanday et al., 2022). This raises ethical concerns, given that audiences may not be aware of the techniques that communicators are utilizing to motivate desired effects (Buck & Ferrer, 2012). With that being said, Hilton (2008) argues that all risk communication—even messages constructed with the attempt of presenting objective information—inherently have emotional relevance. In other words, even communications aligning with the IDM are value-laden. Buck and Ferrer (2012) argue that the greater efficacy of risk communication that utilizes emotion, and the notion that emotion is to some extent inextricably linked to risk communication, warrants the use of emotional risk communication. It is also important to note that risk psychology

strategies, especially empowerment, aim to improve an individual's ability to understand and act upon a given risk. As such, risk psychology can more effectively give individuals the tools to make informed decisions about risk.

1.4 Risk Communication and Dual-Process Theories

Recent developments in risk communication can be explained by dual-process theories in the fields of psychology and neuroscience, which highlight the connected roles of reason and emotion in human decision-making. Following Epstein (1994), researchers have recognized that emotion is a fundamental part of understanding and decision-making—alongside rational thinking (Markanday et al., 2022). According to dual-process theories, humans use two distinct systems to process information and make decisions. The first system, named by Slovic et al. (2004) as the 'analytic system', typically analyzes information in a calculated or rational manner and uses logic to assess factors of probability and risk (Markanday et al., 2022). Conversely, the 'experiential system' typically involves making quick decisions that rely on intuition, past experiences, and emotion (Markanday et al., 2022). Slovic et al. (2004) use the term 'risk-as-feeling' to describe how the experiential system uses intuition and emotion in decision-making about risk assessments. The IDM—which considers information exchange a driver of risk perception and decision-making—caters mainly to the analytical system of thinking and decision-making. In comparison, information transfer and translation guided by dual-process theories appeal not only to this analytic system—as does the IDM—but would also appeal to an individual's emotions and experiences.

As dual-process theories gain greater acceptance over the IDM, natural hazard risk communication is increasingly shaped by an interdisciplinary lens. Many

recommendations for risk communication that have emerged post-IDM echo dual-process theories by integrating more of the experiential system into messaging and strategy. Strategies incorporating emotion, experience, and empowerment to motivate individuals to engage in risk mitigation behaviours in the face of natural hazards are gaining prevalence in communications theory (Kim, 2021; Manojlovic & Pasche, 2008; Johnston et al., 2022). Researchers emphasize that how a message is framed is a crucial driver of behaviour (Rollason et al., 2018). According to Manojlovic and Pasche (2008), appealing to emotion and experience through risk communication can increase people's interest in information. Utilizing emotions and framing content to improve how individuals process risk information aligns with dual-process theories because it demonstrates that the experiential system of thinking should be accessed alongside the analytical system when communicating risk.

1.5 Research Gap

Despite the growing research on how to effectively motivate behaviour exchanges, including the role of the experiential system in communication, there is a significant gap between theory and practice. This knowledge gap is evidenced by the enduring presence of the IDM in practical risk communication (Maidl & Buchecker, 2015). Furthermore, the growing consensus on the role of emotion and experience among psychologists and communication theorists is not consistently reflected in current natural hazard risk communication (Becker et al., 2022; Maidl & Buchecker, 2015; Höppner et. al., 2012). Markanday et al. (2022) write that some formal risk communicators still do not see the value in appealing to emotional risk response because it might lead to irrational reactions. As such, one explanation for the use of the IDM in natural hazard risk

communication—despite the recognition of its limitations—is that some communicators view the experiential system as inefficient or incapable of responding effectively to risk messaging.

Another potential barrier to improved risk communication is that recent developments from research are not always easily accessible to communicators. One barrier to the mobilization of dual-process theories in risk communication is a lack of best practices or recommendations on how to communicate risk (Doyle et al., 2022; 2015). Without recommendations on how to translate complex psychological theories into practical communication strategies, it is difficult to imagine how knowledge on dual-process theories can be mobilized among communications practitioners.

1.6 Core Research Questions

The aim of this thesis is to better understand how current knowledge about risk communication is utilized in practice. The core research question is, "to what extent are insights from literature on risk communication reflected in practice?" To answer this question, this thesis first reviews the recommendations for communication from risk psychology and then subsequently examines the extent to which these recommendations are evident in practice. Two additional sub-questions are "how are recommendations for risk communication evident in Best Practice Guides for communicators?" and "to what extent are recommendations for risk communication mobilized in practice?"

1.7 Methodology

To answer these research questions, this thesis utilizes a theoretical framework to analyze existing Best Practice Guides for risk communication and real-world communications from the Canadian context. Developing a framework for analysis

involved a literature review of recommendations by risk psychologists on communication. In completing this review of risk psychology, eight themes emerged as overarching recommendations for 'best practice' when communicating about risk. The insights from risk psychology and theoretical framework are outlined in greater detail in Chapter 2.

Using this framework, I then analyzed Best Practice Guides for natural hazard risk communication. Sourcing the guides involved internet searches including terms such as "best practice guide for risk communication", "natural hazard communication toolkit", and "natural hazard communication guide". These searches yielded many results (see Appendix A), of which ten were selected for analysis. Given that this research involves case studies of Canadian communications, the guides included recommendations that were relevant to the Canadian context. As such, the guides selected are mainly from countries in the Global North (Australia, Canada, United States). Guides produced by multilateral organizations were also included for analysis, as these would outline recommendations for risk communication on an international scale. With these criteria, ten guides (listed below) were selected for analysis.

- *Public Information and Warnings* produced by the Australian Institute for Disaster Resilience
- *Warning Message Construction: Choosing your words* produced by the Australian Institute for Disaster Resilience
- *Strategic Risk Communications* produced by Health Canada
- *A Practical Guide for Natural Hazard Risk Communication* produced by the National Oceanic and Atmospheric Administration

- *Risk Communication Basics* produced by the National Oceanic and Atmospheric Administration
- *The SALT Framework: A Process Framework to Guide Risk Communication* produced by the Environmental Protection Agency
- *Message Library User Guidance* produced by the Communicating with Disaster-Affected Communities Network
- *Principles of Risk Communication* produced by the Natural Hazards Center
- *Public awareness and public education for disaster risk reduction: Action-oriented key messages for households and schools* produced by the International Federation of Red Cross and Red Crescent Societies.
- *Public Communication for Disaster Risk Reduction* produced by the United Nations Office for Disaster Risk Reduction

I then created an Excel spreadsheet with the framework for analysis (eight best practices from risk psychology) and analyzed the ten guides. Analysis first involved making note of which recommendations from the framework were included in each Best Practice Guide. This data is illustrated in Table 1 which is found in Chapter 3. I then analyzed each guide further to assess the quality of each recommendation within the Best Practice Guides. I made note of the intended audience for each guide as well how easily a communicator might make use of each recommendation based on the explanations and steps provided. I chose to analyze the guides in this way as it allowed me to assess the quality of each guide regarding how it aligned with risk psychology and regarding how clear and actionable these recommendations would be for a communicator.

I then selected a series of real-world communications to further assess how recommendations from risk psychology manifest in practice as well as potential barriers to implementation. I selected five different communications from the Canadian context (ranging from municipal to national) that were available on social media pages (Facebook and Twitter) as well as a case study of an emergency alert issued for evacuations in Alberta. I analyzed these communications based on how they aligned with the Best Practice Guides and theoretical framework, I also made comparisons between the case studies to identify potential themes, and I analyzed the communications from the perspective of an audience member. Given that I included analysis from my own perspective I chose communications that would be targeted to those with similar positionalities as myself— a white female living in Canada. While this limits the scope of findings, analyzing Canadian case studies was necessary for this research given that risk perception varies contextually (Quigley et al., 2017). Furthermore, this methodology still provided important insights on the mobilization of knowledge on natural hazard risk communication from theory to practice.

1.8 Organization of Thesis

This thesis is organized into five chapters. Chapter 2 is a review of academic literature on risk psychology. The purpose of this chapter is to develop an understanding of the prevalent recommendations in the literature to establish a framework of best practices. In the following chapter, this framework is applied to current 'Best Practice Guides' on natural hazard risk communication. This third chapter involves analysis of multiple Best Practice Guides from various agencies to determine the collective knowledge that is presented as best practice for risk communication. This knowledge is

then compared against the framework for analysis that was developed in Chapter 2. The objective of this comparison is to assess the extent to which literature on risk psychology is reflected in the Best Practice Guides as well as possible challenges and areas for future research and knowledge mobilization. The fourth chapter examines various case studies of real-world risk communications. The aim of this chapter is to identify whether and how best practices for risk communication are implemented in practice as well as potential barriers to knowledge mobilization.

Chapter 2: Insights from Risk Psychology

The failure of the Information Deficit Model (IDM), and the widespread acceptance of the role of dual-process theories in risk perception, both suggest that psychology plays a key role in risk perception (Slovic, 2010). Insights from psychology are critical for many aspects of risk perception, including building trust, increasing risk perception, and willingness to act. This chapter examines literature on risk communication to determine how researchers recommend communicating risk in ways that extend past the IDM.

2.1 Emotions and Decision-Making

Understanding the role of emotions in decision-making is something of recent interest for risk psychologists. Despite garnering little attention through most of the 20th century, many psychologists now believe that emotions have a significant influence on decision-making (Lerner et al., 2015; Bechara et al., 1994; Poppa & Bechara, 2018). Emotional influence counters the previously dominant belief that decisions are made analytically. The growing recognition of the role of emotions in decision-making aligns with dual-process theories because it demonstrates that emotional response often has a comparable or greater weight to analytical evaluation when individuals make decisions. While there is still a lot to learn about the role that emotions play in decision-making, the current understanding sufficiently demonstrates the importance of engaging emotion in risk communication because of its influence in decision-making.

2.2 Perspectives from Neuroscience

The role of emotion in decision-making is also supported by research in neuroscience—as evidenced by the Somatic Marker Hypothesis. The Somatic Marker

Hypothesis is a neurocognitive framework that offers insight into how decision-making is influenced by emotion (Bechara et al., 1994). Broadly speaking, the Somatic Marker Theory claims that "decision-making is a process that is influenced by visceral and somatosensory markers that arise in bioregulatory processes, including those that express themselves in emotions and feelings" (Poppa & Bechara, 2018, p.61). In other words, decision-making is influenced in part by emotions. The Somatic Marker Hypothesis also notes that the ventromedial cortex is a critical part of the brain that aids in decision-making and processing emotions alongside other neurological systems and structures such as the amygdala (Poppa & Bechara, 2018). Bechara et al. (1994) observed that patients with damage to their ventromedial cortex would often engage in activities and behaviours that negatively affected their wellbeing despite having relatively normal intellect. Furthermore, Bechara et al. (1994) observed that these patients experienced relatively flat emotional states and had an impaired ability to emotionally react to situations. As a result, Bechara et al. (1994) hypothesized that this damage to the ventromedial cortex impaired their ability to use emotions to guide their decisions, thus recognizing how emotions play a significant role in decision-making about risks. The Somatic Marker Hypothesis countered the previously dominant cost-benefit theories which assumed decision-making was based solely on evaluating information.

The Somatic Marker Hypothesis has been supported and reproduced, for example, by Bechara and Damasio (2005) who presented subjects with damage to the ventromedial cortex and amygdala, but unaffected intelligence levels, a gambling task. Bechara and Damasio (2005) found that these subjects with abnormal emotional activation had impaired decision-making. Accordingly, Bechara and Damasio (2005)

concluded that "both emotional parts of the brain, the amygdala and ventromedial cortex assist with rational decisions" (p.346). This conclusion further demonstrates that providing individuals with information about a risk will not ensure sound decision-making.

Researchers have also used evolution to explain the role of emotions in responding to risk. From an evolutionary perspective, emotions influence almost every part of an individual's psychological function—including learning and perception (Al-Shawaf et al., 2016; Ekman, 1992). For example, some evolutionary psychologists hypothesize that disgust is an emotion that evolved in humans to protect from infectious diseases (Curtis et al., 2004; Al-Shawaf et al., 2016). This hypothesis is evidenced by an experiment that demonstrated that humans display higher levels of disgust to images salient with disease in comparison to similar images with less disease relevance (Curtis et al., 2004). Research from multiple disciplines established that emotions play a critical role in how individuals make decisions and evaluate risk, so they need to be incorporated into communication about risk.

2.3 Emotions and Risk Perception

The role of emotion in risk perception and decision-making has been theorized in multiple different ways, but with common underpinnings. Loewenstein et al.'s (2001) *Risk as Feelings* was one of the first works to hypothesize the role of emotion in decision-making on risk. Loewentstein et al. (2001) aimed to address the gap in research on the role of emotions in decision-making when encountering risk. This work countered previous assumptions informed by the IDM that decision-making is an entirely rational process devoid of emotion. Furthermore, Loewentstein et al.'s (2001) findings supported

dual-process theories by indicating that individuals evaluate risk both cognitively and emotionally and that cognitive and emotional systems in the brain interact with each other. Importantly, the Risk as Feelings theory emphasized that the emotions one experiences at the point of decision-making have a key role in the choices an individual makes.

Slovic et al.'s (2007) work, *The Affect Heuristic*, also aligns with dual-process theories and the Risk as Feelings theory. While 'affect' and emotion are at times used interchangeably, 'affect' describes a broader negative or positive feeling under which different emotions then fall. In Slovic et al.'s (2007) 'Affect Heuristic', 'affect' is defined as a "specific quality of 'goodness' or 'badness'" that an individual experiences (either consciously or subconsciously) that subsequently associates a negative or positive quality with a given stimulus (Slovic et al., 2007, p. 1333). In the case of risk response and decision-making, 'affect' describes the feelings that are evoked when an individual is exposed to a risk or information regarding a risk. To avoid confusion, this paper will avoid use of the term 'affect' except when it is directly pertains to the Affect Heuristic (Slovic et al., 2007). Slovic et al. (2007) theorized that 'affect' is often used as a shortcut in decision-making. This theory has serious implications for communication because it means that the emotions an individual experiences when presented with a risk will influence how they perceive the risk and their subsequent actions.

2.4 General Attributes of Emotion in Risk Communication

Accessing emotion is becoming increasingly recognized as an effective tool in risk communication because of the growing recognition of the role of emotion in risk perception and decision-making (Loewenstein et al., 2001; Slovic et al., 2007; Pidgeon &

Fischoff, 2011). Slovic (2010) notes that given emotion's role in directing "fundamental psychological processes such as attention, memory, and information processing" (p. 740) emotions are instrumental in navigating risk. Pidgeon and Fiscoff (2011) echo this by noting that "emotion is an integral part of our thinking, perceptions, and behaviour" (p. 38). As such, emotions influence how individuals perceive risk, for example, by impacting how they evaluate evidence (Pidgeon & Fischoff, 2011). The authors further note that when targeted correctly, messaging that appeals to emotion can effectively motivate action (Pidgeon & Fischoff, 2011).

Kim (2021) further argues that emotional response plays a more significant role in risk perception and decision-making than processing information. Kim (2021) also argues that the media an individual uses can shape their emotional response. That is to say that content communicated in media has the potential to evoke emotions that will shape how an individual perceives and makes decisions based on risk. These insights reinforce the need to move past the IDM when communicating natural hazard risk, and they suggest that communicators need to target both the analytical and emotional parts of the brain when communicating risk in order to elicit a more effective response.

As previously stated, many researchers assert there is a significant connection between emotion and risk perception which should inform how we communicate about risk. Researchers are still working to understand the specific ways emotion influences risk perception (Sobkow et al., 2016). Finucane (2012) calls for more interdisciplinary efforts to identify variables that cause a reaction to risk. Much of the existing empirical evidence appears somewhat inconsistent because there is currently no agreed-upon way to use emotion in communication. So, while there is evidence that establishes a

relationship between emotion, risk perception, and risk-mitigating behaviours, there is no universally accepted way to utilize emotion in risk communication that will yield consistent results. With that said, the significant role that emotion plays in risk perception demands that it be taken into consideration when communicating risk. Sub-section 2.5, 2.6, and 2.6 offer further insight into the current understanding of how to utilize emotion in risk communication as well as various case studies that demonstrate the complexity of this process.

While there is still much to be understood regarding how exactly emotion relates to risk perception and risk-mitigating behaviour, the current understanding can be used to improve the effectiveness of risk communications. Both negative and positive emotions play an important role in risk perception and motivating risk-mitigating behaviours. For example, Kim (2021) found that evoking negative emotions such as anger, sadness, and anxiety through media communications were all effective at increasing individuals' risk perceptions. That said, there are important distinctions among the impacts of different negative emotions. For example, feelings of anxiety are typically linked with uncertainty and a lack of control (Kim, 2021). As such, those experiencing anxiety when confronted with risk are considered more likely to behave in ways that will mitigate the uncertainty such as learning more about the hazard (Kim, 2021). Conversely, sadness, while also linked to a lack of control, often leads individuals to believe they have no ability to control the outcome of the situation and as such will lead individuals to withdraw (Kim, 2021). This means that, while these emotions can all increase an individual's risk perception, they are not necessarily equally effective at encouraging risk-mitigating behaviours.

2.5 A Case Study of Negative Emotions in Communication

Kim (2021) suggests that risk communicators try to evoke feelings of anxiety in their messaging so as to motivate individuals into action. While negative emotions are not the only way to effectively communicate risk, feelings such as anxiety and fear can be important in increasing an individual's risk perception and risk-mitigating behaviours. During the 2015 Middle East Respiratory Syndrome coronavirus outbreak in South Korea, researchers found that communication through social media use worked to increase both risk perception and risk-mitigating behaviours (Oh et al., 2021). While they were unable to establish a causal relationship between negative emotions and risk perception, meaning that it was unclear whether negative emotions caused risk perception or if risk perception caused negative emotions, Oh et al. (2021) did find a strong relationship between the two. In particular, they found that fear and anger were both related to communication about the outbreak on social media and these emotions mediated the relationship between social media use, risk perception, and risk-mitigating behaviours (Oh et al., 2021). These findings also support the notion that emotions play an equal if not greater role in evaluating risks than information (Oh et al., 2021). As such, this study demonstrated fear and anxiety can be elicited by risk communication and that these emotions are integral in risk perception.

2.6 Limitations of Negative Emotions and Risk

While negative emotions are effective at increasing risk perception, an increase in risk perception does not always motivate an individual to take actions to mitigate risk. This disconnect is described by the Risk Perception Paradox (Wachinger et al., 2013). The Risk Perception Paradox notes that an individual may understand the dangers of a

given risk, but this does not automatically correlate to an increased motivation to take protective action against the risk (Wachinger et al., 2013). While communicating to evoke negative emotions may effectively increase risk perception, that will not necessarily translate to motivation to act. In fact, fear-based communication practices can in some cases have the opposite effect and lead to maladaptive behaviour (Sanquini et al., 2016). To counter this, Wachinger et al. (2013) suggests that techniques which directly encourage citizens to engage in risk mitigation may help to bridge the gap between risk perception and action. In more recent years, researchers have theorized that messaging which elicits the emotion of hope can be effective in motivating behaviour changes (Nabi & Myrick, 2019). An element of fear is, in a way, inextricably linked to messaging about natural hazard risk, but pairing this with messaging that elicits hope may work to enhance response.

Along these lines, risk psychologists have examined how to evoke positive emotions through communication in a way that motivates individuals to engage in risk-mitigating behaviours. One approach involves constructing messages that help individuals feel they have sufficient knowledge and ability to respond to the risk they are faced with. For example, in the context of flood risk, Rollason et al. (2018) note the importance of communicating risk in a way that frames the individual as having an active role in preventing risk. There is a debate, however, regarding whether the aim of 'empowering' a community simply justifies a government in transferring responsibility to the public (Rushing, 2016; Miraftab, 2004; Sharma, 2008). This debate highlights the tension between educating a community so that they feel empowered to reduce the impact of inevitable risks, without assuming that an empowered community is one where

each individual is primarily responsible for protecting oneself from hazards. Fostering empowerment in this way requires educating communities about flooding so that they feel competent in assessing risk and thus will likely feel more empowered to act when presented with an impending risk (Rollason et al., 2018). Rather than communicating with a negative framing to induce anxiety or fear, communication is framed in such a way that it encourages individuals to feel they are competent at taking actions that will mitigate the risk—whether that be through their own actions or resources provided by governments and agencies.

2.7 The Impact of Positive Messaging

One way to enhance the emotional influence of risk communication is through storytelling and memory. A case study utilizing storytelling through documentaries to communicate about volcanic risk illustrates well the complex ways that emotion can be utilized to increase risk perception and motivate protective action. In this case study, Hicks et al. (2017) created films that documented two volcanic eruptions: the 1979 eruption of La Soufrière in St. Vincent and the 1985 eruption of Nevado del Ruiz in Colombia. These documentaries were made with the intention of raising risk awareness about volcanic eruptions, fostering memory both socially and culturally of past eruptions, empowering communities to become more prepared against volcanic eruptions, and strengthening risk and response between local communities and the state (Hicks et al., 2017). With these goals in mind, the creators made specific design choices. Both films centred around the stories of local actors to keep the films relevant to the audiences and preserve social memory of the eruptions (Hicks et al., 2017). The researchers also wanted to maximize the emotional impact of the documentaries and did so by "creating content

that triggered attention, achieved comprehension and generated an emotional response which would positively influence decision-making around risk" (Hicks et al., 2017, p. 141). In doing so, the researchers avoided any footage during or following the eruptions that would potentially be upsetting to viewers (Hicks et al., 2017). This decision supports the role of emotion in generating an impactful response from audiences, but it suggests that evoking negative emotions may not be beneficial. Instead, the main themes of the documentaries outlined the personal experiences of individuals surrounding the eruptions, the work involved in rebuilding following the eruptions, and a present-day look at volcanic risk and what life is like living in communities with this risk (Hicks et al., 2017). To increase the emotional impact of the films, the selected actors were representative of different ages, genders, and social categories, given that character identification plays a critical role in producing emotional impact (Hicks et al., 2017).

The films were shown in their respective communities (St. Vincent and Nevado del Ruiz) at various screenings and workshops and intentionally targeted individuals who may not typically be involved in discussions about natural hazards (Hicks et al., 2017). Through pre- and post-viewing surveys, the researchers learned that the documentaries elicited strong emotional responses both from those who had past experiences with eruptions as well as those who had no prior experience (Hicks et al., 2017). Furthermore, the films successfully fostered a sense of empowerment within the communities because they showed viewers ways community members had acted to reduce risk in the past (Hicks et al., 2017). In doing so, Hicks (2017) demonstrated that positive emotion can be used as a tool in risk communication "to help positively guide thinking and behaviour" (p. 150). The researchers demonstrated that emotions can be instrumental at encouraging

various positive outcomes associated with risk mitigation. Namely, that fostering positive emotions can help promote feelings of hope and empowerment. As such, this case study illustrates that emotion should be strategically integrated into risk communications as it contributes to both increased risk awareness and willingness to act.

2.8 Importance of Lessons Learned and Testing

Emotionally salient messaging can be a powerful tool in risk communication, but the exact ways in which to do so are not completely understood. Oh et al. (2021) argue that negative emotions can increase both risk perception and positive behaviour changes, but Sanquini et al. (2016) and Wachinger et al. (2013) note that eliciting these emotions does not guarantee such a response. Other researchers assert that utilizing a combination of hope and fear may yield better outcomes (Nabi & Myrick, 2019) as may messaging that access primarily positive emotions (Hicks et al., 2017). This lack of consistency suggests that the impact of evoking specific emotions might be audience-specific. It is imperative, then, to test messaging and to directly assess whether messaging is effective at achieving the specific goals of communication.

2.9 Audience-Specific Messaging and Testing

Audience-specific messaging and testing messaging is critical for risk communication—especially given that the influence of emotions on risk perception are not yet completely understood. Multiple factors influence the ways in which a message is interpreted by an individual or community. Lundgren and McMakin (2018) note the depth of understanding of an audience will depend on the intent of the messaging (i.e., raising awareness or promoting behaviour change), noting that behaviour change requires greater understanding of the audience, as well as the time and resources available to the

communicators. They further note that base-line understanding includes factors such as education levels, trust towards organizations, and ideal methods of communication (Lundgren & McMakin, 2018). Deeper analysis would also include demographic, socio-economic, and cultural information. Finally, they note that to change behaviour, understanding psychological factors of the audience such as motivations and how the audience understands risk are important considerations when constructing messaging about risk (Lundgren & McMakin, 2018). Conducting surveys, interviews, or focus groups are various techniques for understanding specific characteristics of the audience as well as pretesting messaging (Lundgren & McMakin, 2018). The benefits of these strategies can also go beyond garnering a better understanding of one's audience by building greater trust between agencies and communities. This audience-specific understanding is important because it gives communicators insight into pre-existing barriers to action, such as a lack of trust in communicators or a low understanding of the present risk, and thus allows communicators to shape messaging to address these barriers.

Accordingly, information about an audience should shape how messaging is constructed. For example, Lundgren and McMakin (2018) note that when communicating with an audience about an unfamiliar risk, the audience will typically want a description of the risk that is not technical, and the audience will want to know the potential consequences of the risk, how to respond to the risk, and what exposure to the risk would include—for example the duration and details about the impact. An individual's previous experience with a risk will also influence how they interpret messages (Lundgren & McMakin, 2018; Slovic, 2010). Individuals with little natural hazard experience typically process messaging in a way that leads to a more stable response to change and a greater

likelihood of behaviour change (Lundgren & McMakin, 2018). To encourage this sort of information processing, communicators must incorporate an audience's values into messaging about risk (Kahlor et al., 2003). Specific knowledge about an audience can provide communicators with concrete techniques to tailor messaging that will better encourage behaviour change. Furthermore, as with other practices for effective risk communication, constructing audience-tailored messaging is an iterative process that often requires testing and refining for the benefits to be fully realized (Lundgren & McMakin, 2018).

2.10 Empowerment and Two-Way Communication

Fostering empowerment through communication is characterized largely by active community engagement. Johnston et al. (2022) note that communities play multiple different roles in disaster preparedness—all of which can meaningfully improve disaster mitigation strategies. Historically, disaster management approaches included top-down and linear forms of communication, in which the community was not engaged with disaster mitigation (Johnston et al., 2022). The top-down approach to disaster management is widely rebuked due to its tendency to produce negative outcomes, yet it is still used occasionally following a disaster. For example, this was demonstrated by top-down disaster management following an earthquake in 2009 in Abruzzo, Italy (Imperiale & Vanclay, 2019). While working to build an actively engaged community can be a long and involved process, requiring increased communication, transparency, as well as higher levels of trust for both the community and the agencies involved in disaster management, the benefits are significant (Johnston et al., 2022). In terms of communication, the level of community engagement depends largely on the extent to which agencies actively

communicate with the community, where planning is based on this communication. Accordingly, a limited level of dialogue will yield limited results when compared to a long-term dialogue.

Johnston et al. (2022) note that community-centric approaches to disaster management are founded on community participation. From a communications standpoint, this means actively engaging with the community at all points of a disaster cycle. This community participation can range from lower involvement, such as completing surveys, to higher involvement such as attending workshops and meetings (Balog-Way et al., 2020). Participatory communication between organizations and communities can help foster trust in organizations and empowerment in community members (Richard Eiser et al., 2012). Community members also have place-based knowledge that is vital in mitigating the effects of a hazard (Rahmayati et al., 2017; Setten & Lein, 2019; Fincher et al., 2014). As such, it is important to create an environment where knowledge and input can be easily transferred in both directions between communities in agencies and where such knowledge is recognized as valuable and encouraged.

Ickert and Stuart (2016) illustrate how dialogue can reveal barriers to disaster mitigation within communities as well as community-centric solutions through a case study in Turkey. Istanbul is projected to endure a severe earthquake in the coming decades, yet there is a major disconnect between geoscientists and communities in terms of communication and mitigation practices (Ickert & Stuart, 2016). To remedy this, scientists and community members participated in communication workshops to better understand how the political and social context of communities in Istanbul shape their

communication needs (Ickert and Stuart, 2016). Utilizing workshops to improve communication proved to be an effective tool revealing many points for improvement, including the need to incorporate more local knowledge into communication (Ickert & Stuart, 2016). Furthermore, these workshops revealed that collaborating with local community members in risk assessment and communication strategies can help increase trust in scientists as well as improve how messaging is perceived by the community (Ickert & Stuart, 2016). This case study reinforces the notion that simply presenting technical information on risk is often ineffective at motivating communities to act (Wachinger et al., 2013), and the case study demonstrates how strategies to motivate action are often largely place-specific and can be revealed by creating an intentional dialogue with communities.

2.11 Psychology of Trust and Communication

Active communication, or dialogue, also helps to create trust between communicators and communities. One facet of risk psychology offers insight into the role that trust plays in effective communication. A lack of trust is considered one of the most significant barriers to risk management (Slovic, 2010). Trust in communicators is particularly important because individuals rely on communicators to help them make decisions and judgements about risk (Siegrist, 2021). With natural hazard risk, trust in communicators is vital as the public often does not have enough personal knowledge of hazards to make their own informed judgements. The psychology of trust can give communicators insight into how trust is built and shaped. Given the importance of trust in effective risk communication, incorporating this knowledge into current communication has many positive implications.

Insights from psychology indicate that individuals have a predisposition to lose trust and confirm distrust more easily than they build trust, meaning that it is easier to destroy trust than to build or maintain a trusting relationship. This predisposition can be explained by what Slovic (2010) calls the Asymmetry Principle. According to the Asymmetry Principle, the inclination toward distrust is influenced by multiple different psychological factors. Humans typically notice negative events that reduce trust more readily than positive events, these negative events are also typically remembered more easily than positive (Slovic, 2010). This means humans are predisposed to more readily recall negative events that perpetuate distrust in comparison to positive events that reinforce trust. As well, sources that provide negative news are typically given more credibility than those that give good news (Slovic, 2010). Finally, Slovic (2010) notes that once distrust is established, it is difficult to rebuild trust as individuals are biased to seek information that confirms their existing distrust. Essentially, psychology tells us that it is easier to undermine trust than to build it, so risk communicators must be especially careful to protect pre-existing within a community. With this psychological insight in mind, Slovic (2010) hypothesizes that one way to overcome the Asymmetry Principle is to incorporate more participation when trying to convey risk to the public. This strategy is further echoed by other researchers who note that two-way communication and an active dialogue between experts and the public may be effective practices for risk communicators.

Trust plays a crucial role in risk management, yet there is still much to understand about how to build and keep trust in communicators, where the factors that contribute to a communicator's perceived trustworthiness are often subjective. Current understandings

of trust indicate there is no definitive way to build trust in a communicator and that practices for building trust should be case specific (Balog-Way et al., 2020). That said, there are some widely effective strategies to strengthen trust in risk communicators. For example, building relationships with those who are already trusted in a community, such as local leaders and journalists, can help strengthen trust (Balog-Way et al., 2020). Literature on trust also notes the importance of clarity and consistency in messaging (Balog-Way et al., 2020). As such, communicators can ensure that messaging is consistent across different agencies and messengers to build trust.

Furthermore, transparency is recognized as an effective tool for both building trust and re-building lost trust (Balog-Way et al., 2020). Messengers who are perceived as transparent are more likely to be seen as trustworthy in comparison to a messenger who is thought to be withholding information or misleading a community (Balog-Way et al., 2020; Lyshol & Rolfheim-Bye, 2021). There is a critical balance, however, between transparency and providing so much information that recipients become confused (Balog-Way et al., 2020). This balance further emphasizes the need to understand the audience when communicating. Based on the context and pre-existing knowledge of a community, what may be perceived as positive and transparent by one community may be perceived as confusing to another. Furthermore, there is not a universal degree to which uncertainty should be communicated to an audience. While uncertainty is an inevitable aspect of risk (Richard Eiser et al., 2012), the capacity a community may have for tolerating uncertainty should be considered when determining how transparent communication about uncertainty should be. Simply being transparent in communication about risk is

insufficient without employing other communication techniques to better understand the needs of the community.

There are also specific qualities that are shown to increase trust in communicators, such as warmth, integrity, and competence (Balog-Way et al., 2020; Hendriks et al., 2015). Researchers also suggest that perceived similarities between risk communicators and community members can influence trust. For example, Poortinga and Pidgeon (2004) note that shared identities and common understandings create trust and link people together. This insight is significant because it further emphasizes the importance of having close and open dialogue between agencies and communities to create these social bonds that positively influence trust.

The subjectivity of factors that influence the level of trust between communities and emergency managers during a natural hazard is exemplified well in a case study on Montserrat, a volcanic island in the Caribbean. Haynes et al. (2008) aimed to determine who was most trusted by community members among various risk communicators during volcanic crises. Aligning with Poortinga and Pidgeon's (2004) discussion on the role of shared identities in building trust, they found that family and friends were considered the most trustworthy in terms of providing volcanic risk information. The public then considered scientists and emergency management agencies to be the next most trustworthy source of information, and the Montserrat government was considered the least trustworthy due to its political and cultural history (Haynes et al., 2008). This research led Haynes et al. (2008) to recommend that emergency management agencies and scientists be the primary communicators of risk on Montserrat—given the high level of distrust in the government. Importantly, they note that this is case-specific and that

some situations—for example in communities with high levels of scientific distrust—warrant greater communication by the government (Haynes et al., 2008). Furthermore, given that some individuals or communities may not have trust in any authority, locating trust community members or influencers is necessary. The high level of trust given to family members and peers further emphasizes the importance of locating trusted community members to aid in communication (Haynes et al., 2008). The subjectivity of trust as demonstrated by Haynes et al. (2008) further underlines the need to understand the cultural, political, and social context of the communities to ultimately understand who the most trusted communicator would be.

2.12 Summary of Best Practices from Risk Psychology

The literature on risk psychology provided multiple insights for best practice on risk communication that will be used as a framework in the coming chapter. Given the influence of emotions on decision-making and risk perception, as supported by neuroscience (Bechara et al., 1994; Bechara & Damasio, 2005; Poppa & Bechara, 2018) and evolutionary psychology (Al-Shawaf et al., 2016; Curtis et al., 2004), risk psychologists recommend strategies that access an individual's emotions such as memory access and storytelling (Hicks et al., 2017). The literature also indicated that empowerment is a salient emotion for communicators to evoke when constructing messages about risk so that individuals overcome the barrier between risk perception and action (Balog-Way et al., 2020; Richard Eiser et al., 2012). Furthermore, given the subjectivity of risk perception, message testing is an important strategy for communicators to ensure that messaging is appropriate and effective for a given audience. Along these lines, active dialogue is also a noted strategy within risk

psychology because of the subjectivity of risk perception and to build trust—another critical component of risk communication in risk psychology (Poortinga & Pidgeon, 2004; Haynes et al., 2008). Like trust, the literature also notes that uncertainty is another aspect of communication that communicators should give careful attention to because the level of transparency about risk a community can tolerate is also subjective (Balog-Way et al., 2020). To summarize, storytelling, using memory as a mental shortcut, fostering empowerment, testing and evaluating communication, audience-specific messaging, active dialogue, mitigating uncertainty, and trust are all strategies for communication that are highlighted by risk psychology. In the next chapter, these best practices will be used as a framework for analysis of Best Practice Guides.

2.13 Risk Psychology: Response from Sociology, Anthropology, and Complexity Studies

While this thesis is primarily informed by risk psychology, there are multiple other disciplines involved in risk research. Each discipline, such as sociology or anthropology, understands risk in a different way. Psychology, for example, is primarily concerned with risk perception to learn how to improve the communication of technical information about risk and to learn how an individual's perception of risk will influence their behaviour (Quigley et al., 2017). Alternatively, approaches to risk from sociology, anthropology, and complexity studies examine risk from a structural perspective rather than an individual perspective. Sociology examines risk as something that is inextricable from social contexts (Lidskog & Sundqvist, 2013). As such, how risk is understood and acted upon is contingent on the actions taking place within societal contexts (Lidskog & Sundqvist, 2013). Risk psychology offers important insight about risk, especially risk communication, but it is important to acknowledge that lenses from sociology,

anthropology, and complexity studies enhance risk psychology and address what risk psychology does not. With its prevalent focus on the individual, risk psychology gives less attention to the role of context. As such, while risk psychology offers a helpful lens for understanding many critical aspects of risk communication, such as risk perception and heuristics, lenses from sociology anthropology, and complexity studies are also critical because they take into consideration how societal context should shape risk communication (Quigley et al., 2017). There are also aspects of risk psychology with overlap—especially with the emphasis that risk psychology has on understanding how factors such as context and values shape how an individual understands risk. Given that risk and risk perception is vastly different among geographic and social contexts—shaped, for example, by location, infrastructure, politics, and economy—a risk psychology lens is ideal because it incorporates broader context into examination about how individuals interpret and perceive risk.

Chapter 3: Analysis of Best Practice Guides on Natural Hazard Communications

Many different agencies have guidelines that recommend specific strategies for communicating risk. The following chapter analyzes ten Best Practice Guides. For some of these guidelines, the intended audience are communicators working directly for an organization that has provided the guidelines, while other guidelines have a broader intended audience, providing guidance for any agencies, individuals, government officials, or broadcasters that are committed to sharing warnings about risk to the public. While the intended audience varies between resources, every guideline selected was created with the intent of enhancing communication to at-risk stakeholders through provided recommendations for best practice.

3.1 Parameters for Selection

An important consideration when examining these guidelines is that the length and detail provided is in many ways dictated by the audience for which it was created. There is a critical balance between detail and conciseness in these guidelines given that they are designed for communication practitioners rather than academics. The translation of the academic and theoretical understanding of risk communication needs to be practical by providing enough information to communicators that they can adapt the information to the necessary context, but still a reasonable enough length to navigate relatively quickly. The length of the guidelines examined varies considerably with the shortest at 4 pages and the longest at 174. However, the longest guideline is considered an outlier given how the other nine of the ten guidelines included are between 4 and 39 pages.

The documents included in this analysis are only a small sample of the best practice guidelines for risk communication that are available. Appendix A lists a larger sample of guides available to risk communicators. Each guide included gives recommendations for how to communicate risks that go beyond the scope of the Information Deficit Model (IDM). In other words, the guidelines not only discuss what information to communicate to communities about risk, but also offer different techniques and processes of communication that can enhance the outreach and efficacy of messages. Given the more recent departure from the IDM and the fact that risk communication is an ever-evolving field (Lundgren & McMakin, 2018), the guidelines included were also selected for their more recent publication to ensure that the documents included the most recent academic recommendations available. The dates of publication for the guides range from 2006 to 2022, with the average date of publication being 2017. The organizations that produced the Best Practice Guides analyzed in this thesis are listed below:

- United Nations Office for Disaster Risk Reduction (UNDRR), International (2017)
- Health Canada, Canada (2006)
- National Oceanic and Atmospheric Association (NOAA), United States of America (2016 & 2019)
- Environmental Protection Agency (EPA), United States of America (2022)
- Australian Institute for Disaster Resilience (AIDR), Australia (2018 & 2021)
- Natural Hazards Center (NHC), United States of America (2020)

- Communicating with Disaster Affected Communities Network (CDAC), International (2022)
- International Federation of Red Cross and Red Crescent Societies (IFRC), International (2018)

Each Best Practice Guide was examined using the theoretical framework for analysis developed from risk psychology. Where necessary, ideas from the guidelines that were previously not included in the framework were also added. Of the eight recommendations included in the framework for analysis, audience-specific messaging and trust were discussed in every Best Practice Guide (see Table 1 for an outline of the practices evident in each guide).

3.2 Audience-Specific Messaging

The importance of audience-specific messaging was a consistent theme in every Best Practice Guide analyzed. While discussed in varying detail, each guide highlights the idea that a better understanding of one's audience and messaging that tailors specifically to that audience is the ideal way to communicate. Few guides discuss why it is important to directly tailor messaging to audiences. The NOAA (2016) guide, however, notes that there are multiple factors that will influence the way that an individual or community responds to risk messaging such as culture or previous experiences with disasters. This idea is also evident in the AIDR (2021) guide and the UNDRR (2017) guides which both emphasize that generalized messages for large audiences will often be less impactful than messaging tailored to smaller audiences. These guides echo insight from risk psychology, such as Lundgrin and McMakin (2018), who argue that a deeper understanding of one's audience typically correlates with messaging that is more

effective at motivating behaviour, as well as insights from sociology that suggest understandings of risk vary between social contexts (Quigley et al., 2017; Lidskog & Sundqvist, 2013).

Each guide provides resources for implementing audience-specific messaging, but audience-specific messaging is not always explicitly stated as a strategy for effective risk communication. In other words, all the guides examined recommend that communicators employ audience-specific messaging to some extent, but only a few guides explain why it is valuable to do so. Some recommendations offered in the guidelines promote baseline understandings of the audience (Lundgrin & McMakin, 2018), such as communicating to various audiences depending on their geographic proximity to the risk (Australian Institute for Disaster Resilience [AIDR], 2021). Other recommendations include using personalized language in communication such as 'home' rather than 'house' to directly engage with the audience in communication (AIDR, 2018). Many guides also go beyond this baseline to advocate for a deeper sense of understanding that would encourage behaviour change.

A common theme among the Best Practice Guides was to learn the barriers to risk perception that an individual or community may have. This aligns with Lundgrin and McMakin's (2018) assertion that deeper levels of understanding that access an individual's psychology and motivations will often lead to messaging that promotes behaviour change. For example, the NOAA (2019) lists a set of questions that a communicator would ideally learn about their audience when constructing messages. Some of these questions include: "What does your audience care about—their values and concerns?", "Who does your audience trust?", and "Does the audience perceive that

taking action is possible and effective in mitigating risk?" (p.8). The UNDRR (2017) similarly provides a list of questions designed to help a communicator learn how a community relates to a given risk. All guides asserted that it was important to develop an understanding of one's audience before communicating about risk, but only six of the ten guides advocated for a deeper level of understanding that would yield behaviour changes.

Demonstrating how to use audience-specific knowledge to shape messaging is also a key aspect of the Best Practice Guides. There is little practical value in audience-specific knowledge if communicators are unsure how this knowledge to construct effective messages. In comparison to the other guides examined, the NOAA (2016) guide successfully illustrates how knowledge about an audience can translate into effectively tailored messaging. Reflecting Kahlor et al. (2003), this guide encourages communicators to "shape or frame the message to affirm the values of those receiving the message" (National Oceanic and Atmospheric Association [NOAA], 2016, p.8). As they note, factors such as worldview and values will help communicators understand how an individual perceives risk which can then be translated into message construction (NOAA, 2016). Furthermore, this guide helps communicators utilize this knowledge in practice by exemplifying how the values and knowledgebase of an individual should shape communication with them about a given risk (NOAA, 2016). For example, the guide notes that people who value authority and individualism will be receptive to messages emphasizing personal responsibility (NOAA, 2016). In comparison, the guide notes that messages emphasizing the need to work together to reduce a risk will appeal to audiences who are community-driven (NOAA, 2016). While this example will not be directly applicable to every communicator utilizing this guide, by giving a concrete example of

this communication technique in practice, it offers insight into how this may be adapted to other cases.

A common limitation among the Best Practice Guides examined is how they emphasize the need for audience-specific messaging, and communicators are provided with tools to foster this understanding, but they lack details and examples to help communicators construct messages in practice. One explanation for this limitation is that the nature of audience-specific messaging may limit how detailed recommendations can be. A common theme with many communication practices is that understanding what is effective for a given community requires testing and evaluation. As such, some guides recommend that communicators pre-test messages when constructing audience-specific messages rather than explaining how to construct a particular message. As demonstrated by the NOAA (2016), however, guides can offer examples of how to approach message construction while utilizing audience-specific information to help communicators conceptualize how implement this recommendation. This extra step would also keep the length of Best Practice Guides reasonable while ensuring that communicators have the tools they need to mobilize their knowledge.

3.3 Trust

In addition to audience-specific messaging, the importance of trust when communicating about risk is also emphasized in all the guides. Trust is cited as a vital aspect of risk communication within risk psychology (Siegrist, 2021). A lack of trust is a major barrier between communication and behaviour changes (Slovic, 2010). These Best Practice Guides demonstrate that trust-building can manifest in many ways and that the techniques for building trust can often be integrated into other techniques for risk

communication. This sub-section will explore how trust is understood within the Best Practice Guides as well various techniques available for communicators to foster trust between communities and communicators.

Within some of the Best Practice Guides included in analysis, audience-specific messaging is included as a technique for building trust in agencies and communicators. This suggests that communicating to an audience in ways that are clearly tailored specifically towards them can help to establish greater trust between communicators and a community. The AIDR (2021) notes that communicators can demonstrate that the information being communicated is audience- or location- specific by using place names and language that is common in that location, such as the nickname of a place (AIDR, 2021). Similarly, the NOAA (2019) suggests that demonstrating empathy in communication is integral to increase the trust communities have in communicators. Many of the techniques the NOAA (2019) offer for this involve keeping the community or individual at the center of discussions on risk mitigation. To do so, the NOAA (2019) suggests actively listening to community members and asking for input from the community to convey empathy (NOAA, 2019). Both recommendations demonstrate ways that a communicator can use the tailored experience of an audience member to build trust.

As previously noted, the risk psychology literature indicates that communicating through a trusted messenger is a critical aspect of risk communication. The NHC (2020) writes that "expertise and rank alone do not automatically provide credibility or authority in these circumstances. Rather, this kind of influence is developed by building trusting and mutually respectful relationships with credible partners" (p. 4). This summarizes well

the importance of using trusted messengers in risk communication—something that is also discussed in the literature about risk psychology (Haynes et al., 2008). The NHC (2020) emphasizes that communicators need to explore not only how to construct effective messages but also *who* will be most impactful at delivering the messages. Many of the other Best Practice Guides echo this strategy. For example, the EPA (2022) suggests that in some situations, collaborating and coordinating messages with trusted individuals or organizations within a community can be more effective than if the EPA were to be the primary messenger. While they do not offer significant details about how to identify a trusted messenger, they do note that this is an important part of risk communication. Other guides echo this strategy noting that individuals with pre-existing trust such as family, friends, and influencers will often impact the salience of a message (AIDR, 2021; International Federation of Red Cross and Red Crescent Societies [IFRC], 2018; Communicating with Disaster Affected Communities Network [CDAC], 2022) or simply by writing that messages are better internalized when they come from trusted sources (NOAA, 2016). The UNDRR (2017) also offer a unique perspective by suggesting that the specific media a communicator uses must also be trusted by the target audience. For example, utilizing social media for younger audiences and radio broadcasting for rural audiences (UNDRR, 2017). This means that a communicator will need to consider both the level of trust in the mode of communication they are utilizing as well as the representative of the messaging. The importance of using trusted messengers is thus a theme that is evident throughout many of the Best Practice Guides examined.

The Best Practice Guides also indicate that trust helps to bridge the gap between risk perception and action. The NOAA (2019) highlights that a common misconception is

that trust is built by demonstrating competence and openly providing information. This is also echoed by the NHC (2020) which notes that expertise does not automatically translate to authority when communicating about risk, as illustrated in the previous sub-section. The IFRC (2018) similarly writes that willingness to act is dependent on whether an individual trusts who is communicating about risk. This aligns with Slovic (2010), who writes that a lack of trust is one of the most significant barriers in risk management, alongside Siegrist (2021) who emphasizes that risk communicators need to gain the trust of their audience because individuals rely on communicators to shape their judgements and decisions. This reliance on communicators also offers insight into why distrust is one of the reasons that the IDM fails to influence behaviour changes. Furthermore, these messages are important because they remind communicators not to take trust for granted or assume that—because they represent a well-known agency with expertise—they will be trusted.

Consistency and transparency are also cited in many of the Best Practice Guides as techniques for building and maintaining trust between communities and communicators. One of the most prevalent recommendations along these lines is that messaging should be coordinated and consistent between different organizations (Balog-Way et al., 2020). Oftentimes, multiple agencies communicate about the same risks, so it is crucial for agencies to ensure that messaging is consistent. As the AIDR (2018) notes, "conflicting content will erode public trust in the message" (p. 5), so it is extremely important to be cognizant of the messaging that is being communicated to communities about a risk to ensure that it either aligns or that discrepancies can be addressed. The AIDR (2021) also offers further advice on this topic, noting that it is also possible to be

too consistent with messaging. They write that messaging which is identical between different organizations can erode trust in the same way that inconsistent messaging does (AIDR, 2021). The negative impact of identical messaging is especially significant when messaging becomes so consistent across organizations that the effect of tailored messaging is lost (AIDR, 2021). Importantly, this recommendation aligns with literature from risk psychology that recommend consistent messaging across organizations to maintain trust (Balog-Way et al., 2020), but it also demonstrates the complexities of implementing this recommendation in practice. The Best Practice Guides show that communicators need to be consistent across agencies, but identical messaging can also erode trust.

In terms of consistency, another recommendation is to be aware that an agency's communications may not align with what is observed by a community. The AIDR (2018) handbook explains, for example, how there may be instances where an organization communicates to the public about a flood risk while there are no observable signs of a potential flood. They note that these discrepancies can deter action and thus advise communicators to be aware of when they need to include extra content that explains to individuals why their observations may not align with risk communications (AIDR, 2018). Furthermore, when changes do occur in risk, they should be communicated so that they do not look like inconsistencies (AIDR, 2018). In a similar way, many of the Best Practice Guides also emphasize that transparency is an important, yet complex aspect of building trust in communicators. In risk psychology, transparency is considered an important tool for building trust because communicators who are perceived as transparent are often considered to be more trustworthy (Balog-Way et al., 2020; Lyshol, &

Rolfheim-Bye, 2021). Researchers also note, however, that it can be difficult to find the right amount of transparency for a given community (Balog-Way et al., 2020). Within the Best Practice Guides, the caveat that transparency is complex is not always included with the recommendation to be transparent. For example, the AIDR handbook (2018) tells communicators to be transparent whenever information in not available instead of leaving holes in information as this makes the messenger appear more credible. The AIDR handbook effectively explains why it is important to be transparent and provides examples of what this transparency can look like when information is unknown; however, the guide lacks details about how to communicate transparency to different audiences. This is common throughout multiple handbooks wherein transparency is included as an important tool for building trust, but little information is provided about how to frame this transparency for different audiences or why transparency may fail if communicated incorrectly.

Multiple Best Practice Guides examined also highlight the complex psychology of trust. Namely, the difficulty of building and maintaining trust as well as the long process of re-building lost trust. These guides often indirectly align with Slovic's (2010) Asymmetry Principle. For example, the EPA (2022) guide notes that "trust can be hard to build, especially if it has eroded over time" (p. 3). Similarly, the NOAA (2016) guide writes that "building trust with an audience may take a substantial amount of time, especially with a history of distrust" (p. 11) and that trust is easily damaged and extremely hard to rebuild. While less overt, the AIDR (2018) handbook hints at the difficulty of building and maintaining trust by emphasizing that it is very important to protect whatever trust there is between a community and communicators through various

trust-building techniques. While these guides do not go into detail about how to shape communication with specific attention to the psychology of trust and distrust, they do flag to communicators that building and maintaining trust needs to be given careful attention.

The NHC (2020) guide expands on this idea by explaining that the psychology of distrust can hinder how messaging is received. The guide notes that messaging that includes technical information is more likely to be misinterpreted by an audience that lacks trust in the communicator (Natural Hazards Center [NHC], 2020). This insight is further informed by the literature on the psychology of trust as it reflects Slovic's (2010) assertion that individuals will more readily seek out information that confirms pre-existing distrust. While many guides do highlight that trust is important because it makes an audience more engaged and willing to act, this additional information is also important because it can help make communicators wary of how they communicate to an audience with pre-existing distrust.

In some instances, the importance of trust and techniques for building trust are included in the Best Practice Guides as their own separate categories—for example using trusted messengers, and the relationship between transparency and trust—as previously discussed in this chapter. In some instances, however, trust is integrated into other techniques for communication, rather than being included on its own. This is particularly evident in the NOAA (2019) Best Practices Guide. In a section about using empathy in messaging, the guide writes that empathy and compassion is a key method for building trust (NOAA, 2019). In a section on uncertainty, they note that transparency is a technique for building trust. The UNDRR (2017) guide similarly includes the concept of trust throughout the guide, but trust is not given its own section in the guide, nor is the

importance of building trust discussed. As noted previously, best practice techniques often reinforce each other. For example, audience-specific messaging has benefits that do not directly relate to trust, such as understanding how a community relates to risk, but it is also a way to build trust between a communicator and a community. As such, while dispersing trust-building techniques throughout other recommendations is a good start for Best Practice Guides, the fact that trust is considered a direct barrier to action with risk communication (Slovic, 2010) suggests that communicators would benefit from a direct discussion about how to build and maintain trust. Furthermore, discussions about the psychology of distrust and the difficulty of re-building trust are imperative for Best Practice Guides as it demonstrates to communicators that trust requires careful attention given that it is both critical for effective communication and is extremely fragile.

3.4 Fostering Empowerment

Fostering empowerment through communication is another technique prevalent throughout the Best Practice Guides that were analyzed. Building empowerment through communication was evident to some degree in every guide except for the IFRC (2018). Alongside audience-specific messaging and trust, fostering empowerment is considered a critical aspect of communicating to motivate behaviour changes (Rollason et al., 2018). While both negative and positive messaging have the potential to be effective in risk communication, fostering positive emotions—namely empowerment—was significantly more prevalent among the Best Practice Guides. Regarding empowerment, the three main strategies highlighted in the guides were avoiding negative language, empowering audiences, and providing action-oriented risk communication.

The Best Practice Guides examined often encourage communicators to avoid using overly negative language or inciting fear in at-risk communities. In some instances, the guides make direct connections to psychology to justify why it is best to avoid communicating multiple negative things at once. For example, the NOAA (2019) guide notes that—because psychology tells us that people are predisposed to focus on the negative—it is important to balance any negative content with positive content when communicating. This recommendation counters the literature that suggests fear is a strong motivator in risk communication (Oh et al., 2021) and aligns with researchers like Wachinger et al. (2013) and Sanquini et al. (2016) who suggest that negativity can lead to maladaptive behaviour and propose instead to foster empowerment through communication. The guides further note that empowerment is important because perceived inability and lack of confidence are considered significant barriers to action. They also suggest that evoking negative emotions can lead individuals to shut down rather than act (NOAA, 2016). As such, the Best Practice Guides clearly advocate for fostering empowerment rather than fear when constructing messages.

The Best Practice Guides provide many different recommendations for how to foster a sense of empowerment when communicating risk. For example, some guides write that messages should be structured in a way that encourages people to think about how to problem-solve responses to risks. Guides also note that two-way communication between communities and risk communicators can be an effective way to build empowerment. The NOAA (2019) guide writes that "when people help identify ways to prevent or reduce risks, they feel empowered and are more likely to follow through" (p. 12). The NOAA (2019) suggests that involving communities in the problem-solving

aspect of risk will increase the likelihood that they will take risk-mitigating behaviours. Furthermore, this insight connects to the ongoing theme throughout the Best Practice Guides and the literature on how two-way communication and collaboration with communities is an effective way to motivate individuals to act in the face of risk. Along these lines, an overarching theme is how effective communication builds on both motivation and confidence to act.

The Best Practice Guides also advocate for action-oriented risk communication—with empowerment being a key driver of this sort of communication. The guides note that complacency is not the only explanation for inaction and that, oftentimes, a barrier to action is perceived inability to act. The guides note how messaging about risk should be paired with actionable and practical steps that make behaviour changes seem manageable. For example, the UNDRR (2017) writes that effective messaging should be "engaging and motivating; with practical, doable actions people can take to reduce their own risk" (p. 4). Similarly, the EPA (2022) writes that messaging should be "meaningful, understandable, and actionable" (p. 3). The NHC (2020) also encourages communicators to "emphasize protective actions that the audience has the capacity and resources to implement" (p. 12). The excerpts from each of these guides all follow the same theme surrounding how messaging needs to both empower audiences and contain actionable steps that can be followed through. Communicators must also be proactive by considering pre-existing barriers to action that should be addressed. Action-oriented risk communication can include instructing community members about what they should do with pets or livestock in the event of an evacuation, as these might hinder an individual's ability to act, or by giving directions on the location of resources so they are more easily

accessible (IFRC, 2018). As such, the guides recommend a balance of fear and hope that favours hope, because information about risk needs to be paired with actionable steps that encourage people to feel capable of their abilities to prevent the impacts of risk.

3.5 Testing and Evaluating Practices

Recommendations to monitor the efficacy of communication practices is also consistent throughout the Best Practice Guides analyzed. Many of the recommendations for risk communication arise from the fact that the way messaging is perceived by communities is subjective. There are multiple different factors, such as previous experience with hazards and worldview that shape the way an individual or community responds to risk communication (Lundgren & McMakin, 2018). As a result, communicators may not know how messaging will be received because there are so many factors that shape this. Accordingly, all guides except for the AIDR (2018) emphasized the need to test and evaluate messaging at all phases of risk communication.

Determining the goal of a message is a fundamental first step in risk communication as message construction is determined by the intentions of the communicator. Communicating with a predetermined goal is also critical because all other practices for risk communication rely on clear objectives. It is difficult to effectively employ a specific practice, such as audience-specific communication, or achieve a desired outcome, such as building trust, without first being intentional. The Best Practice Guides recommend that communicators be conscious of their goals so that they can determine if messaging has the desired outcome (NOAA, 2019). In doing so, communicators can evaluate whether their messages generate the intended outcomes.

The Best Practice Guides first recommend that communicators pre-test messages. Pre-testing can include focus groups, surveys, or interviews that are representative of the audience that the communicator aims to reach (NOAA, 2019). Pre-testing will help ensure that the content of the messages, such as language and calls to action, are compatible with the demographics and culture of a community (CDAC, 2022). There are also multiple different items the guides recommend testing for before a message is distributed such as to test that technical information is accurate (NOAA, 2019). The guides also recommend that messages are tested for factors such as clarity and comprehensibility for their intended audience (NHC, 2020), as what may be clear or intuitive to a communicator will not necessarily be perceived in the same way by the recipient. Messages should also be tested to identify what channels will maximize the outreach of a message (NHC, 2020). The Best Practice Guides also suggest that messages are tested alongside any other organizations that are communicating about the risk to ensure the information and advice that is communicated is consistent across all communicators, to protect the trust of the audience (NOAA, 2019). Pre-testing is critical because how a message is perceived can either support or undermine the goals of a communicator, depending on how it is interpreted by the audience. Finally, the guides note that pre-testing is necessary because it is one of the first steps in ensuring that messages are successful (UNDRR, 2019). As such, the Best Practice Guides emphasize that pre-testing messages on a representative sample audience is critical to maximize the efficacy of communication—especially considering the subjectivity of how a message might be perceived.

The guides note that communicators must also evaluate the impact of active messages. The risk psychology literature highlights that risk communication is an iterative process that requires ongoing evaluation (Lundgren & McMakin, 2018). Similarly, the Best Practice Guides recommend that communicators must consistently check the impact of messaging so it can be improved when necessary. During the active phase of communication, communicators should seek input from community members to learn if content needs to be addressed or clarified (CDAC, 2022; IFRC, 2018). While the guides do not go into specific detail about what this testing should look like, presumably, the process would be similar to pre-testing, including surveys or interviews. There are two main benefits of testing active messages. First, by evaluating messages, the communicator is working to learn how messaging is perceived so that it can be adjusted if necessary. Second, by working with community members and being open to feedback, message testing can fulfill other communications practices—especially active dialogue and mitigating uncertainty.

The final step in message evaluation described by the Best Practice Guides takes place after communication has occurred so communicators can evaluate the success of messaging and identify any lessons that can be applied to future communications. Many Best Practice Guides included in analysis emphasize the importance of learning from past communications. The guides note that communicators should be prepared to evaluate their messages post-incident and that evaluation will ideally involve the recipients of the communication (AIDR, 2021). Importantly, the guides also note that careful consideration is required when undertaking post-hazard evaluation because the community involved in the study will potentially have experienced trauma from the

hazard (AIDR, 2021). The Best Practice Guides further emphasize the importance of learning from experience by including real case studies of lessons learned from past communications. For example, the IFRC (2018) notes that when communicating about Ebola, the phrasing 'Ebola Kills' that was used in messaging led some to believe there was no cure. Consequently, rather than trying to seek assistance after contracting Ebola, some would choose to instead die at home (IFRC, 2018). This case study also exemplifies the importance of pre-testing communication to learn about how different individuals interpret messages. The IFRC (2018) guide notes how they learned from previous experience that using trusted leaders as communicators mobilizes community members quicker than without—a technique that is incorporated into many of the Best Practice Guides. The guides also further recommend incorporating reflexive practice into their communication strategies. This means actively considering *how* any lessons learned post-incident can be incorporated into future risk communication (United States Environmental Protection Agency [EPA], 2022). Reflexive practice helps communicators learn more about how best to communicate with communities about risk which is especially important given that risk communication is an ever-evolving field.

3.6 Active Dialogue

Risk psychologists note an important shift from linear communication between agencies and communities to a more active dialogue (Johnston et al., 2022; Lundgrin & McMakin, 2018; Richard Eiser et al., 2012). This shift towards active dialogue is evident in the Best Practice Guides that were examined. While some guides explicitly recognize the limitations of linear communication (NOAA, 2019; IFRC, 2018), others reflect this by explicitly emphasizing the importance of active dialogue and recommending various

ways dialogue can be incorporated into communication practices. As shown in the risk psychology literature, this dialogue can occur to varying degrees (Lundgrin & McMakin, 2018), and in multiple different formats. The Best Practice Guides outline various benefits that come from actively engaging with community members through communication as well as different ways to achieve two-way communication.

Two-way communication between agencies and communities is commonly included in the Best Practices as an opportunity to gain community-specific knowledge that will enhance disaster responses. The guides note that communicators should not assume they have all the necessary information about a risk before engaging with the community in question (NOAA, 2016; Health Canada 2006; AIDR, 2021; UNDRR, 2017; NOAA, 2016; NHC, 2020) and that there is much that communicators should aim to learn about from communities. For example, communicators can speak with a community to learn about barriers to action of which communicators might not have been previously aware (NOAA, 2019). Seeking information from community members positions the community as keepers of critical knowledge about risk rather than enforcing a power imbalance between communities and communicators—something which has also been noted in risk psychology (Johnston et al., 2022; Rahmayati et al., 2017; Setten & Lein, 2019; Fincher et al., 2014). The guides further highlight that seeking input from the community about their needs and how to best design communication strategies will work to make communication practices both more effective and more sustainable (IFRC, 2018). As such, the Best Practice Guides that were examined demonstrate an understanding that the knowledge and input provided from a community will often work to improve the efficacy of risk communication.

Within the Best Practice Guides, dialogue is often included alongside other best practices for risk communication. Most commonly, there is a direct connection between dialogue and audience-specific messaging. In these cases, dialogue is often listed as a practice for communicators to understand more about communities so messages can be better tailored to their needs or values (NOAA, 2019). For example, the guides suggest creating a dialogue to "identify which actions are most locally and culturally appropriate, given the needs and conditions in the community" (NHC, 2020, p.12) or "to understand stakeholders' priorities and contextualize risk information in ways that resonate with their lived experiences" (NHC, 2020, p. 10). Here, audience-specific communication and active dialogue are directly tied because dialogue is utilized as a technique to achieve communication that is more relevant to the community.

Active dialogue is also often listed as a technique to build and maintain trust between communities and communicators. In particular, the guides note that it is important to create a space for dialogue that encourages debates and open discussion (NOAA, 2016). Facilitating this sort of environment helps to build trust between community members and agencies—especially for those who might have previously felt excluded from conversations about risk (NOAA, 2016). Similarly, the guides also note that facilitating active dialogues as a communication technique can foster a sense of empowerment. This dialogue gives community members the opportunity to have an active role in managing risk, and it can give individuals the space to voice their opinions and concerns. As such, when implemented intentionally, the benefits of dialogue can reinforce and build on other communication practices such as trust, empowerment, and audience-specific messaging.

The Best Practice Guides also offer recommendations for how an active dialogue can be incorporated into risk communication. The guides offer advice for both how to facilitate a dialogue with the community and techniques to encourage active communication. Channels for creating a dialogue include community meetings, radio and television discussions that allow individuals to call in, focus groups, hotlines, community activities, and social media (CDAC, 2022). The guides also recommend broadcasting discussions between agencies and community members to amplify the outreach of these discussions (UNDRR, 2017). Communicators are provided with multiple different avenues to facilitate dialogue with communities and are encouraged to utilize multiple different channels that will allow a greater diversity of voices to be heard.

In addition to providing insight on channels for active dialogue, the guides also give communicators advice on how to engage individuals through these channels. For example, the guides give suggestions for different conversation starters. Examples include: “Are you worried about flooding? Why or why not?”, “What in our community is important to you?”, and “What do you worry most about our community’s future?” (NOAA, 2016, p.12). These starters can help initiate the process of communication for agencies as well as give communicators insight into what factors should shape messages to a community about risk. Along these lines, the guides also give suggestions for how to frame conversations in ways that will be received best by different audiences. For example, the guides recommend shifting dialogue to personal responsibility when communicating with those who value individualism and hierarchies (NOAA, 2016). Conversely, when communicating with those who strongly value their community and the environment, the guides recommend framing dialogue around conversations about

stewardship (NOAA, 2016). As previously mentioned, this recommendation also aligns with audience-specific messaging because it demonstrates how different values should shape the way communication is framed. Here, audience-specific messaging can enhance dialogue by giving communicators insight into what sorts of conversations will be the most salient with different groups. Furthermore, as demonstrated previously in this chapter, audience-specific knowledge can be garnered through active dialogue which demonstrates that different strategies can have reciprocal relationships rather than being mutually exclusive.

3.7 Communicating and Mitigating Uncertainty

Uncertainty is another aspect of risk communications that is common in the Best Practice Guides that were analyzed. Broadly speaking, uncertainty occurs in two different ways within risk communication. Given the inherent level of unpredictability of risk management, the first is uncertainty about the hazard which communicators are messaging about. The timing, location, or severity of a hazard may not be definitively known when communication about risk begins. As such, there is a high degree of uncertainty in most natural hazard risk communications. Secondly, the guides also describe uncertainty in terms of how messaging is received by audiences. This uncertainty pertains more to the clarity of messaging and whether individuals perceive and understand messaging in the way that communicators intended. The following sub-section will outline how the guides describe these two forms of uncertainty and various techniques that are included for communicating and mitigating uncertainty.

The Best Practice Guides reflect the risk psychology literature on uncertainty by noting that the level of transparency being communicated should be community specific.

That said, there is a consistent theme amongst the guides that some degree of uncertainty *needs* to be communicated to the audience. For example, the AIDR (2021) guide highlights that uncertainty about a risk should not lead messengers to delay or stop warnings, but, instead, the uncertainty about a risk should be communicated in ways that are easy for audiences to understand and communication about the risk should be altered as knowledge evolves. The guides also acknowledge that the level of uncertainty communicated can be difficult to balance. Overemphasizing uncertainty, for example, can lead to a confused community that is unsure of how to act, or it may inadvertently minimize the potential of the risk (NOAA, 2019). Conversely, underemphasizing the uncertainty can lead individuals to take unnecessary actions (NOAA, 2019), and it can erode trust in the communicating organization. The guides do not give prescriptive advice on the specific degree of uncertainty that needs to be communicated but rather highlight that this decision must be context specific. The guides highlight different factors that should influence how much uncertainty is communicated. They note that communicators should consider how much complexity a community wants to be communicated and how much a community's actions will be influenced by uncertainty (NOAA, 2019). This advice aligns also with the importance of understanding one's audience and audience-specific messaging because uncertainty needs to be directly based on the wants and needs of the community in question. An additional aspect of uncertainty absent from the guides is how to communicate about risks when disaster response is ambiguous. The response and communication for a common risk in a community will likely differ from that of an unprecedented risk in that same community. As such, outlining how to approach communications when the response for disaster managers is unclear is another critical

aspect of communicating uncertainty that would improve the efficacy of Best Practice Guides in general.

The guides also include various techniques for how to best communicate uncertainty to communities, including what format to describe risk in, how to frame risk, language to use, and where in a message to include uncertainty. The guides note the advantages and disadvantages of all the different formats to communicate risk—numbers, words, and graphics (NOAA, 2019). For example, they note that behavioural research indicates most people like to receive information on uncertainty numerically because "numbers offer precision and convey scientific credibility" (NOAA, 2019, p. 13). However, numbers can be misinterpreted—especially by an audience that might not easily understand technical information (NOAA, 2019). Conversely, the guides note that using words to communicate uncertainty, such as "possible," "likely," and "certain," can be effective at communicating uncertainty as they best encapsulate intuition and emotion, and improve the flow of communication (NOAA, 2019). Furthermore, using words to describe uncertainty is often more easily understood by audiences without a strong technical background (NOAA, 2019). The guides note, however, that this sort of communication is more prone to misinterpretation because phrases like "likely" and "possible" do not convey universal levels of probability (NOAA, 2019). Given the different pros and cons, the guides note uncertainty should be communicated based on the needs of the audience. Furthermore, because the needs of a community are often diverse, the guides recommend avoiding using any terminology that is overly technical (NOAA, 2016).

In terms of message framing, the guides also demonstrate how to describe uncertainty to audiences. For example, the guides recommend avoiding the term 'uncertain' because it can lead individuals to dwell on their lack of knowledge and instead use words like "could" to convey this uncertainty (NOAA, 2016). Guides also suggest pairing uncertainty with information about how risk managers are trying to reduce uncertainty (NOAA, 2019). Regarding message construction, aspects about uncertainty should also be included in the middle of a message, with known information at the beginning of the message and the most important parts of the message at the end (NOAA, 2019). These recommendations align with risk psychologists who suggest pairing positive information with negative due to the tendency for individuals to dwell on the negative (Poortinga & Pidgeon, 2004). This recommendation also suggests that, while communicating uncertainty is important, it should not be the most important thing for audiences to understand within a message.

Messaging that mitigates uncertainty is also a critical aspect of risk communication outlined in the Best Practice Guides. When an individual is uncertain about the content of risk communication, this leads to greater time processing and researching rather than taking protective action (AIDR, 2021). The guides outline how communicators can construct easily understood messages that minimize confusion. For example, the guides note that communicators should ensure consistent messaging across different messengers (AIDR, 2021). Like strategies for trust, the guides also recommend coordinating messages between agencies to ensure the content is similar (AIDR, 2021; UNDRR, 2017). They note that consistency is also crucial because people will often seek out multiple sources about a risk to confirm the level of threat (AIDR, 2021).

Furthermore, if there is uncertainty due to conflicting information, communicators need to address and clarify this with the community members (AIDR, 2021).

In terms of messages themselves, the guides also provide insight into how to construct content to minimize uncertainty. One aspect of this is the translation of scientific and technical terms. The guides highlight different ways to translate scientific terms (NOAA, 2019), and they suggest giving space for feedback and questions when communicating technical information because technical content is more easily misinterpreted (AIDR, 2021). They also suggest that messages be as tailored and targeted as possible, so it is clear for whom the risk communication is intended (AIDR, 2021). As such, audience-specific messaging can also enhance the efficacy of messaging because it helps to ensure that it is clear who is at risk. The guides also urge communicators to prepare and practice before communicating with the public (NOAA, 2019). While the reason for this is not made clear by the guides, one possible explanation is that this will increase the clarity and confidence of the communicator. Presumably, a communicator who appears unsure or delivers unclear messages will undermine public confidence in the message.

Another common theme within the Best Practice Guides that were analyzed is the availability of predefined terms. This is an important aspect of uncertainty because it helps to ensure that terms commonly used in risk communication are used accurately. For example, the guides note that some terms, such as hazard, risk, and uncertainty, have different meanings depending on the discipline, so they provide definitions that are consistent with risk communication (NOAA, 2019). These definitions help ensure that a

communicator uses proper terminology and that relevant terms are consistent across communicators and messages.

3.8 Memory as a Mental Shortcut

The Best Practice Guides also offer insight on how to incorporate memory into risk communication practices. Memory in this context refers to any previous experience with hazards. As noted in the risk psychology literature, emotion plays an important role in directing psychological processes such as memory (Slovic, 2010). Given the link between memory and emotion, memory can be a powerful tool for communicators to target risk perception and motivate behaviour changes (Pidgeon & Fischoff, 2011). The Best Practice Guides reflect this idea by citing memory of past hazards as a tool for influencing how a community understands risk and willingness to act. For example, the guides highlight that people draw upon "personal experience to inform their interpretation of risk" (AIDR, 2021, p. 9). Communicators can use these emotions and experiences that are drawn from past events "to help residents remember what has happened in the past and what could happen in the future" (NOAA, 2016, p. 5). The guides also reflect risk psychology by highlighting that memory can be a mental shortcut. The NOAA (2016) notes that the strength of a memory and any emotions associated with that memory can influence how an individual or community views any future events, but the use of past experiences should only be used in moderation and with particular care. Past experiences that evoke negative emotions, for example, should be used sparingly because this can lead to feelings of hopelessness (NOAA, 2016; Wachinger et al., 2013; Sanquini et al., 2016).

The guides also suggest that communicators can use community memory from past hazards to inform risk communication and risk management practices. The UNDRR (2017) notes that "people directly affected by risks have extremely valuable understanding about the potential impacts and how the risks could be addressed" (p. 5). Furthermore, the guides suggest that communicators can use a community's experience with a past hazard to benchmark or contextualize a future hazard for communicators (NOAA, 2016). While first aligning with literature on the use of memory in communication, these recommendations also align with risk psychology literature that advocates for the use of audience-specific messaging and lessons learned. These recommendations encourage communicators to consider incorporating community-specific memory with risk into messaging to help individuals better understand the current risk they are facing. The emphasis on community-based knowledge throughout the guides also indicates that communicators can learn how to communicate more effectively based on the insight a community has from previous hazards. The relationship between community-based knowledge and lessons learned also further highlights how strategies for risk communication tend to reinforce each other.

3.9 Storytelling

The final theme evident throughout the Best Practice Guides is the role of storytelling in risk communication. Despite the emphasis on storytelling in risk psychology, this practice was mentioned the least throughout the guides. Nevertheless, some guides do highlight the impact storytelling can have on risk communication. The most prevalent recommendation within the Best Practice Guides is to use storytelling to help individuals contextualize complex or technical concepts found in risk

communication. In the guides, storytelling is considered "an effective learning tool to make information real and relevant" (NOAA, 2016, p. 9), and "an important way to get audiences engaged" (NHC, 2020, p. 5). As noted in the guides, combining technical information with storytelling can help engage the audience and make messages more personalized so that messages better resonate with and motivate audiences (NHC, 2020). The academic research also points at the role of storytelling in personalizing messages and encouraging action —especially the case study where audiences viewed documentaries about previous hazards in their community (Hicks et al., 2017). Here, storytelling proved to be an effective technique at fostering empowerment and risk awareness in communities vulnerable to volcanic eruptions (Hicks et al., 2017). The importance of storytelling in personalizing communication also further highlights the role of audience-specific messaging within risk communication.

Communicators can also use storytelling to share past experiences with natural hazards. The guides suggest sharing stories from people's past experiences to emphasize the importance of taking protective action as these messages are often the most salient when coming directly from the source (NHC, 2020). They also suggest encouraging community members to share their past experiences with hazards to help foster a greater sense of understanding and connection between communities and agencies (NHC, 2020). Here, techniques that use memory go together with techniques for storytelling as individuals are encouraged to recall their own previous experiences with hazards in hopes to motivate a wider audience. With that being said, the guides do not offer any insight on how communicators should construct these stories. This lack of instruction could be a

barrier to effective implementation as communicators may not know how to effectively translate an individual's experience into a compelling story.

3.10 Broader Insights on Knowledge Mobilization

Analyzing how content from the literature on risk communication is reflected in the Best Practice Guides also offers insight into knowledge mobilization more broadly. Knowledge mobilization (Kmb) describes the importance of ensuring that the knowledge from research extends past the academic realm such that its benefits are relevant to society more broadly (Cooper et al., 2018). Best Practice Guides are one form that KMb can take, but others can also include books, journalism, podcasts, social media posts, summaries of research written in non-academic language, or networks and events that help support KMb (Cooper et al., 2018). This research is relevant to KMb because it explores how different agencies concerned with disaster risk reduction (DRR) mobilize research on risk communication.

The strengths and weaknesses identified within the Best Practice Guides on risk communication can likely offer insight into guides for KMb on other topics. Analyzing the Best Practice Guides revealed significant strengths and limitations throughout the guides and offered insight into how research on risk communication is reflected in practice. Some of the guides gave communicators insight on how to incorporate recommendations into messages. For example, the EPA (2022) stated that it is important to know your audience and incorporate that into communications. The NOAA (2016) demonstrated how different values shape risk perception and gave concrete examples on how to shape messages that appeal to these values. The NOAA (2016) did not include a definitive list of how to navigate different values in risk communication, but it still allows

communicators to conceptualize what meaningful audience-specific communication can look like. Understanding the level of detail required for each recommendation within a Best Practice Guide will likely require working directly with communicators to understand how a Best Practice Guide is interpreted by those who are using it.

Analysing the Best Practice Guides also revealed that the length of a guide does not dictate its strength. In other words, guides that were longer did not necessarily contain more helpful insights on how to communicate natural hazard risk effectively. In fact, while some guides reached over 100 pages (IFRC, 2018), the guides that most closely reflected the risk psychology literature were approximately 30 pages in length. These guides, especially the NOAA (2016) and the NHC (2020), also successfully clarified how recommendations could be implemented practically. This suggests that it is not the quantity of information that is included in a guide that makes it effective, but how that knowledge is communicated and explained to audiences. These insights are critical for developing future Best Practice Guides on natural hazard communication and the larger scope of KMb for other issues. Much like risk communication, there is an art and science to KMb that requires one to understand who their audience is and how to shape knowledge in a way that it makes recommendations understandable and actionable.

3.11 Politics, Science, and Risk Communications

An important consideration not evident in the Best Practice Guides analyzed is the role of politics in risk communication. Oftentimes, how risk is communicated is a political decision—not a scientific one, and politicians are typically held accountable for how a disaster is managed. For example, government officials were scrutinized over their communication decisions for calls to evacuate amidst the August 2023 wildfires in Maui.

Maui County Emergency Management Agency Administrator, Herman Andaya, faced criticism for his decision to not utilize Maui's warning sirens to notify residents of the impending forest fires (Helsel, 2023). Andaya noted that, while these alarms alert multiple hazards including wildfires, many residents associate these sirens with tsunamis. Andaya feared people would follow tsunami protocol and move inland—directly towards the incoming forest fires (Helsel, 2023). Amidst this scrutiny, Andaya resigned from his position (Tanyos, 2023). The calls for evacuation in Guadeloupe in 1976 also further exemplify how public officials are responsible for the decisions they make about risk as informed by science (Komorowski et al., 2015). Volcanologists were highly uncertain about whether a period of unrest from La Soufrière, a volcano in Guadeloupe, indicated an impending destructive eruption (Komorowski et al., 2015). Public officials had to decide how to proceed with hazard management based on the information and conflicting recommendations provided by scientists. Government officials called for an evacuation of 70,000 people from the island (Komorowski et al., 2015). While there was no loss of life, the evacuation led this to be one of the costliest volcanic eruptions of the twentieth century, as 60% of Guadeloupe's Gross Domestic Product was lost that year (Komorowski et al., 2015). Furthermore, the unrest from La Soufrière did not actually lead to any significant eruption during the evacuation period (Komorowski et al., 2015). While this decision to evacuate did ensure that there was no loss of life, should an eruption occur, the economic loss and inability to definitively predict the eruption undermined citizens' trust in both public servants and science (Komorowski et al., 2015). These two cases exemplify that communications surrounding natural hazards often have an inherent level of uncertainty, and public servants are held responsible for what is

communicated and how. Furthermore, the implications of imperfect communications, such as distrust and scrutiny, are also often placed on public servants. This responsibility is a critical aspect of risk communication, yet none of the Best Practice Guides evaluated in this research offered any insight into how to navigate this relationship between governments and scientists and how to weigh the implications of different communications. This is a significant gap given that, as demonstrated by these cases, decisions in risk communication have major implications in terms of loss of life and livelihood, but also in terms of the perception of those tasked with communication.

Another critical aspect of communications that is absent from the Best Practice Guides that were analyzed is the role of democracy. The goal and role of communications will vary depending on the level of freedom that an individual has to make their own decisions about a given risk. As such, an important consideration for communicators in democratic societies is how to shape communications when notifying an audience of a mandatory action, such as an evacuation order, in comparison to an optional action that will mitigate risk, such as purchasing an emergency preparedness kit. These factors will likely impact how a message should be framed, and, therefore, are a critical missing aspect of the Best Practice Guides and risk psychology.

Table 1

List of recommendations evident in each Best Practice Guide

	Audience-Specific Messaging	Trust	Fostering Empower-ment	Testing and Evaluating Practices	Active Dialogue	Communi-cating & Mitigating Uncertainty	Memory as a Mental Shortcut	Story-telling
UNDRR								
Health Canada								
NOAA (2016)								

	Audience-Specific Messaging	Trust	Fostering Empower-ment	Testing and Evaluating Practices	Active Dialogue	Communi-cating & Mitigating Uncertainty	Memory as a Mental Shortcut	Story-telling
NOAA (2019)								
EPA								
AIDR (2018)								
AIDR (2021)								
NHC								
CDAC								
IFRC								

Chapter 4: Case Studies of Natural Hazard Communication

The following chapter analyzes examples of real-world natural hazard risk communications. It highlights various ways that recommendations from the Best Practice Guides are reflected in practice as well as potential challenges faced by communicators and directions for future research. The communications examples that are shown in this chapter are not representative of all the communications that are available for natural hazard risk communication. Rather, the examples were selected because they highlight various strengths and weaknesses in knowledge mobilization of recommendations to practice. It is important to note that the case studies analyzed in this thesis are all from Canada. As highlighted in risk psychology and sociology literature as well as the Best Practice Guides, there are objective and subjective differences in how risk is experienced contextually (Quigley et al., 2017; NHC, 2020; AIDR, 2018). This is a limitation of the research given that the experience of risk varies so significantly, so lessons from the Canadian experience can only apply to others on a context-by-context basis and would require a nuanced understanding of the different values and cultures. There are also various experiences within the Canadian context that would require a further nuanced understanding—namely within Indigenous communities. Given the scope of this thesis, it was appropriate to analyze communications that are targeted to communities with similar cultural and value backgrounds to the researcher.

These various messages were identified by examining the social media platforms of organizations that communicate natural hazard risk to the public, including Public Safety Canada, the New Brunswick Emergency Management Organization (NBEMO), Toronto and Region Conservation Authority (TRCA), the City of Markham, and the

Alberta Emergency Management Agency (AEMA). The organizations' social media feeds (Twitter and Facebook) were used to source communications because past messages are easily preserved and located on these platforms. These specific tweets and posts exemplify multiple communication techniques from the Best Practice Guides and framework for analysis. The communications offered through social media provided sufficient material for analysis including communication that requires immediate response as well as communication aiming to educate about risk. The case studies also represent samples of communication from multiple scales of governance including national, provincial, regional, and municipal agencies.

4.1 Case Study 1: Public Safety Canada

Figures 1 and 2:

Tweets from Public Safety Canada

Case Study 1 examines two tweets from Public Safety Canada (PSC) on flood preparedness. These two posts were selected because they demonstrate two comparable instances where PSC is directly communicating about hazard risk with the aim of encouraging behaviour changes to mitigate flood risk. In Figure 1, posted on April 6th, 2023, PSC uses Twitter to communicate what to do when flooding is forecast where you are living (Public Safety Canada, 2023a), and in Figure 2, April 8th, 2023, they communicate what to do after flooding has occurred (Public Safety Canada, 2023b). In Figure 1, PSC attached an animated image of a house floating in water with three bullet points that outline actions to take when flooding is forecasted and a link to more information on flood preparation. The image in Figure 2 is identical but outlines information on what to do after a flood has occurred. The link on each of these communications also leads to a webpage on the Government of Canada website that provides more information on what to do before, during, and after a flood. It should also be noted that these are two messages out of multiple tweets on the PSC twitter page in a similar format about flood preparation—all of which use the same image and link.

The PSC messages on flood preparation provide communication that is concise, actionable, and consistent and that gives opportunities for two-way communication. Each message makes it clear from the first sentence who the communications are intended for—a person who is in an area where flooding is forecast or where flooding has occurred. While still quite broad, this does align with recommendations on audience-specific messaging because it only targets those who are experiencing various stages of flooding within Canada. The messages also successfully provide concise guidance for their audience that clearly indicates what steps to prioritize at various stages of flooding.

Both the Best Practice Guides (AIDR, 2021) and the risk psychology literature (Nabi & Myrick, 2019) emphasize that messaging needs to be clear and actionable, as perceived inability to act is a common barrier to action for risk preparation and mitigation. Including three steps and then providing a link for more information also allows individuals to triage their actions and gives them the opportunity to take further action and learn more should they feel that is manageable. The PSC tweets also prioritize important steps and demonstrate an understanding that while some individuals will want to read more and research—as highlighted in the guides and the risk psychology literature—some might be unable to process any more content (Balog-Way et al., 2020; NOAA, 2019). As such, providing links in this way allows PSC to tailor their message to both audiences.

The format of these messages is also effective because it makes content easier to navigate and allows for two-way dialogue. By using a consistent image for all content on flooding, individuals can easily scroll through the PSC Twitter page and locate flooding messages because they all have the same eye-catching image. Consistency in this way—while not discussed in the Best Practice Guides or the literature—allows individuals to navigate information more quickly rather than having to read every tweet sent by PSC to find relevant information. Furthermore, using social media as the platform for communication enables individuals to interact with and comment on the tweets. That said, individuals can often only access and interact with these tweets if they have their own Twitter account—limiting the scope of outreach and feedback. In doing so, PSC opens their communications to dialogue—albeit to a limited audience—another recommendation that is consistent within the Best Practice Guides and the literature.

The Best Practice Guides also contain additional insight that can further improve the messages. One limitation is that the intended audience for these messages is very large. While PSC does aim to limit the scope of their messaging by highlighting what phase of a flood a message is intended for, this still leaves a very broad scope. The importance of targeting a narrower audience, however, may be more critical when the intention is to encourage immediate action in comparison to this message which aims to educate about future flood risk. That said, messaging seems to be targeted to individuals in a one-family house—with instructions involving basements and outdoor gas valves. Presumably, this information would not be relevant for audiences living in an apartment building or other types of housing. As both the risk psychology literature and Best Practice Guides have suggested, messaging that is more audience-specific is typically more effective. Given the scope of PSC, it may not be reasonable to expect messaging on all flooding within Canada but providing proactive advice for more specific groups of people, for example those living in apartments or close to bodies of water, could improve this communication further.

Some of the language included in Figure 1 is also unclear. PSC recommends that individuals make sure their homes are "structurally safe" before returning to them following a flood (Public Safety Canada, 2023a). This message highlights an issue that is also consistent within the Best Practice Guides regarding balancing messaging so that it is both sufficient and concise. In this case, PSC creates a message so short that it becomes potentially unclear. As emphasized in the Best Practice Guides and risk psychology, messaging that is both clear and actionable is a critical component of motivating individuals to act amidst a natural hazard (NOAA, 2019; IFRC, 2018; NHC, 2020;

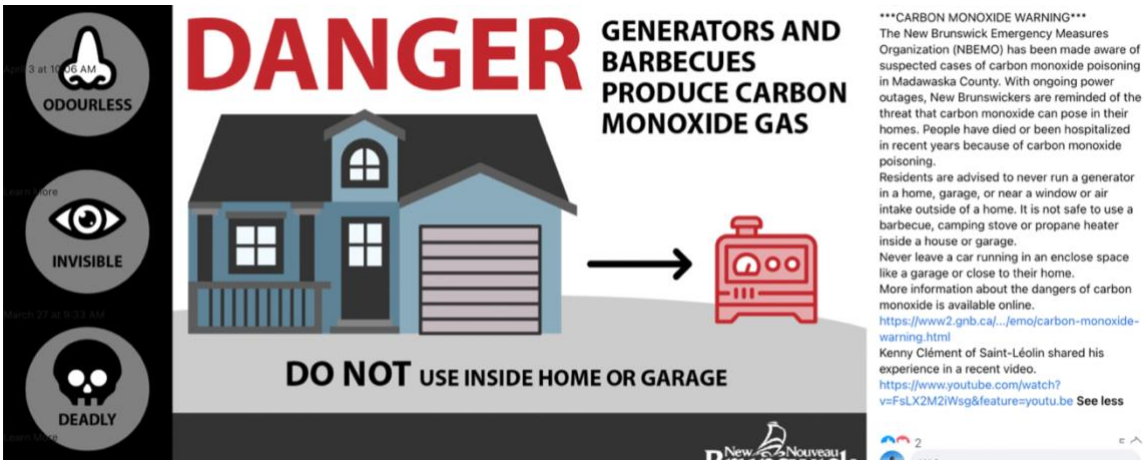
Rollason et al., 2018). Stating only that individuals should make sure their homes are structurally safe may not be enough information considering many people may not know how to identify signs that their homes are unsafe from flood damage. While PSC does provide more guidance about this on their website, this information should accompany the recommendation to assess a home's structural integrity, given the likelihood that an individual may not understand what to look for. The need to include more content is also particularly important in this case because the message may already evoke a sense of fear in the audience. The Best Practice Guides recommend pairing information about risk with actionable steps to promote empowerment (NOAA, 2019; IFRC, 2018; NHC, 2020). By communicating that a home may be unsafe due to flood damage and explaining how to determine if a structure is safe after a flood, communicators increase the likelihood of making an individual feel empowered rather than fearful.

Finally, while PSC does make dialogue an option by communicating via Twitter—where anyone with a Twitter account can reply to their posts, PSC could directly encourage dialogue and feedback. Encouraging two-way communication increases trust in communicators, and it helps to ensure that what is being communicated is understood and relevant to audience members (Johnston et al., 2022). Communicating on a platform that already enables dialogue is a positive step towards creating meaningful dialogue between people and PSC, but including one sentence in posts that directly asks for feedback or questions is an easy way to encourage people to voice their opinions rather than just assuming they will do so because they have the option.

4.2 Case Study 2: New Brunswick Emergency Management Organization

Figure 3:

Facebook Post by NBEMO



Case Study 2 examines a Facebook post by the New Brunswick Emergency Management Office (NBEMO) about carbon monoxide safety. The message includes an image that provides information about carbon monoxide—namely that it is odourless, invisible, and deadly, and the image also explains what machines produce carbon monoxide and to avoid using them in enclosed spaces (New Brunswick Emergency Management Organization [NBEMO], 2023). The message also includes a block of text that details recent cases of carbon monoxide poisoning in a county within New Brunswick. NBEMO highlights that—because power outages are a current issue in New Brunswick—people need to be aware that generators, gas BBQs, and other appliances that are commonly used during outages produce carbon monoxide (NBEMO, 2023). NBEMO also provides a link to more information on carbon monoxide as well as a link to a video where a citizen of New Brunswick shares their experience with carbon monoxide (NBEMO, 2023).

This message demonstrates how communicators can employ both audience-specific messaging and storytelling in their messages. Both risk psychology and the Best

Practice Guides have indicated that audience-specific messaging is an effective risk communication strategy (NOAA, 2019; AIDR, 2021; UNDRR, 2017; Lundgren & McMakin, 2018; Slovic, 2010). While this message does not necessarily engage deeper levels of audience-specific understanding, such as appeals to values or trust (Lundgrin & McMakin, 2018), this message does make efforts to tailor messaging to specific audiences. In particular, the NBEMO makes direct references to various locations throughout the message, including various counties within New Brunswick, and they direct the message to 'New Brunswickers' rather than just a broad audience (NBEMO, 2023). The NBEMO also further contextualizes this message by connecting it to a recent case of carbon monoxide poisoning in a particular county and by connecting the relevance of this message to current power outages within New Brunswick (NBEMO, 2023). Finally, as in Case Study 1, the message uses 'home' rather than 'house' when describing carbon monoxide risk which reflects the Best Practice Guides' recommendation to use emotionally engaging and personalized language (AIDR, 2018). The use of this audience-specific messaging is important because it helps both personalize and contextualize risk communication.

These benefits of audience-specific messaging are also further realized by the NBEMO's inclusion of a New Brunswicker's personal experience with carbon monoxide. In a one-minute and twenty-second-long video, a resident of New Brunswick, Kenny Clément, recalls his sister's death from carbon monoxide poisoning from their generator during a power outage (NBEMO, 2023). In the video, Clément emphasizes that he and his sister thought the generator was installed properly but that there was one small spot where carbon monoxide could enter their home, which led to his sister's death (NBEMO,

2023). He also explains that this event showed him how important it is not to underestimate the power of carbon monoxide (NBEMO, 2023). As noted in both risk psychology and the Best Practice Guides, storytelling and the use of personal experiences are important tools for risk communicators because they help people contextualize messages and make content real and relevant to them (NOAA, 2016; Hicks et al., 2017). Storytelling can increase the resonance a message has with audiences and can lead to greater motivation (NHC, 2020). Furthermore, this use of memory and storytelling is also an effective tool to elicit an emotional response from viewers—another recommendation throughout the literature and guides. While the content of the video would likely foster negative emotions, the content of the message provides very clear and actionable strategies to avoid this hazard.

This message reflects many of the recommendations from the Best Practice Guides and risk psychology, but it is possible to strengthen the strategies that have already been employed. One recommendation is to include messaging on the image that indicates why carbon monoxide safety is of particular importance. In the smaller text, the NBEMO indicates this by noting ongoing power outages as well as potential carbon monoxide poisoning in the province. By including in the image that carbon monoxide poisoning is more prevalent amidst power outages, the message may resonate with more people. Doing so would make the audience-specific messaging more overt, which may help to increase engagement.

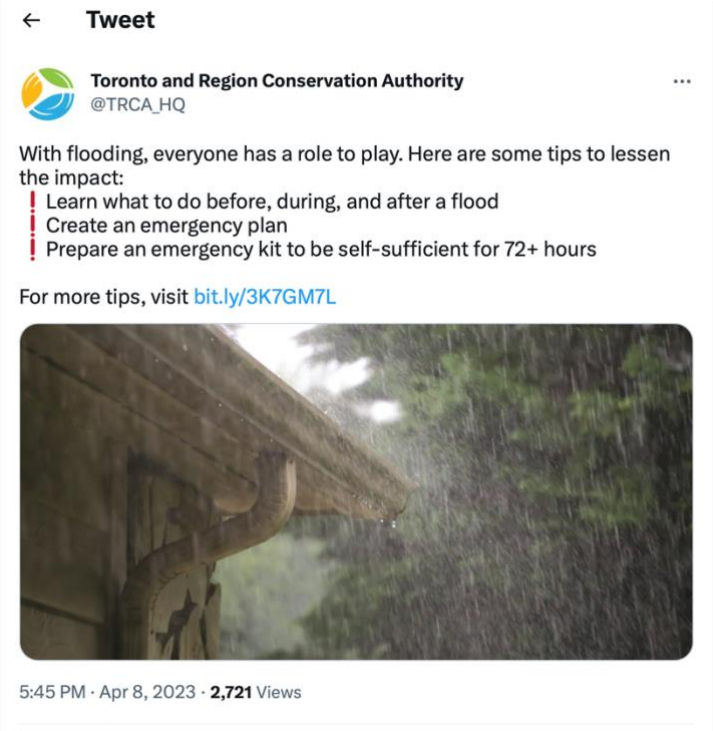
This message from NBEMO demonstrates well how audience-specific messaging and storytelling can be implemented in risk communications. By targeting New Brunswickers directly through their wording and referencing specific locations within

New Brunswick, the NBEMO makes stronger connections to audience members. Furthermore, including a story of a local resident's experience with carbon monoxide poisoning helps to target and personalize this message even further. This message also successfully demonstrates how communicators can aim to implement a few best practices in detail rather than attempting to include as many recommendations as possible and yield strong results.

4.3 Case Study 3: Toronto and Region Conservation Authority

Figure 4:

Tweet by the TRCA



Case Study 3 examines a tweet from the Toronto and Region Conservation Authority (TRCA). One of the TRCA's objectives is to help protect communities from the impacts of extreme weather events—with a particular emphasis on flooding (Toronto

and Region Conservation Authority [TRCA], 2023a). For the regions included in the TRCA's jurisdiction—making up 5 million people—the TRCA is the "first line of defence against natural hazards" (TRCA, 2023a, para. 2). In this message, the TRCA provides a list of three tips that community members can use to reduce the impact of flooding as well as a link that leads to more information about each tip for flood risk mitigation.

This message from the TRCA has multiple features that are similar to the communications analyzed in previous case studies, but one distinct difference is that the language used in this tweet appeals to specific values. As noted in the literature, audience-specific messaging that promotes behaviour change will often require a deep understanding of the audience such as their motivations and perception of risk (Lundgrin & McMakin, 2018). The NOAA (2016) further reflects this by suggesting that shaping messages based on a community's values is an effective tool for motivating behaviour changes. For example, the NOAA (2016) suggests emphasizing personal responsibility for those who value individualism and working together for those who value community. By writing "with flooding, everyone has a role to play", the TRCA (2023b) appeals to both community-driven and individualistic individuals. One who values individualism may interpret this as each person having their own personal responsibility to protect themselves from flooding. Alternatively, one who values community may interpret this message as meaning that everyone has a role to play in making their community safe from flooding. While it is impossible to know if this was the intent of the message, or if the message was successful in impacting audiences with diverse values, it is a clear reflection of recommendations from both risk psychology and the Best Practice Guides.

A limitation of this message is that every recommendation the TRCA makes for flood preparation requires further research by viewers. This message tells individuals what to do to mitigate flood risk in very basic terms, but without any specific instructions about how to approach these tasks. As such, the impact of providing concise and direct recommendations for mitigation is lost because the messaging does not include any further actionable steps aside from accessing more information. As noted in risk psychology and the Best Practice Guides, communicators must construct actional messages as this increases an individual's perception that they can follow through with advice which can lead to a greater willingness to act (Rollason et al., 2018; AIDR, 2021; NHC, 2021). Case Studies 1 and 2 offer a helpful contrast of how messaging can be concise but still offer more practical recommendations on how to act.

Another opportunity to include more actionable content would be to include a different image that has greater relevance to the content of the text. In this message, the TRCA uses an image of a house and an eavestrough in the rain (TRCA, 2023b). This image might inadvertently restrict the audience of the message to only those occupying a single-family home despite that many regions within the TRCA's jurisdiction do not live in this style of home. This potential restriction is also problematic because the messages accompanying the image are relevant to an audience much bigger than those who live in single-family homes. This case study exemplifies how a message may target a specific audience in a way that hinders the efficacy of a message by inadvertently excluding other community members—a lesson not evident in the Best Practice Guides or literature. By using a different image, the TRCA could expand the message's outreach to a greater population. Case Study 2 exemplifies well how communicators can construct an image

that enhances messaging, having included steps about how to practice carbon monoxide safety in their image. In a similar way, the TRCA could use an image that adds more insight to the steps they write about in their tweet. For example, the TRCA could use an image of an emergency kit to exemplify important items to include, or they could outline what to do in different stages of a flood rather than expecting individuals to seek out this information with their link. This is an important case study because it demonstrates how a particular image may inadvertently harm the efficacy of a message rather than add value.

Case Study 3 offers unique insights into strengths and weaknesses in communications that were not evident in the previous case studies. The TRCA mobilized Best Practice Guides and literature by directly targeting specific values in their message. The TRCA's message exemplifies how audience-specific messaging has the potential to strengthen the outreach and efficacy of communication. Conversely, their use of imaging demonstrated how the content of a message can potentially hinder the efficacy of a communication by restricting who may view the message as relevant.

4.4 Case Study 4: City of Markham

Figure 5:

Tweet by the city of Markham

The fourth case study explores communication by the city of Markham on risk preparedness. In this message, the city highlights various risks that citizens of Markham are susceptible to—including severe storms, power outages, and other emergencies (City of Markham, 2023). The message then asks viewers if they are prepared for these hazards and advertises an Emergency Preparedness Exposition (City of Markham, 2023). The text is also accompanied by more details about the exposition as well as various animated hazards, such as lightning and a tornado (City of Markham, 2023).

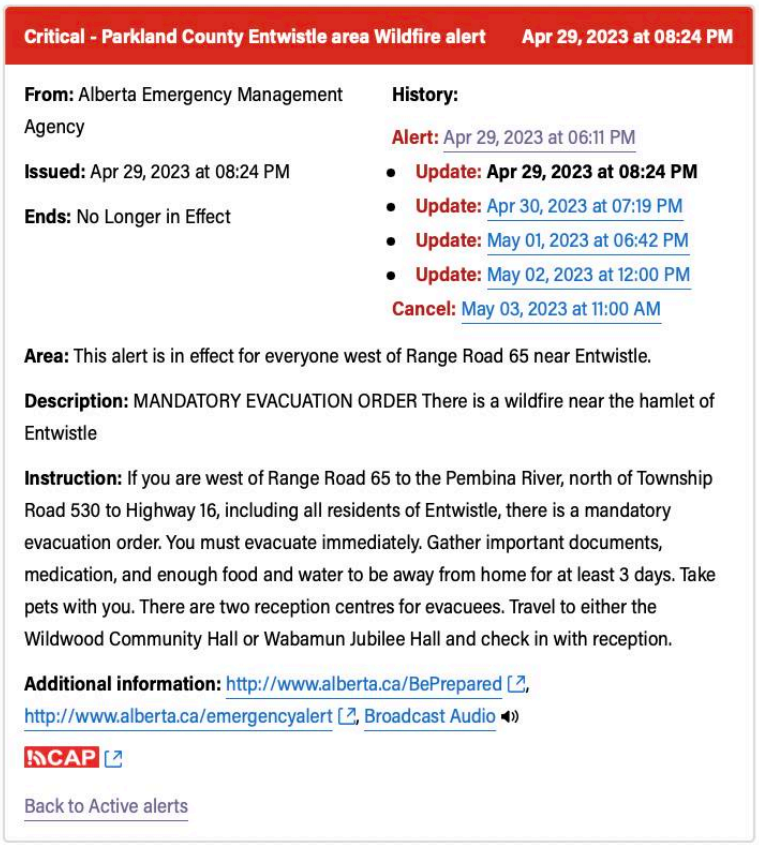
This case study offers a unique perspective on how risk communication can be designed because it advertises an in-person exposition on hazard preparedness. This sort of communication technique builds on many recommendations in the guides and the

literature—especially empowerment, two-way dialogue, audience-specific messaging, and trust-building. As noted in Case Study 3, best practices for communication can often be easily employed together. Hosting an exposition on emergency preparedness and encouraging residents to attend exemplifies this, given that all four of these practices are potential outcomes of the exhibition. The City of Markham is communicating that there is an opportunity for individuals to empower themselves to mitigate the risks posed by inevitable hazards. Empowering a community against hazards is important because it increases the likelihood that they will be willing and able to mitigate the risks posed by a hazard (Rollason et al., 2018). Furthermore, hosting an exposition presumably allows individuals to actively engage with agencies concerned with risk management. Opportunities for this sort of dialogue are important because they can help to build trust between residents and agencies (NOAA, 2016; Richard Eiser et al., 2012) and opening this dialogue can enable agencies to learn about the communication needs specific to residents. Additionally, this case study exemplifies well how communicators can engage with communities about risk mitigation in the absence of an actual disaster. While the impact of this exposition is unknown, the emphasis on empowerment seems to aim to encourage hope rather than fear in preparing for a future hazard. This case study is also important because it demonstrates how communication can extend past social media messages and emergency alerts. While hosting an exposition on emergency preparedness is likely costlier than creating an informational social media post, it has the potential for impacts that can outweigh the greater investment in communication.

4.5 Case Study 5: Alberta Emergency Management Agency

Figure 6:

Emergency alert issued by the AEMA



Case Study 5 examines emergency communication made by the Alberta Emergency Management Agency (AEMA) amidst the forest fires occurring in April and May of 2023. As of May 8th, 2023, nobody has died as a result of these forest fires, but over 29,000 individuals evacuated their homes (Salahieh, 2023). This case study highlights a recent example of emergency communication with immediate calls to action. Importantly, this case study highlights strengths in natural hazard risk communication and limitations to the communication—as provided by community members experiencing the hazard. This case study examines a particular emergency alert issued by the AEME as

well as a news report that details individual's experience with emergency communication during this case study.

Here, the AEMA calls for the immediate and mandatory evacuation of Parkland County, Alberta. This message is the second call for evacuation issued during this forest fire, and unlike the first, it includes information about emergency centres where evacuees can access support (Alberta Emergency Management Agency [AEMA], 2023). The message also provides a written and visual description of who needs to evacuate, and that individuals have two halls that they can travel to so they can check in (AEMA, 2023). The message also instructs individuals on what they should bring with them—including medication, pets, food, and water to last at least three days, and important documents (AEMA, 2023). Additionally, the alert includes links to websites that provide more information about what to do during a forest fire and how to create a preparedness kit (AEMA, 2023). Finally, the alert a provides a link to the broadcast audio of the message—presumably played on radio stations amidst the evacuation (AEMA, 2023).

This message is successful in reducing uncertainty in terms of who the message is intended for and what they need to do. The AEMA first indicates for whom the evacuation notice is intended (AEMA, 2023). Given the nature of this message, clarifying who needs to evacuate is a crucial first step in adequate risk messaging. Along these lines, the message also successfully mitigates uncertainty by clearly indicating where individuals should evacuate to and what they need to bring. Here, mitigating uncertainty plays an important role in fostering empowerment through messaging. Clarifying where individuals need to evacuate to and what they should bring empowers audiences because it makes evacuating seem more actionable. This message aligns with recommendations

for action-oriented risk communication (IFRC, 2018) because it pairs information about the forest fire risk with clear and actionable steps that outline how to protect oneself from the hazard. This is an extremely important aspect of risk communication because, as noted in the literature and best practices, perceived inability is a common barrier to action.

There are also multiple other positive aspects of this message, some of which align with the other case studies. Like the other case studies, this message includes important information and then provides a link where viewers can access more information about the risk. As previously noted, this prioritizes the content that community members see, and it makes the content more audience-specific as individuals can determine the amount of content they require from a message. The AEMA also fulfills recommendations for audience-specific messaging by personalizing content through place names. Here, the AEMA uses both street addresses and geographic locations as well as community-specific place names to detail where individuals should evacuate (AEMA, 2023). As noted in the Best Practice Guides, this technique can improve the success of a message because it makes the content more personal (AIDR, 2021). Finally, the AEMA increases the potential for success with this message by utilizing multiple different platforms, including social media and radio, to reach community members (AEMA, 2023).

The AEMA does not alter the message depending on which platform they are using—it is consistent across radio, social media, and the emergency alert website. The use of identical messaging suggests a potential tension between audience-specific messaging and consistency in messaging. The demographics and values of audience

members receiving risk messaging on social media may differ from those using a radio—as was suggested by the UNDRR's (2017) Best Practice Guide. However, the AEMA does not customize their message for each mode of communication despite this being a strategy for risk communication (AEMA, 2023). As noted by the guides and the literature on risk psychology, inconsistent messaging can erode trust which is a significant barrier to action (AIDR, 2021; NOAA, 2019l; Balog-Way et al., 2020) By keeping their message for evacuating consistent across platform, the AEMA does not personalize their message further, but they do protect the trust that they have with community members and reduce the risk of potential confusion.

While this message does successfully employ multiple recommendations from the literature and Best Practice Guides, increasing opportunities for two-way dialogue would strengthen practices that the AEMA have already employed. By providing a of point of contact in this message, the AEMA could mitigate uncertainty even further by giving individuals the opportunity to contact representatives if they have any questions. In terms of uncertainty, this could mean allowing an individual to confirm if they are in an evacuation zone or give individuals further directions regarding where to evacuate. As noted in previous case studies, this increased opportunity for dialogue also helps to build trust between communities and agencies communicating about risk. While this is not a perfect solution given that a contact point may be taken advantage of or experience high levels of volume during a time of panic, including an avenue for dialogue is an opportunity for improvement.

This case study is unique because there is available feedback from community members that offers more opportunities to evaluate the success of the AEMA's

messaging. This feedback does not represent the collective view on communication amidst these forest fires, nor does it solely pertain to the specific communications examined in this case study, but it does offer insight into how messages like this were interpreted by community members. An article published by the Canadian Broadcasting Corporation (CBC) details feedback from some evacuees amidst the forest fires (French, 2023). In sharing the experience of multiple evacuees, the article demonstrates that some evacuees were frustrated with what they perceived as a lack of communication by agencies managing the hazard (French, 2023). In particular, some individuals felt that there should be more communication about when to evacuate, the level of damage caused by the fires, and when it would be safe to return to their homes (French, 2023). Furthermore, the article highlights that misinformation has filled this lack of communication as residents who defied evacuation orders gave false updates on the state of evacuated communities (French, 2023). This article is significant because it highlights tensions that can arise between agencies and communities during an emergency. As noted by the AEMA, the magnitude of the hazard made it impossible to provide daily updates to evacuees about when they could return home, or the extent of the damage caused by the forest fires. It is possible, however that communicating more frequently with evacuees—even just to update that there is no new information—could help minimize uncertainty and frustrations. This article also suggests that there is a need for greater dialogue and feedback between evacuees and disaster management as it is likely that individuals have shared their frustrations with reporters as they are unable to do so with the AEMA. The frustration among evacuees does not mean that the AEMA has failed—given that residents who evacuated were safe from the forest fires. It does, however,

present an opportunity for communicators to evaluate how to improve future communications so to mitigate frustration and maintain trust in emergency management organizations. Working to preserve the relationship between community members and disaster management agencies by seeking feedback will likely improve future response to natural hazards by protecting the trust communities have in disaster management.

This case study offers unique insight into current hazard messaging that requires an immediate response. The high level of evacuation and total survival rate indicates that the AEMA was successful in their natural hazard communication. Additionally, the reflection of practices from both the Best Practice Guides and risk psychology further demonstrates this success. Given that the goal of these communications was the evacuation of affected areas, this message was successful because many individuals—but not all—evacuated. Feedback from community members also highlights, however, limitations to communication as the hazard is ongoing—particularly regarding information about the length of the evacuation and the extent of the damage caused by the forest fires. Communicators can learn more about what their community members want to know—something that can be improved with greater two-way dialogue. When done right, effective DRR can bolster the perception that communities have of agencies and individuals participating in disaster relief. As demonstrated here, preparation and ongoing evaluation are critical for DRR given that the perception of responders can also be undermined when a community's needs are not met (French, 2023). This case study also highlights tensions that can arise when trying to employ multiple different best practices for risk communication, which indicates, perhaps, that the quality of practices

outweighs the quantity and that different scenarios require different communication strategies.

4.6 Reflections from all Case Studies

The case studies included in this chapter exemplify how recommendations from Best Practice Guides and risk psychology are translated to practice as well as current limitations and tensions in knowledge mobilization (KMb). One limitation consistent across all the case studies was a failure to directly encourage dialogue between community members and the communicating agency. While most of the case studies utilized a format that enables dialogue (Facebook and Twitter) none of the agencies made direct attempts to open two-way communication between the audience and organization. Communicators can include a small message that encourages and seeks out feedback to actively bridge the gap between communities and agencies. Furthermore, the risk psychology literature and Best Practice Guides both emphasize that a robust dialogue can improve the efficacy of risk communication in many ways including building trust and mitigating uncertainty (NOAA, 2019; UNDRR, 2017; IFRC, 2018; Ickert & Stuart, 2016). These case studies demonstrate that utilizing a platform that enables dialogue does not automatically result two-way communication between communities and agencies.

These case studies also reveal a potential bias in communication that appeals primarily to people in single family homes. While this only offers a very small sample of available natural hazard risk communication, there was a prevalence in single family homes throughout the messages; case studies one, two, three, and four each feature an image of a single-family home in their messaging. PSC's inclusion of a single-family home is understandable because the organization is communicating to a very large

audience. The use of a single-family home in messaging by the TRCA, however, is more problematic considering a significant proportion of the population living in the TRCA's jurisdiction are densely populated urban areas. It is not possible to determine the direct impact of using this image as opposed to one that might appeal to a greater proportion of the TRCA's audience, but it does suggest a potential trend in risk communication as well as how message choices can be inadvertently exclusionary. This potential trend might also reveal a middle-class and able-bodied bias in emergency management more broadly, wherein the tools for DRR—including communication— are primarily accessible and relevant for middle class and able-bodied individuals. It is also important for communicators to consider the importance of creating messages for preparedness regarding insurance. Many insurance policies do not cover all damage caused by hazards, and this lack of coverage impacts all individuals—especially those with lower incomes. While avoiding loss of life is the most critical aspect of DRR, the growing economic impact of hazards will only reduce a community's resilience and thus should be included in messaging about risk preparedness.

The case studies also offer insight into potential tensions or pitfalls that communicators should be aware of when implementing recommendations for risk communication. In case study 4, TRCA's use of a single-family home in messaging seems to align with recommendations to tailor communications to audiences and increase the personalization of messaging. Here, communications achieve this by personalizing messages for any audience member who occupies this sort of home, but this subsequently excludes—or at least limits the salience of the message—for any individual who cannot relate. The Best Practice Guides highlight that "if you target everyone you target no one"

(UNDRR, 2017, p. 2) and this is something that is also reflected in risk psychology (Lundgren & McMakin, 2018). The caveat to this, however, is that everyone still needs to be targeted in some way or else some community members will be left behind. While this is only a small example of how such exclusion might manifest, it highlights a significant tension between audience-specific messaging and inclusion or outreach. The need for communicators to be cognizant of who might be left behind constructing a particular message should be better emphasized within Best Practice Guides to ensure that all members of a community are targeted in some form of message. Furthermore, it suggests that the strength of audience-specific messaging is still evident in reverse—meaning that a message intended for a wide audience that unintentionally only targets a specific subsection can work to limit who in a community engages with the message.

This chapter also highlights tensions that can arise between audience-specific messaging and consistency in risk communication—as was demonstrated in case study five. In this case study, messaging about evacuations remained the same across messaging platforms rather than having the message shaped to different audiences depending on the media being used. This seemed to be an appropriate decision given that—when communicating the need to evacuate—mitigating any risk of confusion and protecting trust is crucial. On a broader scale, though, these tensions highlight that the translation between theory and practice is more complex than simply trying to accomplish as many of the recommendations as possible. Communicators also must make decisions about what recommendations should be prioritized in a message. This small sample of case studies has revealed multiple instances where tensions can arise when constructing a message, and it is likely that examination of other messages would reveal

more barriers between theory and practice. The extent of DRR resources also varies among communities. As such, disaster managers may need to make decisions about what practices to employ based on the resources that are available for a particular jurisdiction. In some cases, the disaster management team for a community may not have the resources and infrastructure available to support an adequate emergency response. Best Practice Guides need to give greater attention to the complexity of implementing recommendations to help communities adapt their response to guidelines according to their available resources.

Chapter 5: Conclusion

Effective disaster risk reduction is critical as climate change causes natural hazards to become more prevalent and severe. On a global scale, organizations have recognized the growing need for improved disaster risk reduction—as evidenced by its inclusion as part of the UN's eleventh sustainable development goal. Canada's commitment to the Sendai Framework for disaster risk reduction further reflects the need to improve resilience to natural hazards as the effects of climate change persist. One of the many different aspects of disaster risk reduction (DRR) is communication. Although communicators have widely rejected the Information Deficit Model (IDM) for risk communication, researchers need to bridge the gap between theory and practice on natural hazard risk communication.

5.1 Summary of Best Practices

A careful reading of the literature on risk communication advocating for communication techniques that go beyond presenting risk information revealed eight strategies to motivate behaviour changes. These strategies were audience-specific messaging, building trust, fostering empowerment, testing and evaluating practices, active dialogue, acknowledging uncertainty (communicating and mitigating), memory as a mental shortcut, and storytelling. Many of these recommendations are mutually reinforcing. Aligning with dual-process theories in psychology, a prevalent recommendation within the literature is how communicators should appeal to emotions in messaging because of the relationship between emotions and decision-making about risk (Markanday et al., 2022). A notable debate on this recommendation is whether communicators should elicit positive or negative emotions—namely hope or fear—in

their messaging. Along these lines, storytelling and memory as a mental shortcut are recommended as ways to elicit emotion and create messages that resonate with a community. Researchers also advocate that communicators should foster empowerment when communicating about risk because a perceived inability to act is a common barrier to engaging in risk-mitigating behaviours (Rollason et al., 2018; Nabi & Myrick, 2019). Research also examines the role of trust as a critical aspect of risk communication because a lack of trust in the individuals and organizations responsible for communications is a significant barrier to action (Slovic, 2010; Siegrist, 2021). Researchers draw on insights from psychology to explain why trust in communicators needs to be valued and protected by explaining that trust is easily lost and hard to rebuild.

Many of these recommendations highlight audience-specific messaging. The extent of audience-specific messaging varies, but ultimately encompasses the recommendation from researchers that communicators should tailor their messages to the needs and specific characteristics of an audience. In addition, recommendations for how to communicate uncertainty may also rely on knowledge about an audience, so that communicators understand the extent to which uncertainty should be included in a message. Researchers also recommend that communicators engage and encourage active dialogue with audiences to strengthen the efficacy of messaging both by improving trust between communities and communicators and by improving the knowledge communicators have about their audience (Siegrist, 2021; Richard Eiser et al., 2012). Finally, researchers recommend that communicators actively test and evaluate messages at all stages of communication (Lundgren & McMakin, 2018). This testing and evaluation help communicators learn about how their messages are interpreted, what

communities want and need to receive communications about, and how to improve future communications.

5.2 Insights from Best Practice Guides and Case Studies

The analysis of Best Practice Guides in Chapter 3 offered insight into how recommendations from the literature may contribute to improved communication practices. The Best Practice Guides revealed that themes in risk psychology often reinforce and build on each other rather than existing in isolation. For example, analysis of the Best Practice Guides demonstrated how two-way dialogue has its own unique benefits but is also a means to improve both audience-specific messaging and trust with communities. The Best Practice Guides also offered some insight into the debate between using negative and positive emotions when communicating risk. While the sample of guides discussed in this thesis cannot offer a full consensus about negative versus positive emotions, the guides generally advocate for communication practices that foster a sense of empowerment and encourage individuals to act rather than recommend that communicators evoke fear to motivate an audience. In comparison, there were arguments advocating for both the use of negative and positive emotions in the risk psychology literature.

Examining Best Practice Guides from a range of sources was an effective way to understand how knowledge from risk psychology is translated to communicators. All the major themes from risk psychology on natural hazard communication were reflected to some extent in the Best Practice Guides, although not equally in all guides. While the themes of audience-specific messaging and trust were evident in every guide analyzed, recommendations that aligned with themes on storytelling and memory appeared in fewer

guides. This discrepancy suggests that recommendations from researchers on risk communication are all evident to some extent in Best Practice Guides, but not all recommendations are given equal weight. This discrepancy calls into question whether each recommendation is of equal importance. It is unclear whether themes like memory and storytelling are less prevalent because they are considered of less use in risk communication or if researchers constructing the Best Practice Guides were unaware of these recommendations. As such, an important area for future research will be to understand the relative importance of different recommendations for risk communication and if different strategies are more useful for different forms of risk communication. Examination of these guides further revealed how the length of a guide is not always indicative of its usefulness; the guides which seemed to be the most practical were not the longest. This observation indicates that the strength and efficacy of a Best Practice Guide is not determined simply by the knowledge that is included in a guide but, rather, how that knowledge is expressed to communicators.

Examining real world examples of risk communication through the various case studies presented also revealed tensions that may arise when trying to balance different best practices in message construction. While the Best Practice Guides demonstrated that different recommendations may have varying degrees of importance, the analysis of case studies of natural hazard communication in Chapter 4 suggest that some of the best practices may also inadvertently undermine each other. In particular, the case studies revealed how audience-specific messaging may limit outreach as well as how tensions can arise when aiming to implement both audience-specific messaging and consistency in messaging. As such, communicators also need to learn how to prioritize best practices

when they may conflict with each other. Improvements to the efficacy of risk communication will involve understanding how to use different best practices in harmony with each other. Researchers will need to determine which recommendations should be prioritized when considering different variables such as audience, mode of communication, and aim of message. The Best Practice Guides successfully demonstrate effective recommendations for risk communication, but an important next step will be outlining which recommendations are most effective in different real-life scenarios. Similarly, exploring the potential conflicts or limitations that arise when pairing some best practices could also offer insight into how communicators should approach message construction. More research is required to clarify the relative importance of specific recommendations and which practices are most suitable for different scenarios given that this is unclear in the Best Practice Guides. The communications examined also suggested a lack of engagement in active dialogue between communicators and communities despite this being a highly emphasized recommendation for best practice. One explanation for this is that facilitating active dialogue can be costly. One way to navigate this barrier may be for researchers and guides to compare the cost and benefit of engaging in varying degrees of dialogue to demonstrate its importance and further promote it as a vital aspect of risk communication.

5.3 Expanding the Scope: To What Extent Does Context Matter?

The case studies included in Chapter 3 of this thesis reflect a small scope of those impacted by natural hazards because context plays a critical role in how risk, and communications, are perceived. Best Practice Guides are intended to reflect general principles that can be applied to all people, yet many of the guides also note that

communications need to be adapted to the needs and context of a particular community. This contradiction forces one to consider whether the insights from psychology are truly generalizable on a global scale. An intersectional lens may complicate the extent to which these best practices can be applied to all communities. Examining risk communication from an intersectional lens would involve exploring marginalizing factors, such as race, gender, and sexuality, to learn how communication practices might reproduce inequalities (Crenshaw, 1989; Olofsson et al., 2016). An intersectional lens would thus offer insight into how to communicate risk in ways that can specifically work to empower marginalized communities. For example, communicating to an aging community or a community with different abilities may not be as straightforward as creating 'audience-specific' messages, and gaining knowledge about the needs of these communities may not be as simple as engaging in 'active dialogue'. Other intersectional factors, such as race, gender, and sexual orientation, will likely further influence how communicators construct effective and empowering messages (Crenshaw, 1989). Some guides (NHC, 2020; CDAC, 2022) encourage communicators to consider factors such as race and gender when constructing messages, but flagging these factors to communicators without offering further insight into how to create messaging with an intersectional lens limits the efficacy of communications and thus the extent to which these marginal communities are incorporated into outreach. As such, hinting at the importance of communicating to marginalized communities without providing communicatiors actionable tools to do so is a significant gap in the Best Practice Guides.

Given the disproportionate impact natural hazards have on the Global South (WMO, 2021), it is also critical to consider how these findings can be applied to different

contexts on a global scale. For example, recommendations from risk psychology in the Best Practice Guides are likely insufficient to support communicators in regions with significant government distrust or a lack of infrastructure to facilitate disaster management that is possible in most of the Global North. Broadly speaking, the principles of best practice identified in risk psychology can span these different contexts, but guidance on how to approach these practices would likely vary significantly. For example, communicators might find that, in regions with significant government distrust, building effective communications is not a matter of determining how to shape messages, but rather working with community members to identify how to develop a system for communications that citizens deem trustworthy. It would be irresponsible to assume that a Canadian Best Practice Guide could be useful for a communicator in the Global South, or that lessons learned from Canadian communications could be broadly applied to other contexts. That said, these principles are still useful across various contexts if recommendations are taken at their broadest sense and communication practices are shaped by the input and needs of local community members.

5.4 Reflections on Research Questions

The main purpose of this research was to examine how insights from psychology on risk communication are reflected in practice. This thesis examined this gap by first conducting a review of the literature on natural hazard risk communication to establish what strategies scholars recommend communicators use to encourage behaviour changes. From the literature, eight themes on risk communication were included as a framework to analyze Best Practice Guides from a diverse range of agencies concerned with disaster risk reduction. A selection of real-world case studies was then examined to analyze the

extent to which knowledge from risk psychology is reflected in Best Practice Guides. Analysis of the Best Practice Guides revealed that recommendations from current literature are included, albeit to varying degrees. This suggests that, from the sample of guides examined, literature on risk communication is adequately reflected in tools intended to assist risk communication practices. Subsequently analyzing real-world communications then further demonstrated that insight from literature is utilized in practical communications. This analysis also revealed, however, that there are aspects of communication that could better align with insights from risk psychology and that there are potential tensions between recommendations that are not addressed in the Best Practice Guides. One way to better bridge this gap is to give greater attention to the practical implementation of recommendations as well as common barriers to effective message construction. Research that follows the translation of knowledge from academia to Best Practice Guides to practical implementation can help to improve the efficacy of Best Practice Guides as well as the ease with which communicators implement recommendations from researchers. Doing so will help increase the efficiency of risk communication as well as the practice of knowledge mobilization on a broader scale.

Appendix A: Sample of Best Practice Guides

Source of Guide	Title	Date Published	Number of Pages
Australian Institute for Disaster Resilience (AIDR)	Australian Disaster Resilience Handbook Collection: Public Information and Warnings	2021	39
U.S. Environmental Protection Agency (EPA)	A Process Framework to Guide Risk Communication	2022	4
Australian Institute for Disaster Resilience (AIDR)	Australian Disaster Resilience Handbook Collection: Warning Message Construction: Choosing your words	2018	11
Health Canada	Strategic Risk Communications Framework	2006	26
Communicating with Disaster Affected Communities (CDAC Network)	Message Library User Guidance	2022	4
Natural Hazards Center (NHC)	Principles of Risk Communication: A Guide to Communicating with Socially Vulnerable Populations Across the Disaster Lifecycle	2020	30
Auckland Council	Natural Hazard Risk Communication Toolbox	2014	49
National Oceanic and Atmospheric Association (NOAA)	A Practical Guide for Natural Hazard Risk Communication	2019	26
International Federation of Red Cross and Red Crescent Societies	Public awareness and public education for disaster risk reduction: Action-oriented key messages for households and schools	2018	174
National Oceanic and Atmospheric Association (NOAA)	Risk Communication Basics	2016	20
United Nations Office for Disaster Risk Reduction (UNDRR)	Words into Action Guidelines: Public Communication for Disaster Risk Reduction	2017	8

Source of Guide	Title	Date Published	Number of Pages
World Health Organization (WHO)	Risk Communication Strategy for Public Health Emergencies in the WHO South-East Asia Region	2019	52
U.S. Environmental Protection Agency (EPA)	Risk Communication		8
Faculty of Geo-information Science and Earth Observation, University of Twente (ITC, lead), The Netherlands & Caucasus Environmental NGO Network (CENN), Georgia	Risk communication strategy: Institutional building for natural disaster risk reduction (DRR) in Georgia	2017	35
World Health Organization (WHO)	Communicating risk in public health emergencies: A WHO guideline for emergency risk communication (ERC) policy and practice	2017	79
University of Waterloo	A Community Guide to Flood Risk Communication: Promoting Personal Preparedness	2018	30

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