

**Employing Risk/Benefit Communication Best Practice: An Evaluation of Childhood
Immunization Informational Materials**

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Abstract

Although vaccinations have been an incredible public health achievement, these current successes are threatened by growing rates of vaccine hesitancy. Vaccine hesitancy presents numerous communication challenges, which underscores how poor communication can undermine vaccine acceptance in any setting. This case study uses publicly available childhood immunization informational webpages, retrieved through a simulated Google search, at several different search locations, as well as a purposive search of three Canadian health agency websites. This study found that while many of the examined pro-immunization webpages excel at providing crucial vaccine information, there remain many outstanding opportunities for improved communication and engagement with target populations. Moreover, anti-immunization webpages use several persuasive communication strategies that pro-immunization webpages do not. These include personal stories, referencing scientific studies, and employing an alarmist tone when discussing vaccine risks and ingredients. Recommendations for improved risk communication, and informed decision-making are offered: communicating honestly about benefits and safety risks; including using quantitative baseline and risk information; provide readers an opportunity to assess what outcomes matter most to them; making effective use of visual aids; providing authors' qualifications; and pre-testing communications with target groups for reading levels and message effectiveness.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

1.0 Introduction	p. 8
1.1 Vaccine Hesitancy	p. 8
1.1 Research Objectives	p. 13
1.2 Chapter Synopses	p. 14

CHAPTER 2: LITERATURE REVIEW

2.0 Background and Relevant Literature	p. 18
2.1 Immunizations in Canada	p. 18
2.2 Immunization Coverage: Current State of Knowledge	p. 21
2.3 Vaccine Hesitancy	p. 23
2.4 Dissemination of Vaccine Information	p. 27
2.5 Risk Communication	p. 30
2.6 Risk Communication Evaluation	p. 33
2.7 Theoretical Background	p. 36
2.8 Purpose	p. 39

CHAPTER 3: METHODS

3.0 Research Design	p. 40
3.1 Data Sources	p. 41
3.2 Data Collection	p. 43
3.3 Data Analysis	p. 45
3.4 Readability	p. 49
3.5 Methodological Limitations	p. 49
3.6 Research Ethics	p. 50

CHAPTER 4: RESULTS

4.0 Simulated Search	p. 51
4.1 Purposive Search	p. 60
4.2 Evaluation of Webpages	p. 61
4.3 Simulated vs. Purposive Search	p. 76

CHAPTER 5: DISCUSSION

5.0 Discussion	p. 85
5.1 Necessity of Vaccine Risk Communication	p. 94

CHAPTER 6: CONCLUSION

6.0 Contributions of this Study	p. 101
6.1 Recommendations	p. 105
6.2 Limitations and Future Research	p.108

LIST OF TABLES AND FIGURES

Tables

Table 1. Tabulated Simulated Search Results	p. 52
Table 2. Simulated Search Results by Frequency	p. 54
Table 3. Flesch-Kincaid Grade Level Scores of Webpage Text	p. 68
Table 4. Summary of Visual Aids from Purposive and Simulated Search Results	p. 72
Table 5. Anti-immunization Webpages retrieved through Simulated Search	p. 77

Figures

Figure 1. Simulated Search Results by Website Category	p. 52
Figure 2. Types of Pro-Immunization Website retrieved through Simulated Search	p. 58
Figure 3. Anti and Neutral Webpage Results by Search Terms	p. 59
Figure 4. Anti and Neutral Webpage Results by Search Location	p. 60

LIST OF APPENDICES

Appendix A: Complete Simulated Search Results

Appendix B: Coding Scheme

Appendix C: Modified IPDAS Checklist

CHAPTER 1: INTRODUCTION

1.0 Introduction

Vaccine hesitancy is a growing public health issue, one that the majority of researchers working in the area of vaccines, and front-line providers in Canada find to be a significant issue. While causes of vaccine hesitancy have been well studied, effective and appropriate solutions to increase vaccine uptake among vaccine hesitant groups in Canada have yet to be established. Many parents are hesitant after encountering conflicting vaccine information. Vaccine hesitancy presents numerous communication challenges; emphasizing that poor communication can undermine vaccine acceptance in any setting. This chapter provides the context for the main argument: in order to promote informed consent, and to encourage parental confidence in vaccine-decision making, childhood immunization communication materials produced for public dissemination should follow highly informed risk communication best practice. Without regular evaluation of childhood immunization communication materials, it is difficult to develop evidence-informed communication interventions. Risk communication best practice empowers individual and collective management of risk. This particular case study will provide the evidence for innovative communication interventions and best practices that encourage informed consent, with consideration given to issues of parental confidence in decision making.

1.1 Vaccine Hesitancy

Recent outbreaks of vaccine-preventable diseases (VPDs) highlight the need for effective strategies to address vaccine hesitancy (VH). Vaccine hesitancy is a growing public health issue, becoming increasingly apparent in both developed and developing nations. Studies examining the determinants of vaccine decision-making have generated more than one definition for

vaccine hesitancy (Dubé et al. 2013). For example, Gust and colleagues categorized parental attitudes towards vaccination in decreasingly positive order: the ‘immunization advocates’, the ‘go alongs to get alongs’, the ‘health advocates’, the ‘fence-sitters’, and the ‘worrieds’ (Gust et al. 2005). However, Keane and colleagues define the ‘vaccine believer’ as parents who are accepting of the benefits of vaccination, the ‘cautious’ as parents who have emotional concerns regarding vaccination and have difficulty watching their child being vaccinated, the ‘relaxed’ as parents who are characterized by some skepticism about vaccines, and the ‘unconvinced’ as parents who do not believe in vaccination or vaccine policies (Keane et al. 2005). Lastly, Benin and collaborators found that participants of their study fell into one of four categories: the ‘accepters’ include those who agreed with or did not question vaccination, the ‘vaccine-hesitant’ are those who ultimately accepted vaccination but had significant fears about vaccinating their children, the ‘late vaccinators’ purposely delayed vaccinating, or chose to only accept some vaccines, and the ‘rejecters’ were composed of those who refused vaccination (Benin et al. 2006). In literature and policy reviews, vaccine hesitancy is most frequently defined as a combination of beliefs, attitudes, and behaviours that influence an individual’s decision to vaccinate, despite vaccine services being available. These behaviours range from refusal, delay, or reluctant acceptance of vaccines, despite having active concerns (Dubé et al. 2013; Kang et al. 2017). Strategies to address vaccine hesitancy have focused on individual causes of vaccine hesitancy to improve vaccine uptake.

While it is difficult to assess vaccine hesitancy at the population level, recent published literature states that in North America, Europe and other parts of the world, public confidence in vaccines is declining (Dubé, Vivion, and MacDonald 2015; Dubé et al. 2013). In the absence of a pan-Canadian immunization registry linked with validated and standardized measures of vaccine

hesitancy, it is difficult to assess levels of vaccine hesitancy in Canada, and its potential effect on vaccine uptake rates. However, recent studies conducted in both the United States and Canada have shown that religious or conscientious exemptions to vaccines have increased significantly in the past 15 years (Wilson et al. 2015; Richards et al. 2013; Safi et al. 2012; Omer et al. 2006). Vaccines have been shown to be one of the most successful and cost-effective ways to reduce the transmission of infectious disease and improve health outcomes; the Canadian Public Health Association lists Canada's vaccination programs as one of great achievements of the last 100 years, noting that these programs have likely "saved more lives in the last 50 years than any other health intervention" (Canadian Public Health Association 2010). Historically, Canada has benefitted from a relatively high rate of immunization against most vaccine-preventable diseases. However, recent years of inconsistent vaccine coverage constitute a significant and growing threat to public health and safety, to the successes achieved to date (in lives saved and systemic costs), and to current and future threats to life and health expenditures (Public Health Agency of Canada 2015).

It is well-established that not all Canadians get immunized. Vaccine hesitancy has been shown to be the cause of multiple recent outbreaks of vaccine-preventable diseases in both the United States and Canada (Centers for Disease Control and Prevention 2011; Young 2015; Siddiqui, Salmon, and Omer 2013; Zipprich et al. 2015). A 2014 UNICEF report, as well as the results from the 2013 Canadian immunization survey conducted by the Public Health Agency of Canada, both indicate that immunization rates for several routine childhood immunizations fall below targets set by federal, provincial and territorial (FPT) governments at the 2005 National Consensus Conference for Vaccine-Preventable Diseases in Canada (NCC-VPD). It is important to note that national immunization coverage surveys are rarely designed to accurately measure

clusters of un-immunized or under-immunized individuals at the community or regional level (Vaccine Acceptance and Uptake Task Group 2015). Therefore, measuring the prevalence of vaccine refusal, as well as identifying communities of high need for targeted interventions and/or resources remain a challenge.

A 2016 Canadian consultation study found that the majority of vaccine researchers, experts and policy-makers (immunization research network members) and front-line vaccine providers surveyed agree that vaccine hesitancy is a significant problem in Canada. This same study found that the majority of these stakeholders (66% of research network members and 78% of vaccine providers) agree that it is imperative to address this issue (Dubé, Gagnon, Bettinger, et al. 2016). Effective and appropriate solutions to address this hesitancy in Canada have yet to be established. Several reviews of strategies to address vaccine hesitancy and/ or increase vaccine uptake have found limited effectiveness (Dubé, Gagnon, and MacDonald 2015a; Kang et al. 2017).

The Vaccine Acceptance and Uptake Task Group (VAUTG), a sub-group of the Communicable and Infectious Disease Steering Committee (CIDSC) of the Pan-Canadian Public Health Network (PHN) has recommended that research focused on risk/benefit communications should be one of the avenues pursued to target vaccine hesitancy within Canada (Vaccine Acceptance and Uptake Task Group 2015). They suggest that future research should examine how the scientific/ public health community can effectively and efficiently communicate information to the general public and targeted/communities with sub-optimal uptake rates. In Canada, as with many other developed nations and international organizations, regional health authorities, government health departments and public health agencies produce a variety of childhood immunization informational materials (e.g. posters, FAQs, pamphlets, web pages) to

inform the public of key immunization information, and to encourage vaccine uptake. These communication materials are developed as an essential component of the larger processes of risk analysis and management. It is widely recognised that effective risk communication is crucial for limiting morbidity and mortality from vaccine-preventable disease, in addition to minimising the potential healthcare and economic burden of infectious disease outbreaks (Infanti et al. 2013).

Risk communication research clearly highlights the need to employ continuous evaluation throughout the process of risk communication product development and promotion (Infanti et al. 2013; Council of Canadian Academies 2015; Fischhoff 2012). Similar to other public health bureaus and regulatory agencies, Health Canada's Strategic Risk Communication Framework calls for regular evaluation of its communication process and its outcomes (Health Canada 2006). Despite the Government of Canada's recently strengthened commitment to openness and transparency, as governed by Health Canada's 2014 *Regulatory Transparency and Openness Framework*, Health Canada does not publish evaluations of their risk communication products. The framework refers to its three goals for risk communication, which are: i. making information easier to understand, ii. making more information available, and iii. making the decision-making process more open (Health Canada 2014).

It is unclear whether the current childhood immunization informational materials produced in Canada are regularly evaluated against risk communication good practice. If recent formal evaluation of these communication products has been conducted, the information is not publicly available. Without an evaluation of existing materials, it is difficult to develop evidence-informed communication interventions. While evaluation of communication products is integral to effective risk communication practice, vaccine hesitancy cannot solely be regarded as a symptom of ineffective communication efforts. Vaccine hesitancy presents numerous

communication challenges, emphasizing that poor communication can undermine vaccine acceptance in any setting. Although those who adamantly oppose vaccinations might be immune to public health influence, others who fall into the vaccine hesitant category are left with questions after encountering confusing vaccine information. Evidence informed risk communication efforts empower individual and collective management of risk. These efforts require new forms of dialogue to be developed between public health experts and the public, while aiming to build trust among vaccine hesitant parents and encourage vaccine uptake.

This thesis aims to use evidence informed tools and guidelines to provide a timely evaluation of existing communication materials to identify where, and how, these materials can be improved based on risk and benefit communications best practice. This project fills a critical gap in knowledge by applying the risk communication best practice framework to current online communication products. Additionally, this research uses previous literature regarding vaccine hesitancy to evaluate the materials with attention given to concerns raised by vaccine hesitant groups. Lastly, this project provides the evidence for innovative communication interventions and best practices that encourage informed decision making, with consideration given to issues of parental confidence in decision-making.

1.2 Research Objectives

The specific objectives of this research are as follows:

1. To identify what immunization information is retrieved when simulating a search undertaken by a typical parent, using computers with different IP addresses, in multiple locations.

2. To evaluate a sample of the content of the webpages retrieved in objective 1, against risk communication best practice.
3. To evaluate a sample of official public health agency webpages on childhood immunizations against risk communication best practice.
4. To compare and contrast the content retrieved between objectives 2 and 3 and assess potential implications for parental vaccine decision-making.

1.3 Chapter Synopsis

This thesis is structured in a way that seeks to address the main goal and research objectives.

This thesis is organized into the following chapters; (i) general introduction; (ii) background and review of the scientific literature; (iii) methods; (iv) results; (v) discussion, limitations and recommendations; (vi) conclusion. These are outlined in brief below.

Chapter Two: Chapter two provides an in-depth discussion of the relevant background and theoretical models (Health Belief Model, Risk Information Seeking Process Model) related to this research. This includes the recognition of immunizations as an incredible public health achievement, while also discussing vaccine coverage in Canada. Vaccine hesitancy refers to a range of behaviours from refusal, to delay, to reluctant acceptance of vaccines despite immunization services being available. The second focus of chapter two is to describe the influence of the internet on vaccine information dissemination. Proper communication is an essential tool to reduce morbidity and mortality from infectious disease, as well as health care and economic burden due to infectious disease breakouts. The final section of this chapter provides the context for this thesis, and includes an overview of the significance and strategies for risk communication product evaluation. Lastly, this chapter recognizes the influence of

Health Belief Model on vaccine-preventable disease, as well as the significance of the Risk Information Seeking and Processing model on parental vaccine decision-making.

Chapter Three: This chapter presents the design, methods and analysis used to conduct this research. This case study uses publicly available childhood immunization informational webpages, retrieved through a simulated Google search, as well as a purposive search of three Canadian health agency websites. These webpages were imported into NVivo 10 qualitative analysis software using the NCapture function. Textual content analysis of the data was guided by “*Communicating Risks and Benefits: An Evidence-Based User’s Guide*”, written by Fischhoff and colleagues, as well as items from the International Patient Decision Aid Standards (IPDAS) checklist, while new codes emerged from the data itself.

Chapter Four: This chapter presents the results from this research. The results from the simulated search are presented first, by search term and by location. This is followed by a more nuanced analysis of the webpages retrieved during the simulated and purposive searches, as they compare to evidence informed risk communication best practice. From this search, it was found that pro-immunization webpages, anti-immunization webpages and webpages that were neutral towards immunization were all retrieved using common vaccine related search terms. Overall, the pro-immunization webpages retrieved during the purposive search follow a greater number of good risk communication strategies, than the pro-immunization pages retrieved during the simulated search. Moreover, anti-immunization webpages use several persuasive communication strategies that are not found on pro-immunization webpages. These include using personal

stories, referencing scientific studies and researchers, and employing an alarmist tone when discussing vaccine risks and ingredients.

Chapter Five: This chapter situates the results found in this research into a broader context, comparing them with results from other studies, as well as risk communication guidelines. The chapter also directly addresses the objectives of this research. The first objective was to identify what immunization information is retrieved when simulating a search undertaken by a typical parent, using four different computers with different IP addresses. From the results of our simulated search it can be concluded that both the location of the search (i.e. the computer used) as well as the choice of key words greatly influence the results. The second and third objectives of this study were to evaluate the content of the webpages retrieved in objective 1, as well as webpages retrieved through a purposive search of three Canadian health organizations' websites, respectively, against risk communication best practice. This study found that while many of the examined webpages excel at providing crucial vaccine information, addressing vaccine myths and parental concerns, and recognizing the significance of the vaccine decision making process, there remain many outstanding opportunities for improved communication and engagement with target populations. The fourth objective of this thesis was to compare and contrast the content retrieved between objectives 2 and 3 and assess potential implications for parental vaccine decision-making. Recommended risk communication strategies brought forward by this research include: communicating honestly about risk; asking readers what outcomes matter most to them; providing quantitative baseline and risk information; utilizing visual aids; providing authors' qualifications and references to scientific knowledge; including an interactive component; and pre-testing communications with target groups for reading levels and message effectiveness. This

project also supports the importance of continuing to assess the reasons why parents choose to delay or refuse childhood vaccines, in order to design appropriate, timely communication interventions.

Chapter Six: This research provides notable contributions to the literature. The purpose of this case study is to evaluate publicly available childhood immunization informational webpages against risk communication best practice. To our knowledge, this is the first evaluation to gather evidence of risk communication strategies used by sources that are commonly found using vaccine related search terms, within a Canadian location. This study summarizes the strengths and weaknesses of routine childhood immunization webpages during a simulated vaccine search, as well as a purposive search of three Canadian health organizations' websites. Overall, it can be determined that a number of improvements to these communication products can be made. This includes communicating honestly about risk; asking readers what outcomes matter most to them; providing quantitative baseline and risk information; utilizing visual aids; providing authors' qualifications and references to scientific knowledge; including an interactive component; and pre-testing communications with target groups for reading levels and message effectiveness. Lastly, this thesis provides the evidence for targeted vaccine communication strategies, with particular attention given to issues related to parental confidence in vaccine decision-making.

CHAPTER 2: LITERATURE REVIEW

2.0 Background and Relevant Literature

This chapter presents the necessary background information, and provides a review of current scientific knowledge relevant to this study. The goal of this chapter is to provide sufficient information to help understand the context of the thesis. Chapter two provides an overview of immunization coverage in Canada, as well as the current challenges and limitations to gathering national data. The concept of vaccine hesitancy is also discussed, in relation to its causes and definitions used in literature and health policy. Risk communication is an essential tool to reduce morbidity and mortality from infectious disease, as well as health care and economic burden due to infectious disease breakouts. This chapter describes risk communication as a science, in addition to identifying why evaluation of risk communication products is necessary. The influence of the internet on health information dissemination, particularly, immunization information, is also discussed. Lastly, this chapter provides the theoretical foundations for this study. It recognizes the influence of health belief model on vaccine-preventable disease, as well as the significance of the risk information seeking and processing model on parental vaccine decision-making.

2.1 Immunizations in Canada

Immunizations are regarded worldwide as one of the most effective health strategies for population disease prevention. Immunizations are responsible for the elimination of smallpox and the containment or control of infectious diseases once common in Canada (e.g., rubella, diphtheria, measles, and polio). Numerous independent studies, as well as several internationally

recognized health agencies such as the World Health Organization, Centers for Disease Control and Prevention, and the Public Health Agency of Canada, among others, have concluded that vaccines drastically improve child health outcomes, have an incredible safety record, produce relatively minor side effects, and are far safer than therapeutic medicines (Global Advisory Committee on Vaccine Safety 2003; Zhou W et al. 2003; Greenberg, Dubé, and Driedger 2017; Maglione et al. 2014). Vaccine-preventable diseases are still present in some pockets of Canada, and the world, necessitating continued high levels of vaccine coverage in the population. For the past few decades, as various routine childhood immunizations have been introduced there have been dramatic reductions in overall diagnosis, hospitalizations and death from infectious disease, especially among children (Dubé et al. 2013). Immunizations protect individuals in all stages of life, whether directly or indirectly through herd immunity. Vaccination programs rely upon a high uptake level to achieve herd immunity, which in turn protects all of those in a community who are not immune; including infants too young to be immunized, people who cannot be immunized for medical reasons, and people who may not respond adequately to immunization (e.g., the elderly) (Dubé et al. 2013; Dubé, Gagnon, Bettinger, et al. 2016; Fine 2011).

Over the past two decades, vaccination rates have been declining, for reasons that are partially attributable to vaccine hesitancy (Dubé et al. 2013; Ropeik 2013; Cooper, Larson, and Katz 2008). In 2005, many of Canada's scientific, public health and medical communities came together at a National Consensus Conference to establish disease reduction goals and immunization coverage targets for six vaccine-preventable diseases (VPDs): rubella, varicella, invasive pneumococcal disease (IPD), invasive meningococcal disease (IMD), influenza, and pertussis ((NCC-VPD) 2005). In 2013, a UNICEF report concluded that only 84% of Canadian children between the ages of 12 and 23 months had the appropriate number of doses for the

measles vaccine, polio vaccine and the DPT3 –three-dose diphtheria, pertussis and tetanus vaccine (UNICEF Office of Research 2011). In Manitoba, 2014 data (most recent year of data available) show that only 65.5% of children two years of age received the necessary number of doses of vaccine required to be considered complete for age (Government of Manitoba 2015). The most recent Public Health Agency of Canada immunization coverage survey indicates that rates of childhood immunization for a number of vaccines continue to fall below these previously set targets (Public Health Agency of Canada 2015). Moreover, a recent Ontario study looked at over a decade of data on trends in medical and nonmedical immunization exemptions to measles-containing vaccines. This study found that while the overall percentage of students with any exemption classification remained relatively low between 2002/03 and 2012/13 (<2.5%), religious or conscientious exemptions significantly increased during the study period. Additionally, medical exemptions significantly decreased for both 7- and 17-year-old students (Wilson et al. 2015). Furthermore, several published studies from the United States have found evidence of similar increasing trends in nonmedical exceptions (Richards et al. 2013; Safi et al. 2012; Omer et al. 2006).

Herd immunity to many VPDs has taken massive investments over many generations to achieve – the loss of which threatens the cumulative value of all those efforts. Declining rates of childhood vaccination, notably in communities where un-vaccinated people are clustered, have led to major outbreaks of pertussis and measles in the U.S. and Canada, both of which started in under-vaccinated religious communities before spreading to the general population (BC Centre for Disease Control 2014; Deeks et al. 2014). In 2011, measles cases in the United States reached a 15-year high with at least 89% of cases occurring among non-vaccinators or those with an unknown vaccination status (Centers for Disease Control and Prevention 2011). That same year

Quebec experienced the largest measles outbreak in all the Americas since 2002 with over 750 cases. More recently, the United States and Canada experienced multiple measles outbreaks during the winter of 2015, and in the fall of 2015 Canada experienced pertussis outbreaks across several provinces, including forty-four cases in southern Manitoba (Young 2015; Siddiqui, Salmon, and Omer 2013; Zipprich et al. 2015). These outbreaks have not only resulted in numerous preventable deaths of children, but also in vast health expenditures on tracking cases, quarantining, and treatment (Ropeik 2013).

In an attempt to gather a national perspective, Canada's only estimation of immunization uptake (coverage) is through the childhood National Immunization Coverage Survey (cNICS) and the adult National Immunization Coverage Survey (aNICS) (Public Health Agency of Canada 2015). Starting in the early 2000s, these surveys are conducted every two years by the Public Health Agency of Canada. However, these national surveys present their own set of challenges. The NICS have significant methodological limitations, including: small sample size; low response rate; absence/under-reporting of special populations (e.g. First Nations people living on reserves, individuals whose first language is neither English nor French); frequent methodological changes that make multi-year comparisons of coverage challenging; and the potential inaccuracy of self/parent reporting. The surveys have also proven problematic by the significant delay and/or absence of published results (Vaccine Acceptance and Uptake Task Group 2015).

2.2 Immunization Coverage: Current State of Knowledge

The results of the most recent cNICS (2013) emphasize some of its challenges. The national survey results differ from some provincial coverage reports, which may be a result of

inconsistent data collection methods. These discrepancies raise questions of the validity and accuracy of the information provided by cNICS (Vaccine Acceptance and Uptake Task Group 2015). Most importantly, national and provincial/territorial coverage surveys are rarely designed to accurately measure clusters of un-immunized or under-immunized individuals at the community or regional level (Vaccine Acceptance and Uptake Task Group 2015). The information is therefore of limited utility in identifying areas of high need of targeted interventions and/or resources. It has been suggested that more detailed surveys that incorporate “knowledge, attitude and belief” (KAB) questions are needed to better understand immunization coverage trends in order to better design policy changes that address vaccine uptake. The standard NICS fail to answer whether lower reported uptake in one region versus another region reflect differences in financial or logistical access to vaccines, differences in vaccine schedules, or whether it is caused by ineffective or uneven outreach and promotion.

Another potential concern is that because data are collected differently, the surveys do not reflect real differences in vaccine coverage. For example, data collection for cNICS is based on immunization records held by parents. ((NCC-VPD) 2005). However, Canada does not have a national immunization registry, nor are there complete provincial and territorial records; immunization estimates are built using information from several sources. At present, only seven out of the thirteen provinces and territories have centralized computer immunization registries (Vaccine Acceptance and Uptake Task Group 2015). Manitoba introduced its monitoring system, the Manitoba Immunization Monitoring System (MIMS), in 1988, making it the first province in Canada with such a registry. MIMS is a population-based, province wide, electronic immunization registry that has been recording immunizations administered to Manitoban children since 1988 (Government of Manitoba 2015). In 2000, the registry expanded to include

adult immunizations. In addition to monitoring immunizations for policy and planning purposes, MIMS provides reminders to those who are not up-to-date on their immunizations, according to their age and the recommended immunization schedule. These reminders aim to achieve, and maintain, high levels of immunization across the province. It is important to note, that there is known under-reporting of routine infant immunizations among First Nations/Indigenous populations within MIMS.

Other provinces with centralized, computer registries face similar limitations: many jurisdictions do not record adult or First Nations population data; do not record how many people choose to not get vaccinated; are not yet interoperable within jurisdictions (e.g. they do not seamlessly collect and store data from private and public immunization providers); and cannot transfer data between provinces. Therefore, it is difficult to assess whether the unmet targets for routine childhood immunizations are caused by vaccine hesitancy, can be attributed to differing immunization schedules between provinces/territories, potentially causing confusion for parents that move between jurisdictions, or are a result of inadequate measurement tools. Discrepancies between national and provincial reports could be measures of actual difference or simply measures of how consistently information is recorded by parents (Vaccine Acceptance and Uptake Task Group 2015). Regardless, gaps exist with respect to our knowledge about vaccine coverage and in our understanding of what motivates people to get (or not) vaccinated, both broadly and in relation to specific vaccines.

2.3 Vaccine Hesitancy

Vaccine hesitancy has been identified by the World Health Organization as a growing problem.

Vaccine hesitancy refers to a combination of beliefs, attitudes, and behaviours that influence an

individual's decision to vaccinate, despite the availability of vaccination services. These behaviours range from refusal, delay, or reluctant acceptance despite having active concerns. (Dubé et al. 2013). According to the World Health Organization Vaccine Hesitancy Strategic Advisory Group of Experts (SAGE), vaccine hesitancy (VH) is defined as a behaviour, influenced by a number of factors including: issues of confidence (do not trust vaccine or provider), complacency (do not perceive a need for a vaccine, do not value the vaccine), and convenience (access) (World Health Organization 2013).

They further define vaccination confidence as the trust in the effectiveness and safety of vaccines, and in vaccine providers, including the reliability and competence of health professionals, in addition to trusting the incentives of the health policy-makers and health-care professionals who decide which and when vaccinations are needed. Vaccine complacency exists where the perceived risks of vaccine-preventable diseases are low and an individual decides vaccination is not a necessary precaution (World Health Organization 2013). Complacency about vaccines or one particular vaccine can be influenced by under-appreciation of the value of a vaccine (effectiveness and/or safety) or lack of knowledge. The quality of the service (real and/or perceived) and the time/ place in which vaccine services are delivered - whether they are considered convenient, comfortable and affordable - also affects the decision to vaccinate (World Health Organization 2013). Lastly, vaccination convenience and complacency can be influenced by the priority that individuals place on vaccination. In addition to these definitions, the terms vaccine uptake and acceptance are used to describe vaccine coverage in a certain community. Vaccine acceptance (2015, p. 7) is defined as “an individual's overall attitude towards vaccination- whether they fully embrace the belief that all (or certain) vaccines are safe, prudent and effective, are ambivalent towards vaccines with no strong beliefs one way or the other; or are

non-acceptant to the concept of vaccination” (Vaccine Acceptance and Uptake Task Group 2015). Vaccine uptake directly refers to the goal of achieving desired vaccination coverage levels.

Canada is not alone among developed countries in its efforts to better understand the state of vaccine acceptance and uptake. There have been several literature reviews published in Canada, the United States and the United Kingdom, as well as recent expert research on vaccine hesitancy conducted by the World Health Organization’s SAGE, that underscore the complexity and subtlety of factors associated with vaccine uptake and acceptance (Brown et al. 2010; Favin et al. 2012; Dubé et al. 2013; Yaqub et al. 2014; Dubé, Gagnon, and MacDonald 2015b). Among these reviews, several prominent determinants of vaccine refusal have been brought forward. These include social pressures, such as the influence of communication and media, the role of historical and political factors, distrust of the pharmaceutical industry, and religious values (Yaqub et al. 2014; Vaccine Acceptance and Uptake Task Group 2015). Second, vaccine decision making takes place within the broader socio-cultural context. For instance, organizational determinants, such as the accessibility and quality of available immunization services may influence the vaccine decision making process, in addition to competing priorities such as past experiences with health services, family histories, and other day-to-day parental concerns (Dubé et al. 2013). Third, individual influences such as parental knowledge of vaccines/vaccine-preventable illness, attitudes about the health system, trust in providers, beliefs about the potential risks/benefits of vaccines, and role of family and friends’ experiences are all commonly cited factors (Brown et al. 2010; Favin et al. 2012; Dubé et al. 2013; Yaqub et al. 2014; Dubé, Vivion, and MacDonald 2015). Fourth, research exploring the factors that influence parental vaccine decision making process highlight parental desires to receive clear,

comprehensive and balanced information surrounding the risks *and* benefits of vaccines (Gullion, Henry, and Gullion 2008; Glanz et al. 2013). Uncertainty in which source of information to trust has had notable influence on parental decisions to vaccinate their children. Lastly, several studies have shown that even parents of fully vaccinated children have expressed indecision and lack of confidence in their knowledge surrounding immunizations (Hilton, Petticrew, and Hunt 2006; Cooper, Larson, and Katz 2008; Kennedy et al. 2011; Ruijs et al. 2012). It is evident that the accessibility and reliability of communication materials, as one source of information, are critically important to parents, and subsequently, should be considered when designing interventions to address vaccine hesitancy.

While the proportion of Canadian parents who hold strong anti-vaccination beliefs, and adamantly refuse to vaccinate their children is relatively small (less than 3%), an increasing number of individuals hold wavering beliefs, and display behaviours that are characterized as ‘vaccine hesitant’ (Dubé, Gagnon, Bettinger, et al. 2016). The specific combination of factors that influence an individual’s vaccine decision-making process are subject to variation. Whereas some refuse certain vaccines because they are doubtful of the benefits, safety and effectiveness of vaccines (i.e. low uptake/low acceptance), others may acknowledge the benefits of childhood vaccines, but will refuse some or all vaccines because they fear pain or needles, or are convinced that children receive too many vaccines all at once (i.e. low or moderate uptake/moderate acceptance). Others may believe in the value of getting immunized but still may decline vaccines for religious, philosophical or medical reasons or, face logistical and accessibility barriers to vaccines (i.e. low uptake/high acceptance) (Vaccine Acceptance and Uptake Task Group 2015). Lastly, some vaccine hesitant parents may ultimately consent to vaccinations for their children, but remain worried about the risks of this decision.

A 2016 Canadian consultation study found that 57% of vaccine researchers, experts and policy-makers (immunization research network members) and 75% of the front-line vaccine providers surveyed agree that vaccine hesitancy is a significant problem in Canada. This same study found that 76% of research networks members and 87% of vaccine providers agree that vaccine hesitancy is contributing to sub-optimal vaccination coverage rates in Canada. The majority of these stakeholders (66% of research network members and 78% of vaccine providers) agree that it is imperative to address this issue (Dubé, Gagnon, Bettinger, et al. 2016). Effective and appropriate solutions to address this hesitancy in Canada have yet to be established. Several reviews of strategies to address vaccine hesitancy and/ or increase vaccine uptake have found limited effectiveness (Dubé, Gagnon, and MacDonald 2015a; Kang et al. 2017). The Vaccine Acceptance and Uptake Task Group recommends that strategies to address vaccine hesitancy should therefore be comprehensive, tailored to the target population, based in well researched and well-supported attitude and behaviour change theoretical models, pre-emptive rather than responsive or reactive, and lastly, include systematic evaluation.

2.4 Dissemination of Vaccine Information

The widespread utilization of the internet, beginning in the early 2000s, has provided a convenient and widely accessible platform for health information dissemination. However, the internet has also provided an unprecedented opportunity for anti-vaccination groups to spread myths and misinformation about immunizations to a world-wide audience (Hobson-West 2007; Kitta 2012; Mishali and Avrech 2015; Kang et al. 2017). The internet is one of the main sources of information on immunizations used by parents (Stefanoff et al. 2010; Ekos Research Associates Inc. 2011; Greenberg, Dubé, and Driedger 2017). Yearly internet usage statistics

show that in 2016 approximately 87% of Americans and 93% of Canadians utilized the internet (Stats 2016). Current literature indicates that an estimated 75–80% of internet users have searched for health information online within the past year (Kata 2012; Fox and Duggan 2013), with 70% saying that information they encounter online influences their treatment decisions (Kata 2010). As demonstrated by a recent survey of Canadian parents, the majority of respondents (57%) use online news and information sources as their primary source for health news and information (Greenberg, Dubé, and Driedger 2017).

With the burgeoning trend of user-generated web pages, such as personal social media pages, online news forums, and blogs, individuals are turning to these websites for their health information, rather than evidence based health information pages (Chou et al. 2009; Lau et al. 2011; Kata 2012; Witteman and Zikmund-Fisher 2012). These personal webpages allow for any, and all opinions to spread widely and instantaneously, without being questioned or reviewed; a fact to which the anti-vaccination advocates have taken full advantage. Diffusion of negative, false and misinformation about vaccination online and in social media was perceived to be the primary cause of vaccine hesitancy by Canadian vaccine researchers, experts and front-line vaccine providers (Dubé, Gagnon, Bettinger, et al. 2016).

Searching online for immunization information becomes even more problematic with the automatic ‘personalization’ of search results, also referred to as the ‘filter bubble effect’ (Driedger and Garvin 2016; Wiley et al. 2017). Search engines use algorithms to track various signals, such as the computer being used (i.e. the IP address), past search history, and internet activity, to shape the results of the search (Pariser 2011). This personalization narrows the user's search results even further, as Neeley (2014, p. 154) writes “[s]ince the rise of social media one key concern has been whether online communities are insular ‘echo chambers’ that only

aggregate similar-minded people, but also then proceed to harden those views and make them even more extreme” (Neeley 2014) . Anti-vaccination messages are more common on the Internet than in other forms of media, increasing the likelihood that those who solely search for information online may base their decisions on false information (Davies, Chapman, and Leask 2002). Even those who are not searching for anti-vaccination information can be overwhelmed with the amount of information available, leaving them uncertain in which sources to trust. When coupled with the fact that most health information products are written at a reading level much higher than the recommended levels for public dissemination (Rudd et al. 2007; Davis et al. 1998; Neuhauser, Rothschild, and Rodriguez 2007; Murphy 1994), it is little wonder the communication environment is confusing for parents.

In-depth interviews with parents who had immunized their children revealed that even they felt conflicted by the online debates, leading them to second-guess their choices (Downs, de Bruin, and Fischhoff 2008). When asked where they would seek out further information, 70% of parents said they would look online, and when explicitly asked whether they would use the Internet, 93% responded ‘yes’. Close to all parents (93%) said they would use a common search engine, and easily produced search terms (e.g. vaccination, MMR vaccine) – and found that when entered into search engines, these terms returned anti-vaccination websites in the first page of results. Readers with lower skills in navigating and evaluating online health information may misinterpret health behaviour recommendations or inaccurately evaluate the quality of health information resources (Benotsch, Kalichman, and Weinhardt 2004). Moreover, difficulties locating and understanding online health information may negatively influence readers’ perceived trust in, and access to, potentially valuable online health information resources (Thiede 2005; Ye 2011). Wilson and colleagues (Wilson et al. 2008) found that compared to those

parents who fully vaccinated their children, parents struggling with vaccination decisions were more likely to rely upon a wider variety of sources beyond the Internet, such as peers in their social groups, and had difficulty judging source credibility overall. Only parents of fully vaccinated children trusted the recommendations made by their physicians, or health authority; others were distrustful and felt the information provided to them from their physician was one-sided, and did not adequately address all their concerns (Wilson et al. 2008).

2.5 Risk Communication

Communicating about a health risk involves the analysis of a potential threat, understanding what is important to the population receiving the information (otherwise known as stakeholders), and circulating the message in a clear and appropriate manner (Fischhoff 2012). Risk communication is used as a method to effectively communicate in situations of concern, and follows informed principles and strategies to guide the process (Lundgren and McMakin 2004). Research has shown that communication is the most powerful influence on individual risk decision-making and behaviour (Health Canada 2006). Although not always carried out this way, risk communication is an interactive process between invested parties, and is vital to risk management and decision making. This not only includes discussion of the real or potential risks, but must also include information on the benefits that a risk decision can have (Council of Canadian Academies 2015). Intrinsic to the understanding of risk, and the practice of effective risk communication, is an awareness that risk is defined by both subjective and objective qualities, and that risk decisions are subject to social, cultural, and psychological influences (Slovic 1999). Although generally carried out from formal institution to an

individual/population, risk communication is in fact a process of reciprocal relationships that involve multiple stakeholders, and interactions at many points in time (Bunting et al. 2007).

The science of risk communication has continued to evolve over the past forty years. Central to effective communication is the trust in message source (Leiss 1996). Health institutions and regulatory agencies rely upon evidence based risk communication strategies to help establish this trust and to fulfill their mission. Typically, these strategies are developed with the goal of exchanging information to improve and/or maintain the public's health and wellbeing (enHealth Council 2002; Health Canada 2006; Food and Drug Administration 2009; European Medicines Agency 2010; Medicines and Healthcare Products Regulatory Agency 2010). For instance, the Health Canada Strategic Risk Communication Framework states that "risk communication decisions are evidence based, tapping both natural and social sciences [...] decisions must also incorporate stakeholder understanding of a situation, recognizing that stakeholders' understanding on risk issues includes both how they feel about risks (experiential perspective) and what they think about them (analytical perspective)" (Health Canada 2006). During the 1970s and 1980s, risk communication emphasized the scientific approach to measuring risk (Leiss 1996), and promoted risk decision making at a very exact level of detail. However, partly as a result of the 'arrogance of technical expertise' combined with gaps in knowledge, and ever changing scientific knowledge, there existed a public distrust of experts and the institutions they represent (Leiss 1996). To overcome this distrust, risk communication shifted to using persuasive techniques within risk messaging (Leiss 1996).

This approach drew its strength from long standing, well studied marketing techniques which were found to be highly successful. These techniques are identified for enhancing trust in

message source, as well as credibility for the process. Leiss (1996, p. 90) emphasizes this responsibility by writing:

There is an obligation on the part of major institutional actors in society to communicate effectively about risks, not by simply touting the superiority of their own technical risk assessment, but, rather by making an honest effort to understand the bases of public risk perceptions and by experimenting with ways of constructing a reasoned dialogue around different stakeholder assessment of risk situations (Leiss 1996).

While effective risk communication empowers readers to make informed choices, including informed refusal, risk communication products are often used to influence a desired change in behaviour. Risk communication must be accessible to the target population(s), must contain meaningful information, and must include strategies the target populations can reasonably carry out. Moreover, readers must believe that this change in behaviour will successfully help them avoid harm (Council of Canadian Academies 2015). Evaluation of risk communication messages is critical to assess whether these targets are being met. Measurable outcomes of risk communication include *reach* (how the information is sent, and who receives it), *use* (how the information is understood by the target receivers and what action is taken), and *impact* (what effect the information has at present and in the future) (Council of Canadian Academies 2015). In addition to these ideal outcomes, the goals of establishing trust, creating empowerment, promoting engagement, and committing to transparency have become integral in the practice of risk communication (Fukuyama 2000; Siegrist and Cvetkovich 2000; Kasperson et al. 2003; Council of Canadian Academies 2015). In order to achieve these goals, messages should contain easy to understand, actionable strategies of what people can do to protect themselves (Wray et al. 2008), be consistent in terms of content/tone, establish credibility of the communicator (Slovic 1986; Jungermann, Pfister, and Fischer 1996), and ensure recipients are familiar with the information source to increase message efficacy (Bottorff et al. 1998; Sorensen 2000; Tierney

2000). However, research suggests that the issue of trust is dependent upon each risk situation, and that situational factors such as risk perception, new information, social trust, message construction, information specificity, hazard potential, and prior trust attitudes are all liable to influence whether trust is enduring or vulnerable (Cvetkovich et al. 2002; Poortinga and Pidgeon 2003, 2004; White and Eiser 2005; White et al. 2003; Johnson 2005; Shitka and Mullen 2002; Frewer et al. 1996).

2.6 Risk Communication Evaluation

In order to ascertain whether risk communication goals are being achieved, and/or whether the communication is effective, formal evaluation is required. For instance, the Health Canada Risk Communication Framework mandates that risk communication processes require continuous improvement through evaluation (Health Canada 2006). This Framework calls for clear, measurable objectives. The Framework states:

Formal evaluation of the Strategic Risk Communications Process and its outcomes enables continuous improvement of risk management, promoting excellence over time as well as efficient and cost-effective procedures. Regular evaluation of both will ensure that Strategic Risk Communications remains state-of-the-science in Health Canada (Health Canada 2006).

Additionally, the Council of Canadian Academies (2015, p. 7) writes that:

Proper evaluation is integral to risk communication activities and can aid in fulfilling regulatory and fiduciary obligations, demonstrating a commitment to transparency and accountability, and attaining an understanding of the strengths and weaknesses of risk communication efforts (Council of Canadian Academies 2015).

Formal evaluation of risk communication products is imperative for assessing whether the intended purpose has been met, improving upon material content, and gauging strategies for dissemination. Knowledge gained from evaluation of communication products is necessary for

creating effective communication tools, allowing communicators to learn from, and improve upon new and existing communication efforts.

Knowledge gained through evaluation is also critical for establishing trusting relationships with stakeholders, identifying who is paying attention, what they are learning, and what effects have taken place across a range of populations (Kasperson and Palmlund 1989; Council of Canadian Academies 2015). It is important to recognize the divide that can exist between scientific assessment and the general public's assessment of risk; risk perception research has shown that non-scientific populations tend to place greater value on factors such as a risk's voluntariness, controllability, catastrophic potential, scientific understanding, effects on future generations and dread (Slovic 1999, 2000, 1987). This indicates that public risk perception appears to be multidimensional, and much more context specific than formal measurement of risk. Failure to follow through with proper evaluation can not only lead to negative or unintended outcomes, but opportunities to maximize resources, inform the behaviour of stakeholders, and to assess effectiveness of messages can be missed (Council of Canadian Academies 2015). Among other activities, the use of standardized communication appraisal tools and checklists, such as the "*Communicating Risks and Benefits: An Evidence-Based User's Guide*", written by Fischhoff and colleagues, which include evidence-informed communication practices can be used for end-product evaluation (Fischhoff 2012).

This evidence based users guide provides recommended strategies for risk communication best practice, which can be used for product evaluation. These criteria include items such as strategies for improving communication of numerical information. While risks and benefits of intervention options can be described either qualitatively (e.g. saying there is a low likelihood of a side effect) or quantitatively (e.g. saying there is a 1/100 (or 1%) chance of

developing a side effect), these two approaches are not equally effective. Another recommended strategy is to use visual aids to present numerical information (e.g. in graph form), as well as to help lower literate readers process and aid in memory retention (Collaboration IPDAS 2005; Lipkus 2007). Graphs can also be used to influence patient behaviour. For example, graphs that emphasize the numerator of a risk lead to an increase in risk-avoidant behaviours. Conversely, pictographs, which display numerator and denominator information, decrease risk-avoidant behaviours (Waters, Weinstein, and Emmons 2006).

Risk communication best practice also suggests using audio visual information to enhance reader comprehension. One study found that subjects who listened to medical instructions accompanied by a pictograph remembered 85% of what they heard, in contrast to only 14% for participants who did not receive a visual aid (Houts et al. 2006). Wolf and colleagues found that those with lower literacy benefited the most from the addition of visual icons on labelling (Wolf et al. 2010). However, as described by Webb and colleagues, visual aids can be developed for individuals across all literacy levels, so long as the picture or symbol matches mental images held by the intended viewer (Webb et al. 2008). Therefore, similar to most communication interventions, the target audience should be included in the development and evaluation of visual aids. Additional strategies include identifying the main factors determining the risks and benefits of a choice, along with the relationships among them; providing risk and benefit information about taking an action, as well as not taking an action; and using best practice to reduce health literacy disparities. It is well documented that most health information, particularly risk communication materials, greatly exceeds the reading comprehension of the average adult (Fischhoff 2012; Mirsky et al. 2016; Helitzer et al. 2009). It is recommended that documents intended for the general public should not exceed the 7th or 8th

grade reading level (Fischhoff 2012). Risk communication best practice suggests that health risk information should be written at an even lower reading level (grades 4-6). Reading levels can be assessed by applying one of the several standardized readability tests.

2.7 Theoretical Framework

The Health Belief Model

Established in the 1950s, the Health Belief Model (HBM) stems from the theory that while demographic and socio-economic characteristics prove difficult to change, other individual characteristics associated with health-related behaviour could be modified through health education (Rosenstock 1974). Providing the connection between socialization and behaviour, beliefs are individual characteristics that shape behaviour and can be acquired through primary socialization. While not all individuals from the same background share the same beliefs, beliefs are unique in their aspect to be modifiable through engagement. Persuasive interventions used to change behaviour-related beliefs resulting in behaviour change provide the theoretical and practical basis for evidence-based health education (Sheeran and Abraham 1996).

The HBM has previously been used in studies on vaccination, sexually transmitted infections, and infectious disease, among other health topics (Grandahl et al. 2016; Gottvall et al. 2010; Juraskova et al. 2011; Donadiki EM et al. 2014). The HBM relates a person's health behaviour to the individual's perceived susceptibility to the problem, perceived severity of the consequences of the problem, perceived benefits of the preventative behaviour, and perceived barriers to action. The likelihood that a person will act to avoid a threat is related to their threat perception (perceived susceptibility to illness or health problem, and anticipated severity), and

secondly, behaviour evaluation (the benefits of the recommended health behaviour, and the anticipated costs or barriers to acting on the recommendation). The HBM is limited by its disregard for emotional or relational aspects involved in decisions regarding health behaviour (Champion and Skinner 2008). While vaccine hesitancy is not only defined by the act of refusing or delaying vaccination for yourself or your children, it is widely recognized to include the beliefs, perceptions, attitudes and knowledge leading to these actions. Interventions used to address VH that recognize how attitudes and beliefs play an important role in influencing behaviour, provide evidence for aspects that could be addressed by public health interventions (Dubé, Vivion, and MacDonald 2015). For example, people who are identified as concerned, or ‘on the fence’ in their attitudes and beliefs are a target group for public health interventions, as this group has been shown to be more open to public health advice than those who adamantly refuse (Rodriguez 2016).

The Risk Information Seeking and Processing Model

The Risk Information Seeking and Processing Model (RISP) was proposed as a way to explain the variance in individual information seeking and processing, specifically in the context of risk (Griffin, Dunwoody, and Neuwirth 1999). This model draws significantly from the model of heuristic-systematic processing, in addition to concepts of literature on risk (Chaiken 1980). This includes the concepts of perceived hazard characteristics and affective response to risk, mass communication (i.e. the concepts of relevant channel beliefs and information seeking behaviours), and behavioural prediction. Behavioural prediction has been explained via the theory of planned behaviour – recognizing subjective norms and information gathering capacity

which is akin to perceived behavioural control. The RISP model relies upon information insufficiency as a decision point for risk information seeking and processing actions (Kahlor 2010). Also influenced by most of the earlier mentioned concepts, information insufficiency is the perceived need for additional information. This occurs when perceived current knowledge does not equate knowledge needed to deal adequately with the risk, or when the available information is not sufficient to confidently make decisions about the risk. The Risk Information Seeking and Processing Model is well supported by literature (Griffin, Dunwoody, and Neuwirth 1999; Griffin et al. 2004; Kahlor 2007; Trumbo 2002; Kahlor 2010).

The RISP model has been applied to both environmental and health risks. Moore (Moore 2002) argues that individuals seldom seek information for information's sake, but need it as a means for meeting different objectives. These include making life choices, improving their well-being or to support their role as members of society. Health risk literature supports the notion that people will actively seek risk information when they are obligated to make important decision (i.e., when the subject becomes important in that person's life). This may include an active search for further information based on the passive receipt of information, for instance reading a newspaper headline of interest, interacting with others in your social network, or conversation with a healthcare provider. This passive receipt of information may greatly influence how and where one searches for further information, and what type of information they retrieve.

The basis of this thesis greatly relies upon the principle of the RISP model. Parents and caregivers are responsible for making decisions regarding their child's vaccination status, and often seek further information prior to having to make this decision. Given the significance of the

vaccine decision-making process, this thesis draws from concepts of the risk information seeking and processing model to support its discussion.

2.8 Purpose

Based on the information gathered in the literature review, it is apparent that while risk communication best practice is well defined, there is no publicly available evidence to show that these guidelines have been used to inform current childhood immunization communication products. This research aims to evaluate existing communication materials to identify where, and how, these materials could be improved based on risk and benefit communications best practice. This evaluation includes an examination of a sample of webpage results using a common search strategy related to childhood immunizations, in addition to purposely seeking out a sample of official Canadian health agency webpages for evaluation. Equitable access to health information is a priority in the Canada, and it is well established that greater health information accessibility enhances health-related knowledge (Benigeri and Pluye 2003). To help build trust, people need benefit and risk information that is accessible, understandable, and empowering to enable them to make informed health decisions.

CHAPTER 3: METHODS

3.0 Research Design

This chapter presents the research design, data collection, and data analysis of this study. This project uses a case study design that is based on publicly available immunization webpages to address its four research objectives. Data was gathered using a simulated search for childhood immunization webpages, as well as purposive search of three different Canadian health agency websites (one federal, one provincial and one regional health authority). Results from the systematic collection of simulated and purposive searches were used to address objectives 1-3. The data sources were imported into NVIVO software for analysis. To appropriately evaluate the webpages, a records-based approach, using textual content analysis was used. Content analysis informed by items from the “*Communicating Risks and Benefits: An Evidence-Based User’s Guide*” written by Fischhoff and colleagues, as well items from the International Patient Decision Aid Standards checklist was adopted in analyzing the dataset. Lastly, the webpage search results were compared to achieve the project’s fourth objective. This chapter also provides the methodological limitations of this study.

This project follows a case study design. The case study research design is most often used when a holistic, in-depth investigation is needed (Feagin, Orum, and Sjoberg 1991). Case studies are designed to bring out the details of an issue by using multiple sources of data. Methodologists well studied in this area have developed robust procedures for the case study. Yin proposed that the case study design undergoes four stages: design the case study; conduct the case study; analyze the case study; and develop the conclusions, recommendation and implications. (Yin 1994). Yin identified three particular types of case studies: exploratory, explanatory, and descriptive (Yin 1993). Exploratory cases are considered by some as a prelude

to social research, while explanatory case studies are more often used for causal investigations. Descriptive cases differ as they require a descriptive theory to be developed before starting the project. Stake included three additional types of case studies: intrinsic, instrumental, and collective. He describes intrinsic case studies as when the researcher has a special interest in the topic; instrumental case studies as when the case is used to understand more than what is already known; and collective case study as when a group of cases is studied for the purpose of investigating a phenomenon, population or a general condition (Stake 1995). This thesis adopts the instrumental case study with the aim to provide greater insight into an existing issue.

The decision to select the instrumental case study design highlights the main goal of this study. This research aims to evaluate current childhood immunization informational materials against risk communication best practice, and provide evidence for innovative communication strategies, with attention given to issues of parental confidence in decision-making. To achieve this goal, publicly available immunization resources were examined in depth.

3.1 Data Sources

This study relied on one main source of data; publicly available webpages. These webpages were retrieved through a simulated search for childhood immunization information, as well as purposive search of three Canadian health agency websites (one federal, one provincial and one regional health authority).

Simulated Search

This thesis included sources retrieved through a simulated Google search, using common childhood immunization key words. The decision to study webpages retrieved through a Google

search is based on the great depth of literature that highlights the importance of the internet as a source for immunization information (Kata 2010, 2012; Kang et al. 2017; Greenberg, Dubé, and Driedger 2017; Wiley et al. 2017). Previous literature has shown that parents most often use general search terms (e.g. ‘vaccine’ or ‘immunization’) when looking for immunization information online (Kata 2010; Davies, Chapman, and Leask 2002; Wolfe and Sharp 2005; Wiley et al. 2017). These data sources were important to this thesis as they provide a sample of webpages that parents are likely to encounter when conducting an online search for immunization information.

Purposive Search

This thesis incorporates webpages found through a purposive search of three Canadian health agency websites; Health Canada (federal), Manitoba Health, Seniors and Active Living (provincial), and the Winnipeg Regional Health Authority (regional). The decision was made to limit the purposive search to Canadian agencies. The purposive search of the Health Canada website also includes Public Health Agency of Canada (PHAC) webpages, as this is the Health Canada agency that addresses public health issues, including vaccines and infectious disease. The PHAC webpages are found through the Health Canada website. The PHAC and Health Canada webpages were chosen over other relevant websites such as the website Caring for Kids (run by the Canadian Paediatric Society) or Immunize BC websites because they are more widely known health organizations, and have been previously cited as sources of health information used by Canadian parents. Second, although this research is reflective of the greater Canadian context, it was conducted in Winnipeg, Manitoba, therefore the WRHA and Manitoba health department websites were chosen as examples of a regional health authority, and a

provincial health department, respectively. Third, the websites are written in English, the language used for this study. Lastly, these agencies produce online health information intended for public dissemination, on a variety of health topics, including routine childhood immunizations.

3.2 Data Collection

The collection of data for this study began with the retrieval of webpages through the simulated searches, followed by the retrieval of webpages from the purposive searches.

Simulated Search

Data collection for objective 1 took place on March 4, 9, 14, and 18, 2017. The internet searches were conducted using a personal laptop at home, as well as on computers at the University of Manitoba Neil John Maclean Health Sciences Library, in 21 Degrees Internet café (a public Internet café), and at the Winnipeg Millennium Library, respectively. All locations are in Winnipeg, Manitoba, Canada. These specific search locations (two public computers, one personal laptop, and one university computer) were chosen to reduce the potential for the ‘filter bubble effect’. The ‘filter bubble effect’ is caused by search results being filtered through a computer’s IP address (the unique number that gets linked to all online activity) which can alter the results of a Google search. The diversity of search locations was used to ascertain that the web pages gathered comprise the most widely viewed results (Kata 2010; Wiley et al. 2017). Previous internet-based studies on anti-vaccination conducted searches using the terms ‘vaccination’ and ‘immunization’ (Kata 2010; Davies, Chapman, and Leask 2002; Wolfe and Sharp 2005; Wiley et al. 2017). These terms were chosen to closely simulate parental online

search behaviour. This project expanded upon this design by using the terms ‘vaccines’ and ‘immunization’ in combination with the following terms i. childhood ii. safe; iii. risks; iv. benefits. These secondary search terms were chosen to reflect concerns surrounding childhood immunizations raised by parents in previous qualitative studies on vaccine hesitancy (Benin et al. 2006; Wilson et al. 2008; Glanz et al. 2013; Austin 2001; Heininger 2006; Henderson, Millett, and Thorogood 2008; Gullion, Henry, and Gullion 2008; Luthy, Beckstrand, and Callister 2010; Miller, Verhoef, and Cardwell 2008). Google.ca was used as the search engine, as it has been found to be the most highly used search engine (Biswal 2017). Login to personal email and social media accounts (e.g. Facebook) was avoided when using a publicly available computer to minimize any aspect of personalization. Sponsored and advertised pages were excluded as previous research has found that individuals conducting a targeted search, such as for immunization information, tend to avoid advertising material (Cho 2004; Owens, Chaparro, and Palmer 2011). Lastly, all previous search histories were cleared prior to undertaking the searches.

This research limited data collection to the first page of results (Google searches yield ten search results per page) as it has been found that online users typically examine only the first ten results 97% of the time (Eysenbach and Köhler 2002). The first ten search results for every combination of search terms were recorded in a table. The number in which the result appeared, search result title, web page address, and type of webpage were also recorded. Type of webpage was categorized as either i. pro-immunizations; ii. anti-immunizations; iii. neutral towards immunizations; iv. not applicable/broken link. Webpages were categorized as pro-immunization if they encouraged or promoted vaccination or aimed to convince readers that childhood immunizations would benefit their child. Webpages were deemed neutral if they simply provided

information regarding immunizations and did not encourage vaccine uptake. Websites were deemed anti-immunization if they aimed to discourage readers from vaccination, and/or actively criticized immunizations or immunization programs. Websites that were identified as pro-immunizations were also described by the type of organization that runs the webpage (e.g. health organization, health authority, health coalition, university, non-governmental organization).

Purposive Search

A sample of health agency risk communication products, restricted to webpages regarding routine childhood immunizations, were collected and evaluated. The Winnipeg Regional Health Authority, Manitoba Health, Seniors and Active Living and Health Canada websites were purposely searched for informational pages regarding routine childhood immunizations.

Inclusion and exclusion criteria were defined and applied to the webpages found through these websites. To be included in the study, the webpage had to contain information pertinent to routine childhood immunizations given in Canada, including but not limited to, schedules, side effects, and frequently asked questions. Lastly, the webpages had to be written in English (or have an English option).

3.3 Data Analysis

To achieve the first objective, simulated search results were analyzed individually, by the exact webpage that appeared in the Google search results. Simulated search results were then tabulated and a comparison of search results from different locations using different search terms was made. Search results were compared by search terms in different locations, as well as by most common search result across all terms and locations.

To achieve objectives two and three, an analysis of informational materials was done by textual-based content analysis. All relevant data were captured using the NVivo capture (NCapture) function and imported into NVivo 10 software (QSR International Americas Inc., Burlington, MA) for analysis. NVivo 10 is a computerized qualitative data management software programme designed for analyzing textual data (Bazeley 2007). This software is used to replace the labouring traditional method of manual coding. This program aids in the organization and retrieval of data for analysis. NVivo 10 software enables more efficient management of large amount of data, offers researcher flexibility, provides greater accuracy and transparency, and yields faster and comprehensive methods of data inquiry (Jones 2007). The software also allows for the creation of theoretical and conceptual memos which help in data analysis. However, like traditional methods of manual coding, a computer assisted qualitative data analysis software is completely researcher-driven: that is, it is the researcher that examines lines of text and interprets what type of categories to which it will be assigned, and so forth. While NVivo also includes some automated features, all analysis decisions are directed by the researcher.

Content Analysis

Content analysis informed by both pre-determined and emerging coding categories was used to analyze the data. This type of analysis evaluates understandability, by exploring the degree to which the content and format of a risk communication is accurate, clear, and well-presented (Council of Canadian Academies 2015). Content analysis allows a researcher to systematically analyze a body of texts, typically though not exclusively, using a pre-determined list of thematic categories (Krippendorff 2004). Extracting categories from the text allows an examination of content information and an exploration of relationships between data and its context (Stemler 2001; Neuendorf 2002). Analysis began with familiarization with, and unitization of the data.

This involves an iterative process of reading the data to have a full grasp of the content, while systematically distinguishing the segments of text – images, numeric representation, other observables – that may be of interest to the analysis. During this stage, notes that might serve as potential categories are written down. Familiarization also entails the importation of the data into the NVivo software program.

Coding

An initial coding scheme was developed with expertise from my advisor, Dr. Driedger, guided by recent evidence-based risk communication criteria. These criteria have been compiled in the evidence-based user guide, written by Fischhoff and colleagues (Fischhoff 2012) and endorsed as a good practice from the Council of Canadian Academies Expert Panel on Health Product Risk Communication Evaluation (Council of Canadian Academies 2015). Criteria include defining outcomes, describing vaccine-preventable diseases, providing quantitative descriptions of risk, using visual aids, and describing relationships among influences on the vaccine decision-making process. The coding scheme was based on both manifest and latent content. Manifest content analysis looks for the number of times a particular idea/phrase is repeated within the dataset (in this case, informational material), identified as the emerging themes. Manifest content analysis focuses on the surface meaning of the data. On the other hand, latent content analysis is a more detailed and nuanced account of the semantic content. It entails the key ideas, assumptions, conceptualizations and ideologies that underpin the data. With the latent approach, a more complex and insightful analysis is conducted and this goes beyond the scope of mere observation of the data (Krippendorff 2004; Braun and Clarke 2006).

Additional conceptual categories (known as nodes within the NVivo software) were

created based on the content of the webpages, and were updated and revised until no new properties, dimensions or relationships emerged. This included a latent analysis of communication strategies and ideas brought forward from the data itself, rather than the pre-defined risk communication criteria. The coding scheme 'development' process ended once all major coding themes were captured with formalized definitions for each content category. The code book used in this study can be found in Appendix A. This coding scheme was systematically applied to the document dataset. Coding involves selecting, highlighting and assigning line(s) of text to a node. These codes help organize the data into smaller and meaningful groups. The process of reading and coding the dataset was repeated until complete identification of all keywords, phrases, and meanings, as determined by the coding scheme. The analysis process was supplemented by items taken from the International Patient Decision Aids Standard (IPDAS) Checklist - an itemized guide that evaluates patients decision aids based on criteria such as content, development process, and effectiveness (Elwyn et al. 2006). The modified IPDAs checklist can be found in Appendix C. An Excel spreadsheet of these criteria was created, referencing every webpage included in analysis, and imported into NVivo 10 as a classification sheet. Classification sheets contain descriptive information about the individual cases (or in this research, webpages). These descriptors can include age, gender, or other attributes that are determined to be valuable to a project. Classification sheets can also help a researcher see the overview of a particular attribute across all your cases. Coding also included identification, and analysis of visual aids, as defined by the risk communication evidence-based user guide.

Using both the findings from the content analysis, as well as the IPDAS checklist, communication products considered most effective based on evidence-informed risk

communication metrics were identified. Lastly, analyzing the data and writing up the findings based on the research objectives was completed. These findings are outlined in Chapter four (Results). These findings are also compared to existing literature on risk communication, vaccine hesitancy, parental vaccine decision-making process and the health belief, and RISP models in Chapter five (Discussion).

3.4 Readability

Whenever possible, risk communication product readability was assessed using the Flesch-Kincaid (FK) Grade Level test function within Microsoft Word. This function assesses the text based on U.S. grade school level (Microsoft 2017). The FK formula provides scores based on the average number of syllables per word and the average number of words per sentence. FK Grade Levels (FKGLs) represent the minimum grade level at which the reader should be able to read in order to understand the text. An FK Grade Level is calculated as $0.39x + 11.8y - 15.59$ ($x = 1/4 \text{ number of words/number of sentences}$; $y = 1/4 \text{ number of syllables/number of words}$). The FKGL is highly correlated with other commonly used readability assessment methods (Stossel et al. 2012; Friedman and Hoffman-Goetz 2006). Webpage text was copied into Microsoft Word and the Flesch-Kincaid readability assessment was applied. The Flesch-Kincaid Grade Level score for each data source was included in the imported classification sheet.

3.5 Methodological Limitations

To ensure the trustworthiness of this study, the systematic application of content analysis guidelines, as outlined above, was followed. However, some methodological limitations still exist. Data analysis was diligently conducted, with strict efforts to consistently code the data into

their respective nodes and categories. However, there is the possibility of over coding or missing examples of text being coded into its rightful node or category. In conducting more detailed analyses, test queries were run to ensure that text not appropriately coded during the retrieval of queries were deleted or recoded into its respective node. Second, this study relied upon a purposive search from select health agencies. Although the reasoning for the selection of these websites was provided, there are other health agencies and institutions relevant to the Winnipeg and Canadian context that could have been chosen. The selection of alternate or additional websites may have provided a different result. Third, while many different readability tests exist, this research relied upon one, the Flesch-Kincaid (FK) Grade Level test. Different results may have occurred had another readability test been used. Finally, only English language data was retrieved and included in the analysis. As a bilingual country, French keywords, and websites could have been included in this project, although were not. The consultation of French websites and/or the use of a French language simulated search may have given a broader perspective of childhood vaccine communication materials available in Canada.

3.6 Research Ethics

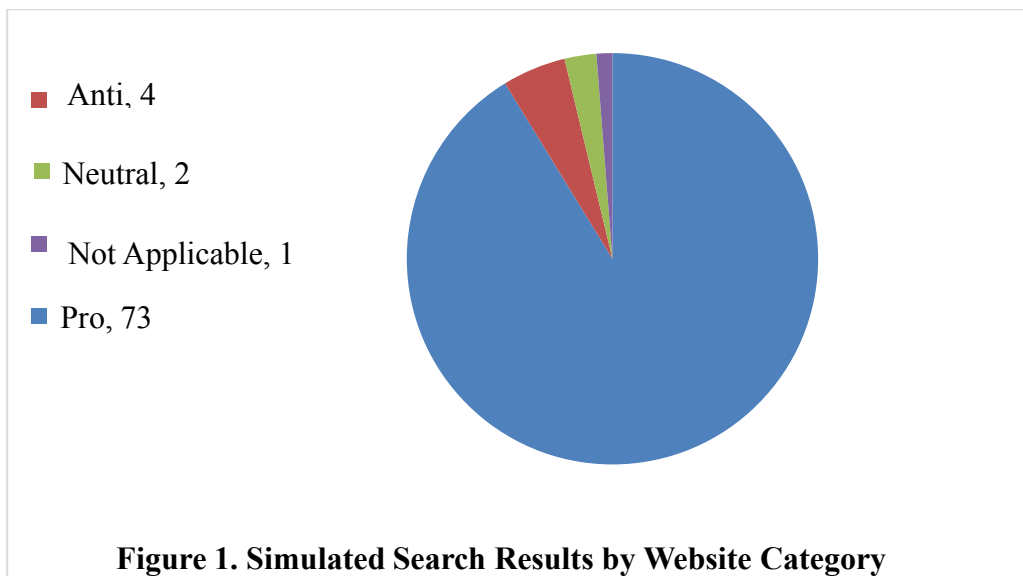
This project relied solely upon data that is available in a public domain (e.g. publicly available on websites), and did not utilize any information collected from human participants. In accordance with the University of Manitoba's Health Research Ethics Board (HREB) guidelines, a one page summary of the research was submitted to the REB office for review. E-mail confirmation from the Research Ethics Board that ethics approval is not required was received.

CHAPTER 4: RESULTS

4.0 Simulated Search

This chapter provides the results from this study, organized by objective. The simulated search results are summarized by type of webpage (anti-immunization, pro-immunization or neutral towards immunization) location, by search terms, and by frequency of results (objective 1). The purposive search results are presented by health agency. Additionally, this chapter provides an evaluation of purposive and simulated search results regarding key evaluation items such as communication product readability, visual aids, quantitative information, definition of outcomes, and description of vaccine-preventable diseases, among other items from the risk communication evidence based users' guide (objectives 2, 3). Lastly, this chapter provides a comparison of findings from objective 2 and 3 (objective 4).

The simulated search, using eight different combinations of search terms (primary terms: vaccines; immunization plus secondary terms: childhood; safe; risks; benefits), in four different locations produced 80 unique webpage results. The complete list of search results can be found in Tables 1-32 of Appendix A. Of these, 1 search result was not applicable to this research, 4 different webpages were determined to be anti-immunization, 73 different webpages were pro-immunization, and 2 different webpages did not persuade one way or another on the topic of immunizations (neutral). The four unique anti-immunization webpages appeared in the searches a total of 19 times. Figure 1 shows the total number of unique webpages retrieved, organized by category (pro-immunizations, neutral towards immunizations, anti-immunization, and not applicable to this research).



A summary of search results by search term, location and by category can be found in Table 1.

Table 1. Tabulated Simulated Search Results

Search Term	# Pro-immunizations Websites	# Anti-Immunizations Websites	# Neutral Websites
Vaccines + childhood			
Personal Laptop	9	1	0
University of Manitoba Library computer	10	0	0
Internet café	10	0	0
Winnipeg Millennium Library computer	10	0	0
Vaccines + safe			
Personal Laptop	10	0	0
University of Manitoba Library computer	10	0	0
Internet café	10	0	0
Winnipeg Millennium Library computer	10	0	0
Vaccines + risks			
Personal Laptop	8	1	1

University of Manitoba Library computer	7	2	1
Internet café	7	2	1
Winnipeg Millennium Library computer	7	2	1
Vaccines + benefits			
Personal Laptop	10	0	0
University of Manitoba Library computer	9	0	1
Internet café	9	0	1
Winnipeg Millennium Library computer	10	0	0
Immunizations + childhood			
Personal Laptop	10	0	0
University of Manitoba Library computer	10	0	0
Internet café	10	0	0
Winnipeg Millennium Library computer	10	0	0
Immunizations + safe			
Personal Laptop	9	1	0
University of Manitoba Library computer	9	1	0
Internet café	8	2	0
Winnipeg Millennium Library computer	9	1	0
Immunizations + risks			
Personal Laptop*	8	0	1
University of Manitoba Library computer	8	2	0
Internet café	8	2	0
Winnipeg Millennium Library computer	8	2	0
Immunizations + benefits			
Personal Laptop	10	0	0

University of Manitoba Library computer	10	0	0
Internet café	10	0	0
Winnipeg Millennium Library computer	10	0	0

*N.B. The search terms ‘immunizations’ and ‘risks’ conducted on a personal laptop yielded one result not applicable to this research. The webpage titled Investopedia contains information on the term ‘immunization’ as defined as a strategy that matches the durations of assets and liabilities, thereby minimizing the impact of interest rates on the net worth.

While several webpages were found in multiple searches, all searches produced variation in search results. Searches using the same combination of search terms in different locations produced new results, in addition to the search results order changing (i.e. depending on the search, specifically identified website results moved up or down within the list of the first ten results). Table 2 summarizes the most commonly produced search results across all 32 searches (eight combinations of search terms in four different locations).

Table 2. Search Results by Frequency

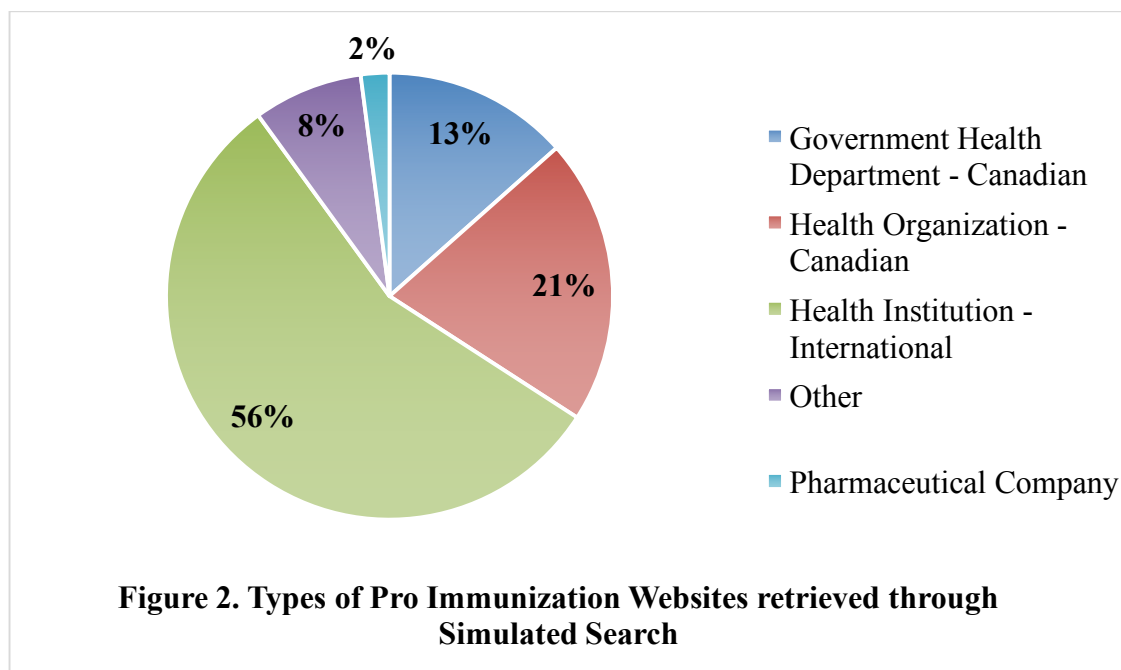
Webpage Name	Total hits	Category
Immunize for Good - Benefits vs. Risk	17	Pro
vaccineinformation.org - Importance of Vaccines	13	Pro
CDC - Possible Side-effects from Vaccines	12	Pro
Immunize Canada - Benefits & risks	10	Pro
WebMD - Immunizations - Childhood Immunizations	10	Pro
HealthyChildren.org - Weighing the Risks and Benefits	9	Pro
Caring for Kids - Vaccine safety: Canada's system	8	Pro
CDC - Immunization Schedules	8	Pro
Government of Canada - Vaccination for children	8	Pro
Immunize Canada – Safety	8	Pro
PHAC - Vaccine Safety	8	Pro
Vaccines.gov – Five Important Reasons to Vaccinate Your Child	8	Pro
CDC - Vaccine Safety	7	Pro
Immunize BC – Understanding risk	7	Pro
Medline - Childhood Immunization	7	Pro

National Vaccination Information Centre - Vaccinations Know the Risks and Failures	7	Anti
Stop Mandatory Vaccinations – The Dangers of Vaccines and Vaccination	7	Anti
CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	6	Pro
Health Link BC - Childhood Vaccines are Safe	6	Pro
Health Link BC - The Benefits of Immunizing Your Child	6	Pro
<u>Immyouunity</u> - Vaccine Side Effects	6	Pro
CDC – Making the Vaccine Decision	5	Pro
CDC – Why Immunize?	5	Pro
NHS - Benefits and risks of vaccination	5	Pro
<u>vaccines.gov</u> - Safety	5	Pro
WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	5	Pro
Caring for Kids - Vaccination and your child	4	Pro
CDC - Immunization Schedules for Infants and Children	4	Pro
CDC - Multiple Vaccines and the Immune System	4	Pro
CDC - Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013	4	Pro
<u>FamilyDoctor.org</u> - Childhood Vaccines: What They Are and Why Your Child Needs Them	4	Pro
Government of Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	4	Pro
Healing Arts – Children’s Vaccines: Research on the Risks for Children and Possible Neurological Consequences	4	Neutral
History of Vaccines – Understanding Risks	4	Pro
Immunize BC – Vaccine Safety	4	Pro
Thinktwice Global Vaccine Institute – Immunization Ploys	4	Anti
<u>Vaccineinformation.org</u> - Vaccine Safety	4	Pro
<u>vaccines.gov</u> - Be Informed	4	Pro
Government of Canada – A Parent’s Guide to Vaccination	3	Pro
Government of Canada – Immunization Schedule Tool	3	Pro
<u>Healthychildren.org</u> - How Safe are Vaccines?	3	Pro
History of Vaccines – Why Vaccinate?	3	Pro
Manitoba Health, Seniors, and Active Living – Routine Immunization Schedule	3	Pro
NHS - Childhood vaccines timeline	3	Pro

What to expect – Are immunizations safe?	3	Pro
WHO - What are some of the myths – and facts – about vaccination?	3	Pro
Wikipedia - Childhood immunizations in the United States	3	Pro
Alberta Health – Routine Immunization Schedule	2	Pro
Immunize BC – Vaccine Schedules	2	Pro
Kids Health – Immunization Schedule	2	Pro
Mayo Clinic - Childhood vaccines: Tough questions, straight answers	2	Pro
National Foundation for Infectious Disease – Vaccine Safety	2	Pro
Nova Scotia Routine Childhood Immunization Schedule	2	Pro
ProCon.org - Should Any Vaccines Be Required for Children?	2	Neutral
Childhood Shots - Welcome to Mary Tocco's Educational Site	1	Anti
Alberta Health Services – Common questions about vaccine safety	1	Pro
Alberta Health Services – Risks and Safety Perceptions	1	Pro
CDC – About the Immunization Safety Office	1	Pro
CDC – Five Important Reasons to Vaccinate Your Child	1	Pro
CDC – Human Papillomavirus (HPV) Vaccine Safety	1	Pro
CDC – Why Vaccines are Important for You	1	Pro
CDC- Infant Immunizations FAQs	1	Pro
Government of Canada – Canadian Immunization Guide Part 3: Vaccination of Specific Populations	1	Pro
Government of Canada – Immunization and vaccines	1	Pro
Government of Canada – Provincial and Territorial Immunization Information	1	Pro
Health Talk – Weighing Up the Risk	1	Pro
Immunise Australia Program – Safety of Vaccines	1	Pro
Immunise Scotland – Why Immunise?	1	Pro
Immunize BC – Child Health Passport	1	Pro
Immunize Canada – Immunization Schedules	1	Pro
Immunize Canada – Side effects	1	Pro
Immunize.org – Vaccine Safety	1	Pro
Ontario Ministry of Health and Long Term Care – Ontario's Publicly Funded Immunization Schedule	1	Pro

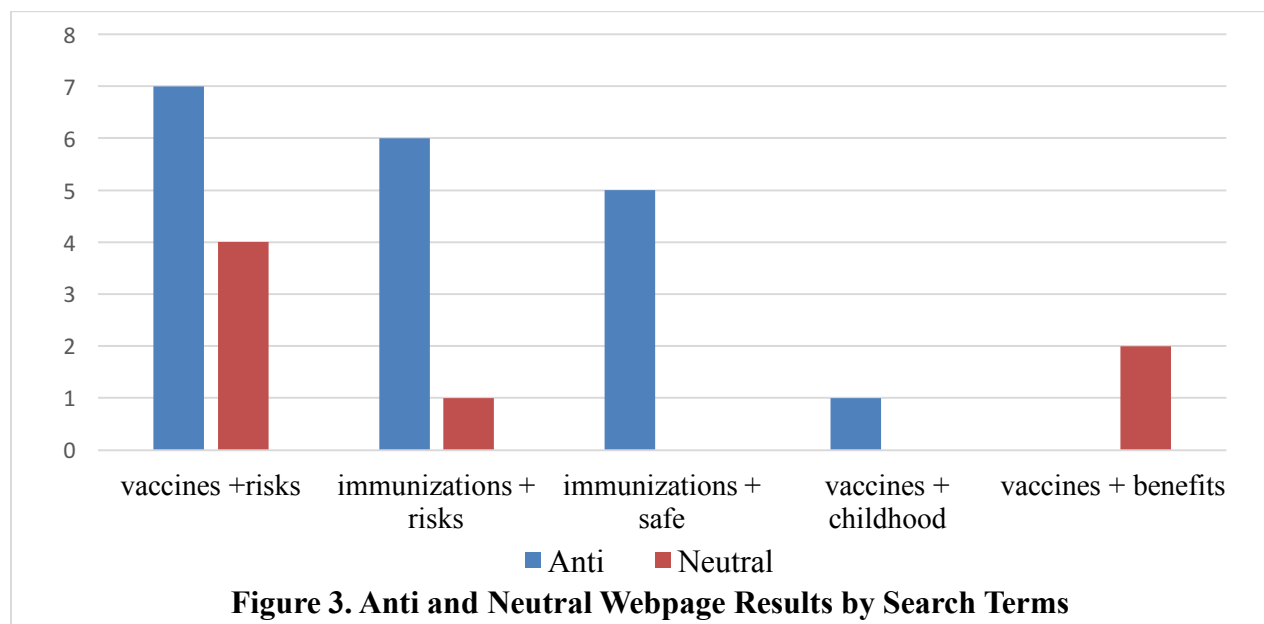
Prairie Northern Health Region – Childhood Immunization Information	1	Pro
Queensland Government – Benefits of immunization	1	Pro
Safety of Vaccines Used for Routine Immunization of US Children: A Systematic Review	1	Pro
Scientific American – Straight Talk about Vaccination	1	Pro
Vaccinate Your Baby – Are They Safe?	1	Pro
Web MD – Should Your Child Get the HPV Vaccine?	1	Pro
WHO – Balancing efficacy and safety	1	Pro

While the majority of search results from all the combinations of search terms were determined to be pro-immunization, the organization that hosted the website varied significantly. Figure 2 shows the distribution of pro-immunization webpages. Canadian government health department websites include Federal government webpages such as Health Canada, and the Public Health Agency of Canada; provincial health departments such as Alberta Health Services; and regional health authorities. Canadian health organizations include the Canadian Paediatric Society and Immunize Canada. International health institutions include organizations such as the World Health Organization, the United Kingdom National Health Service, Centers for Disease Control and Prevention, the United States Department of Health and Human Services, and the American Academy of Family Physicians. The other category includes websites such as Wikipedia, blogs, and parenting websites. As Figure 1 displays, most of the pro-immunization website results are run by international health institutions, followed by Canadian health organizations, Canadian government health departments, other organizations, and lastly, pharmaceutical companies.



Simulated Search Results by Terms

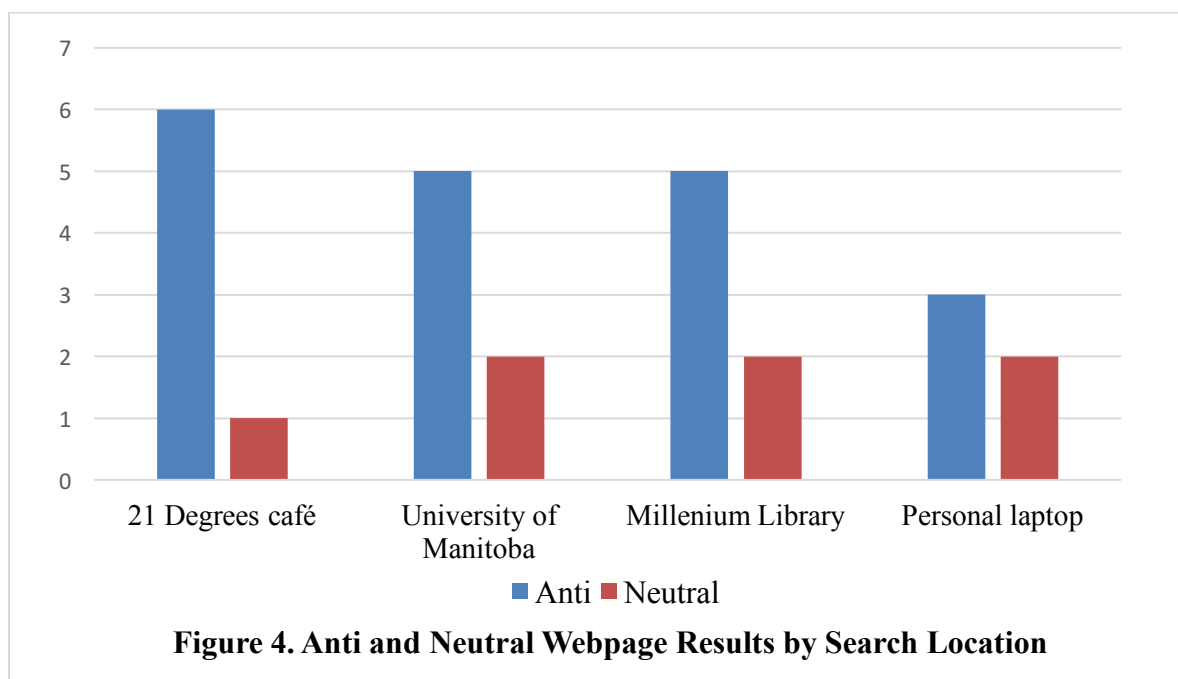
The combination of search terms ‘vaccines’ and ‘risks’ produced the highest number of anti-immunization webpages (7). This is followed by the combination of search terms ‘immunizations’ and ‘risks’ (6 anti-immunization results); followed by ‘immunizations’ and ‘safe’ (5 anti-immunization results) and lastly, by ‘vaccines’ and ‘childhood’ (1 anti-immunization result). The remaining four combinations of search terms did not produce any anti-immunization webpage results. The combination of search terms ‘vaccines’ and ‘risk’ produced four neutral webpages; followed by the combination of ‘vaccines’ and ‘benefits’ (2 neutral results); and lastly, the combination of terms ‘immunizations’ and ‘risks’ produced one neutral webpage result. The combination of search terms ‘immunizations’ and ‘risks’ was the only search that produced a result not applicable to this research.



Simulated Search Results by Location

Searches conducted using a computer at 21 Degrees internet café produced the highest number of anti-immunization webpages (6 anti-immunization webpages); followed by both the University of Manitoba library computer and Winnipeg Millennium library computer searches yielding five anti-immunization webpages. The search conducted at home on a personal laptop yielded three anti-immunization webpage results. As referenced in Table 2, the websites Stop Mandatory Vaccinations and the National Vaccination Information Center (NVIC) were the most frequently retrieved anti-immunization websites. The NVIC webpage was retrieved twice during the each of the searches using a computer at 21 Degrees Internet café, the Winnipeg Millennium library, and at the University of Manitoba. The Stop Mandatory Vaccinations webpage was retrieved three times using the computer at 21 Degrees Internet café, and twice from each of the searches at the Winnipeg Millennium library, and at the University of Manitoba. The anti-immunization webpage Thinktwice Global Vaccine Institute was retrieved once from all four of the search

locations. Lastly, the personal laptop search yielded one unique anti-immunization website result – the website Childhoodshots.com. The University of Manitoba library, Winnipeg Millennium library, and personal laptop searches each yielded two neutral webpage results, while 21 Degrees internet café yielded one.



4.1 Purposive Search

The purposive searches of the Winnipeg Regional Health Authority, Manitoba Health, Seniors and Active Living and Health Canada websites produced 2, 26 and 72 webpages related to childhood immunizations, respectively. These pages were retrieved through systematic searching of the respective websites, for webpages regarding childhood immunizations. Searches were conducted more than once, to ensure that all relevant webpages were retrieved. These webpages represent an inclusive search for relevant criteria.

4.2 Evaluation of Webpages

Analysis is presented firstly by pro-immunization webpages (both simulated and purposive), followed by the differences between simulated and purposive webpages, and lastly, by the differences between pro and anti-immunization websites.

Risk Communication Strengths of Pro-Immunization Webpages

Critical Information

Several pro-immunization webpages provided the ‘need-to-know’ vaccine information for readers. This critical information is often found under headings such as “About Immunizations”, “Why Immunize”, and “What are vaccines”. The information found under these headings generally describes what vaccines do, how they work, how they are received, and what benefits they provide to individuals, communities and families. One example of this is the Health Canada “Get the Facts About Immunizations” webpage, under the heading “About vaccines” which states:

Vaccines are made with a tiny amount of dead or weakened germs. They help the immune system learn how to protect itself against disease. Vaccines are a safe and effective way to keep your child from getting very sick from the real disease. Most vaccines are given by an injection (a needle) into your child's upper arm or thigh. Some vaccines can be given orally (by mouth) or nasally (sprayed into the nose).

The above webpage was found during the purposive search. While some pro-immunization webpages retrieved through the simulated and purposive searches focused on a particular aspect of childhood immunizations (e.g. side effects, schedules or one particular VPD), rather than their general purpose, the ‘need-to-know’ information was presented frequently by a variety of webpages across all searches. Presenting the critical information to parents in an accessible,

easy-to-understand manner prior to them having to make a decision is imperative for informed consent.

Addressing parental concerns/ vaccine myths

Although there is broad consensus among health researchers, medical professionals, and policy-makers that routine childhood vaccination is a safe and effective way to prevent the transmission of several infectious diseases, as well as to drastically reduce morbidity and mortality among children, vaccine myths, concerns, and misinformation continue to persist within society.

Addressing parental concerns, answering frequently asked questions, and/or debunking vaccine myths were common themes throughout the pro-immunization webpages. Frequently discussed misconceptions include: the necessity of following the recommended immunization schedule; the possibility of children catching the real disease from the vaccine; the efficacy of immunity from a vaccine vs. natural immunity, and serious adverse events such as autism, inflammatory bowel disease, and asthma, among others. However, the extent to which webpages provide an explanation to these concerns vary greatly. For instance, from the website Vaccinate Your Baby (a website run by the American pro-immunization non-governmental organization Every Child by Two), under the heading “Are They Safe”, it states:

“A vast and growing body of scientific evidence has shown no connection between vaccines and autism”.

However, the Prairie Northern Health webpage, under the heading “Do Vaccines Cause Autism” writes:

No! Evidence-based reviews have rejected any causal associations between the measles-mumps - rubella (MMR) vaccine and autism spectrum disorders in children, according to the U.S. Institute of Medicine. A Montreal study of 27,749 children born from 1987 to 1998 also concluded there was no relationship between pervasive developmental disorder (autism) rates and a 1- or 2-dose

measles-mumps-rubella immunization schedule. In addition, a large Danish study of all children born in Denmark between 1991 and 1998 (537,303 children) concluded there was no difference in the rates of autism between vaccinated and unvaccinated children. Some speculation has tried to link thimerosal in the MMR vaccine to autism, but the MMR vaccine routinely used in Canada has never contained thimerosal. DTaP, polio and Hib vaccines have not contained this preservative since 1997-98. Although the reason for the increase in autism is not yet conclusively known, one explanation may be the broader definition and inclusion of many more behaviours and learning disorders within autistic spectrum disorders.

Both above examples were retrieved through the simulated search. More frequently, webpages chose to address myths/ frequently asked questions with concise answers rather than detailed explanations such as the Prairie Northern Health Website. For readers who are looking for a quick response to their concerns, these responses may be all they need. However, for readers who have previously read conflicting information, or have serious anxieties about the safety or effectiveness of vaccines, these responses do not seem to provide adequate information, and may be seen as vague or dismissive to the importance of the concern.

However, this parental concern was only addressed by a small number of pro-immunization webpages, which may partly explain why this public misconception continues to persist. One resource that does address this fear is the Centers for Disease Control and Prevention webpage “Infant Immunizations Frequently Asked Questions” that states:

Vaccines do not overload the immune system. Every day, a healthy baby’s immune system successfully fights off millions of germs. Antigens are parts of germs that cause the body’s immune system to go to work. The antigens in vaccines come from the germs themselves, but the germs are weakened or killed so they cannot cause serious illness. Even if babies receive several vaccinations in one day, vaccines contain only a tiny fraction of the antigens that they encounter every day in their environment. Vaccines provide your child with the antibodies they need to fight off the serious illnesses for which they have been vaccinated.

Decision making process

Another risk communication strength among the pro-immunization webpages analyzed, is the recognition of the significance of the vaccine decision. Parents are ultimately responsible for

their child's health and wellbeing, and to vaccinate or not is one of many choices they must make within that role. For instance, the Health Canada webpage "A Parent's Guide to Vaccination" (found during the simulated search) states:

Parents are responsible for the well-being of their children, including protecting them from illness caused by diseases that are vaccine-preventable. Learn about vaccination and why it is important to your child's health. Parents agree that feeding and sleeping schedules are important to help keep children healthy. The same goes for childhood vaccinations. Vaccinating your children is the best way to keep them safe from many serious and potentially deadly diseases. You can help protect your children by getting them vaccinated on time and keeping their shots up-to-date.

Another webpage, vaccineinformation.org (a website run the by pro-immunization non-profit organization The Immunization Action Coalition, retrieved during the simulated search) discusses the impact of the vaccine decision not only on one's family, but in terms of the effect on the greater community:

Vaccination protects others you care about, including family members, friends, and grandparents. If children aren't vaccinated, they can spread disease to other children who are too young to be vaccinated or to people with weakened immune systems, such as transplant recipients and people with cancer. This could result in long-term complications and even death for these vulnerable people. We all have a public health commitment to our communities to protect each other and each other's children by vaccinating our own family members.

The incredible success of herd immunity in protecting those who cannot be vaccinated is a notable strength of routine immunization programs. Discussing one's responsibility to help reduce the spread of communicable disease is an important factor in the decision to vaccinate or not, and one that parents may not realize should be included in their decision.

Definition of outcomes

One consistent feature of the pro-immunization webpages analyzed was including detailed

definitions of vaccine side effects. Often these include the use of both medical and lay terms, a description of who is affected, and were described in both immediate effects (e.g. pain or redness) and potential serious effects (e.g. severe allergic reaction). For instance, the Manitoba Health 4CMenB (type B meningococcal vaccine) Factsheet states:

The most common side effects are fever, soreness, redness and swelling where the vaccine was given. In children up to 10 years of age: Fever is very common in young children (around 60%), and if given with other routine childhood vaccines. The use of acetaminophen immediately prior to and following vaccination can be used in children under 3 years of age to reduce fever rates. Other common reactions include: unusual crying, loss of appetite, irritability, drowsiness, vomiting and diarrhea. Less common reactions (up to 1 in 100 people) include high fever, seizures (including febrile seizures), dry skin, itchy rash and paleness. Individuals 11 years of age and older: The most common side effects include pain at the injection site resulting in the inability to perform daily activity, painful muscles and joints, nausea, generally feeling unwell and headache.

Another webpage, the Health Canada “Baby’s First Immunization” page, describes possible side effects as such:

You will be asked to wait at the clinic for 15 to 20 minutes after your child's vaccination. This is because, as with any medicine, there is a very slight chance of a serious allergic reaction (anaphylaxis). Signs of a serious allergic reaction include: breathing problems (wheezing), swelling of the face, and/or blotchy skin on the body (hives). If you see any of these symptoms, talk to a health care provider immediately. They know what to do to counter the allergic reaction.

The above webpages were retrieved during the purposive search. Defining outcomes is a risk communication strategy that both Fischhoff and colleagues and the IPDAS checklist emphasize.

While different webpages choose to focus on either the potential short-term side effects, potential long-term risks (e.g. loss of immunity over time) or both, the outcomes are well explained. The CDC webpage titled “Possible Side Effects from Vaccines” is one of the most comprehensive examples of defining outcomes. This webpage, which was retrieved through the simulated

search, describes the potential side effects of 25 different immunizations, including those recommended during routine childhood immunizations. This webpage describes potential side effects in terms of mild, moderate or severe problems. Lastly, they choose to employ another recommended communication tactic by including quantitative information to describe the likelihood of potential side effects. For instance, this webpage describes the potential side-effects from the DTaP (Diphtheria, Tetanus, and acellular Pertussis) vaccine as such:

What are the risks from DTaP vaccine?

Getting diphtheria, tetanus, or pertussis disease is much riskier than getting DTaP vaccine. However, a vaccine, like any medicine, is capable of causing serious problems, such as severe allergic reactions. The risk of DTaP vaccine causing serious harm, or death, is extremely small.

Mild Problems (Common)

- Fever (up to about 1 child in 4)
- Redness or swelling where the shot was given (up to about 1 child in 4)
- Soreness or tenderness where the shot was given (up to about 1 child in 4)

These problems occur more often after the 4th and 5th doses of the DTaP series than after earlier doses. Sometimes the 4th or 5th dose of DTaP vaccine is followed by swelling of the entire arm or leg in which the shot was given, lasting 1-7 days (up to about 1 child in 30).

Other mild problems include:

- Fussiness (up to about 1 child in 3)
- Tiredness or poor appetite (up to about 1 child in 10)
- Vomiting (up to about 1 child in 50)

These problems generally occur 1-3 days after the shot.

Moderate Problems (Uncommon)

- Seizure (jerking or staring) (about 1 child out of 14,000)
- Non-stop crying, for 3 hours or more (up to about 1 child out of 1,000)
- High fever, over 105°F (about 1 child out of 16,000)

Severe Problems (Very Rare)

- Serious allergic reaction (less than 1 out of a million doses)
- Several other severe problems have been reported after DTaP vaccine. These include:
 - Long-term seizures, coma, or lowered consciousness
 - Permanent brain damage.

These are so rare it is hard to tell if they are caused by the vaccine.

Controlling fever is especially important for children who have had seizures, for any reason. It is also important if another family member has had seizures. You can reduce fever and pain by giving your child an *aspirin-free* pain reliever when the shot is given, and for the next 24 hours, following the package instructions.

While providing definitions for negative outcomes from vaccines (vaccine side-effects) was common among the pro-immunization webpages, very few webpages describe positive outcomes (immunity from disease). The Canadian Immunization Guide (a Health Canada resource) found through the purposive search includes webpages describing specific vaccinations and provides information on the immunity provided by each vaccination.

Webpage navigation

The International Patient Decision Aid Standards (IPDAS) checklist includes items evaluating ease of use and navigation for Internet based resources. The internet has become an invaluable tool for facilitating access to health information, engaging the public, and disseminating health information. However, disparities in online health information accessibility exist. The IPDAS

checklist includes entries such as providing a step-by-step way to move through the website, allowing patients to search through key words, allowing patients to return to the original webpage after linking to other pages, and permitting printing as a single document (e.g. as a PDF). The pro-immunization webpages analyzed consistently scored well on these items.

Risk Communication Shortcomings of Pro-Immunization Websites

Readability

Of the 168 sources, product readability could be assessed from 120 webpages. Those that were not examined included webpages that included very little text (e.g. contained only links to other webpages) or immunization schedules that were presented solely in table format. Of those examined, 10 webpages were found to be within reading levels 4-6, and an additional 14 were found to be within reading levels 7-8. Overall, the total number of risk communication products found to be within recommended reading levels for public dissemination was 24 out of 120 sources, or 20% of sources. Table 3 summarizes the readability scores of examined data.

Table 3. Flesch-Kincaid Grade Level Scores of Webpage Text

Search Type	Number of Webpages with FK scores of levels 4-6	Number of Webpages with FK scores of levels 7-8	Number of Webpages with FK scores of levels 8 and above	Number of webpages assessed for readability
Simulated	6	8	50	64
Purposive	4	6	46	56
Total	10	14	96	120

As demonstrated in the above data, the majority of webpages retrieved through both the simulated and purposive searches, were not written at levels recommended for public

dissemination, making the information potentially inaccessible to many readers. One example of webpage text that is written at an appropriate reading level for public health information is the Health Canada webpage titled “Baby’s First Vaccination” which writes:

Before the vaccination

If your child has a cold or fever when it is time for his or her vaccination, talk to your doctor or nurse. They can assess whether it is okay to vaccinate or if you should wait until your child has recovered.

During the vaccination

Your health care provider may ask you questions about your child's health, such as if they have allergies or health problems.

There are several things you can do to help your child during the vaccination.

- Relax. Your child may react to your emotions. When you relax and stay positive, your child will be happier too.
- Cuddle. Hold and talk to your child during the vaccination. Studies have found that children who are held while getting a needle cry less.
- Breastfeed. If you are breastfeeding, try nursing your baby right before, during or after the needle. This will be comforting to your baby.
- Distract. Your gentle, soothing voice or touch can help comfort your baby. So can a favourite toy, telling a story or singing.

After the vaccination

Most children are fine after vaccination. Your child may have no reaction at all to the vaccine. But in some cases, your child may:

- be fussy,
- be sleepier than usual,
- have a low fever or
- have a sore, swollen, or red spot where the needle went in.

These reactions are normal and usually last between 12 and 24 hours. You can give your child medicine to help with the pain or lower the fever. Ask your health care provider what medicine is best.

Before you go home

Make an appointment for your child's next vaccination.

You will be asked to wait at the clinic for 15 to 20 minutes after your child's vaccination.

This is because, as with any medicine, there is a very slight chance of a serious allergic reaction (anaphylaxis).

Signs of a serious allergic reaction include:

- breathing problems (wheezing),
- swelling of the face, and/or
- blotchy skin on the body (hives).

If you see any of these symptoms, talk to a health care provider immediately. They know what to do to counter the allergic reaction.

When to call your health care provider

Serious reactions to vaccines are very rare. Call your health care provider or public health office (CLSC in Quebec) if your child has unusual symptoms after vaccination.

Unusual symptoms may include:

- a fever above 40°C (104°F),
- crying or fussing for more than 24 hours,
- worsening swelling where the needle went in or
- unusual sleepiness.

You know your child best. If you notice anything that is not normal after a vaccination, check with your healthcare provider.

Remember, vaccination is part of your children's routine care. Keeping vaccinations up-to-date is important to protect their health.

The Health Canada website had six unique webpages that scored between reading levels 4-8; although none of the webpages from the Canadian Immunization Guide (a comprehensive immunization resource, over fifty pages in length written as a guide for health professionals, vaccine program decision makers and other Canadians) are written at these levels. Given that the Canadian Immunization Guide is designed for health professionals, this is not surprising, but is nonetheless potentially problematic for parents seeking out the kind of detailed information contained within such a guide. One of the six appropriately written Health Canada webpages was retrieved through the simulated search, the remaining five were retrieved through the purposive search. Additional examples of webpages retrieved through the simulated search that are written at appropriate reading levels include the Medline webpage on childhood immunizations (run by the U.S. National Institute of Health); the Familydoctor.org webpage (run by the American Academy of Family Physicians); the UK National Health Service webpage “Childhood vaccine timeline”; and the HealthLink BC webpage “Benefits of Vaccinating Your Child”. Even the most frequently retrieved webpages such as the websites Immunize for Good, vaccineinformation.org

and several different CDC webpages scored much higher than recommended reading levels. Lastly, the anti-immunization webpages retrieved through the simulated search are also written at levels higher than recommended for public dissemination.

Quantitative information

While the importance of numeracy is emphasized in both the evidence based user's guide, as well as the IPDAS checklist, very few pro-immunization webpages employ these recommended strategies. While a few webpages include a numerical description of immunogenicity, these webpages do not provide information in both negative and positive frames. Secondly, while some webpages do use numeracy to describe the likelihood of negative side effects or serious adverse events from immunizations, denominators and time frames are not kept consistent, nor are baseline and intervention risks compared. For example, the Immyounity (a website run by the pharmaceutical company Sanofi Pasteur) webpage titled "Vaccine Safety" writes:

Any vaccination can result in an adverse reaction, but a serious reaction is extremely rare. For example, the risk a child will have a severe allergic reaction after the MMR (measles, mumps, and rubella) or DTaP (diphtheria, tetanus, and acellular pertussis) vaccine is less than 1 in 1,000,000.

Another webpage, healthtalk.org (run by the University of Oxford) states:

It is important to know that you are comparing like with like. For instance, comparing the chance of your child developing inflammation of the brain (encephalitis) as a rare complication of measles (1 in 1,000 cases of infected children - Encephalitis Society 2014) and the chance of developing encephalitis as a complication of MMR (less than 1 child in a million).

The above examples were taken from webpages retrieved through the simulated search. The second example includes a comparison of baseline and intervention risk of serious adverse event;

however, denominators are not kept constant, nor are the event rates of measles discussed by population or time period. Examples of webpages found during the purposive search that contain quantitative information include several of the Canadian Immunization Guide webpages. For instance, its webpage on the Pneumococcal vaccine writes:

In children less than 5 years of age, the effectiveness of pneumococcal conjugate vaccines is 86% to 97% against IPD serotypes whose antigens are contained in the vaccine (vaccine serotypes).

Another example from the Canadian Immunization Guide is its webpage on the tetanus vaccine, which states:

In clinical trials, injection site adverse reactions, including tenderness, erythema, swelling, or any combination, were reported in 10% to 40% of children after each of the first 3 doses of tetanus toxoid-containing vaccine. Mild systemic reactions such as fever, irritability fussiness or any combination were commonly reported (8% to 29%), as well as drowsiness (40% to 52%).

Visual Aids

Both “*Communicating Risks and Benefits: An Evidence-Based User’s Guide*”, and the IPDAS checklist emphasize the importance of utilizing visual aids (e.g. worksheets, visual diagrams to describe probability, videos) to help convey your message. Despite these recommendations, only a very small number of pro-immunization webpages in this research utilize visual aids to complement their message. Table 4 summarizes the visual aids found in the data examined.

Table 4. Summary of Visual Aids from Purposive and Simulated Search Results

Webpage Title	Search Type	Category	Type of Visual Aid
Health Canada - Canadian	Purposive	Pro-immunization – Canadian Federal	Line chart depicting number of Tetanus

Immunization Guide: Part 4 - Active Vaccines		Health Agency	cases and deaths, Canada, 1921-2010
Health Canada - Canadian Immunization Guide: Part 4 - Active Vaccines	Purposive	Pro-immunization – Canadian Federal Health Agency	Varicella Vaccination for Immunocompromised Persons
Health Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	Purposive	Pro-immunization – Canadian Federal Health Agency	Bar chart depicting - reported number of Haemophilus influenzae type b disease cases and incidence rates, Canada, 1979-2010
Health Canada - Canadian Immunization Guide: Part 4 - Active Vaccines	Purposive	Pro-immunization – Canadian Federal Health Agency	Line chart depicting number of reported Diphtheria cases and incidence, Canada, 1924-2008
Manitoba Health	Purposive	Pro-immunization – Provincial Health Department	Video describing how vaccine safety is monitored in Canada
Immyounity – Vaccine Safety	Simulated	Pro-immunization - pharmaceutical company Sanofi Pasteur	Image comparing everyday risks and vaccine risks
vaccineinformation.org - Importance of Vaccines	Simulated	Pro-immunization – International Health Institution	Video describing why vaccines work and whether they are safe
CDC – Vaccine Safety	Simulated	Pro-immunization – International Health Institution	Video describing who is responsible for safety and monitoring of vaccines
Queensland Government - Benefits of immunisation - Health and wellbeing	Simulated	Pro-immunization – International Health Institution	Video describing how to manage children’s needle phobia

Vaccines.gov – Be Informed	Simulated	Pro-immunization – International Health Institution	Video describing the purpose of childhood immunizations
History of Vaccines – Understanding Risk	Simulated	Pro-immunization – International Health Institution	Image comparing risks of accidental deaths and vaccine risks

Images such as logos, photos of health care professionals or patients, and cartoons were not included for analysis. Despite only a small number of webpages utilizing visual aids, the visual aids presented above are all examples of risk communication best practice. The bar and line charts evaluated were added to help explain quantitative data. Different types of graphs have their own advantages and limitations, but can be used to enhance the information presented. For instance, the use of a bar chart compares reported number of Haemophilus influenzae type b disease cases by year, as demonstrated by the Health Canada webpage. The line graphs used by the Health Canada webpages easily and effectively shows trends over time. The videos evaluated are an example of presenting information in formats other than text. Presenting information in audio visual format can enhance patient comprehension and/or improve the readers' overall retention of information.

Vaccine Safety

Vaccine safety is most often described using solely qualitative descriptors. Broad, generalized statements about vaccine safety, without the addition of scientific references or numeric evidence are used in more than half of pro-immunization webpages found through the simulated search.

Examples of these statements include:

“Vaccines are safe, effective and necessary, with huge benefits — all through our lives. Vaccines are among the safest tools of modern medicine.” (Immunize BC)

“Vaccines used in Canada are very safe. They are developed in accordance with the highest standards and are continually monitored for safety and effectiveness.” (Immunize Canada)

“Yes. Vaccines are very safe.” (Centers for Disease Control and Prevention)

“Every vaccine is tested thoroughly to make sure it is safe for use. The dangers of vaccine-preventable diseases are much greater than the risks of a serious reaction to a vaccine.” (Health Canada)

Using solely qualitative terms, particularly to describe safety, goes against risk communication best practice as qualitative terms can be interpreted differently by different audiences.

Vulnerability of Vaccine-Preventable Diseases

Many of the analyzed resources choose to describe the successes of routine immunizations by describing vaccine-preventable disease as no longer a threat to the general population. For instance, the Centers for Disease Control and Prevention webpage titled “Five Important Reasons to Vaccinate Your Child” states:

Immunizations can save your child’s life. Because of advances in medical science, your child can be protected against more diseases than ever before. Some diseases that once injured or killed thousands of children, have been eliminated completely and others are close to extinction—primarily due to safe and effective vaccines. One example of the great impact that vaccines can have is the elimination of polio in the United States. Polio was once America’s most feared disease, causing death and paralysis across the country, but today, thanks to vaccination, there are no reports of polio in the United States.

Messages similar to the one above are frequently used throughout the pro-immunization communication materials. Given that media attention is more often directed to the risk, or alleged risk, of the vaccines rather than to the risk of the diseases, messaging regarding the eliminations

of VPDs may, in fact be counterproductive to promoting immunizations. Unfortunately, there was much less information on the transmissibility, modes of transmission, and risk of complications of once very common vaccine-preventable diseases. Nor is there any explanation of how quickly, or widely VPDs can spread among un-vaccinated or under-vaccinated populations. The relationship between a decrease in vaccine coverage and an increase in the number of VPD diagnoses is an important one for parents to understand. While many Canadians may perceive the threat of VPDs to be low, it is imperative for public health communications to accurately relay that low prevalence of VPDs is directly related to high vaccine uptake.

4.3 Simulated vs. Purposive Search

The most noticeable difference between the results from the simulated and the purposive search is that the Google searches for childhood immunization information retrieved webpages that were categorized as anti-immunization. These webpages not only discourage immunizations, they employ several persuasive communication strategies such as including personal stories, referencing scientific studies and researchers that seemingly support their argument, and use an alarmist tone when describing vaccine side effects and ingredients. These communication strategies are described in detail below. These search results are in stark contrast from the purposive search of Canadian health agencies, all of which provide information of the benefits of vaccines, and encourage childhood immunizations. Table 5 provides greater detail of the four unique anti-immunization webpages that were retrieved during the simulated search.

Table 5. Anti-immunization Webpages retrieved through Simulated Search

Name of Webpage	Frequency of Result	Description of Organization/Website
National Vaccination Information Centre – Vaccinations Knows the Risks and Failures	7	NVIC is an American charitable, non-profit educational organization founded in 1982. NVIC’s mission is to defend the informed consent ethic in medicine; they launched the vaccine safety and informed consent movement in the early 1980's and is the oldest and largest consumer led organization advocating for the institution of vaccine safety and informed consent protections in the public health system.
Stop Mandatory Vaccinations – The Dangers of Vaccines and Vaccination	7	“Founded and directed by Larry Cook, a natural living advocate, the website Stop Mandatory Vaccination aims to educate people about the vaccine anti-exemption bills being introduced across America and why they need to be stopped. The concept of the website is to use both video and written interviews of parents and others so as to make an emotional connection with people about why mandatory vaccination is wrong, as well as provide more specific education about the topic – including the dangers of vaccination. The goal of this website is to reach as many people as possible and help them understand why they must stand up and fight against the medical tyranny being proposed across America and ultimately stop all mandatory vaccination.”
Thinktwice Global Vaccine Institute – Immunization Ploys	4	“The Thinktwice Global Vaccine Institute was established in 1996 to provide parents and other concerned people with educational resources enabling them to make more informed vaccine decisions. Thinktwice encourages an uncensored exchange of

		vaccine information, and supports every family's right to accept or reject vaccines.”
Childhood Shots – Welcome to Mary Tocco’s Educational Website	1	“Mary Tocco-Hovind has been in the natural health care field for over 37 years and spent many years working in the chiropractic health field. On her website, you are able to purchase her DVDs titled “Are Vaccines Safe?” and “Vaccine Risks, Responsibility and Rights” as well as hire her for a speaking engagement. Mary is now married to world evangelist, Dr. Kent Hovind. She was the Director of Vaccine Research and Education for Michigan for Vaccine Choice, a non-profit group, insuring vaccine choice in Michigan until December 2016. She has been sharing and encouraging parents to be proactive in the health of their family, utilizing natural, holistic and health promoting ideas for raising their children. She had four of her five children born at home with mid-wives, promotes breast feeding, attachment parenting and an active healthy lifestyle, supports home education and is a dedicated Christian.”

Overall, the webpages retrieved during the purposive search of the Health Canada, Manitoba Health and Winnipeg Regional Health Authority websites scored higher on risk communication best practice items, than the pro-immunization webpages retrieved during the simulated searches. However, there were some notable exceptions. Immunize Canada’s webpage “Risks and Benefits” (simulated search) includes a checklist to help parents appraise the vaccine information they come across. This is an item on the IPDAS checklist that very few sources included. Another simulated search result, the Alberta Health Services “Common Questions

About Vaccine Safety” addresses many of the common parental concerns/ vaccine myths with appropriate detail. Additionally, the Alberta Health Services webpage “Risks and Safety in Perspective” includes quantitative baseline and intervention information, a risk communication best practice that was seldom exhibited by other pro-immunization websites.

The Manitoba Health Factsheets on individual immunizations, and the Health Canada produced Canadian Immunization Guide (both retrieved through purposive search) employ the greatest number of risk communication best practices, among all the sources analyzed. This included more often reporting the options for immunizations (i.e. how many needles are given for a particular immunization, and at what age); describing vaccine-preventable diseases; using quantitative descriptors; using visual aids to describe quantitative information; and describing how vaccines work. However, there is significant room for improvement even within these sources. First, and most concerning, these sources were not retrieved during the simulated search using common immunization related search terms, which may mean that they are not highly accessible. This is potentially worrisome given that all searches were conducted using computers based in Winnipeg, Manitoba, where presumably, local resources might be more easily accessed. Second, many of these webpages are written at a much higher reading level higher than the recommended reading level 4-8, which may preclude many parents from sufficiently understanding their messages. Third, the Canadian Immunization Guide is over 50 pages in length, which similarly may discourage readers, and preclude parents from receiving the necessary information. Lastly, even though these sources scored highest among all the sources analyzed in this project (of both simulated and purposive search results), there are numerous ways in which the messaging can be improved, based on the evidence informed risk communication strategies described earlier.

Differences between Anti-Immunization and Pro-immunization Websites

Autism

While in the scientific world, any causal relationship between immunizations and autism has been widely dispelled, a public concern continues to persist. Unsurprisingly, the discussion of autism, or other neurological effects due to immunizations is present on all of the anti-immunization websites. The anti-immunization webpage Stop Mandatory Vaccinations states:

Despite all the reporting to the contrary, vaccines have been definitively linked to autism. In 1986, a class action lawsuit against vaccine manufacturers by hundreds of parents whose children experienced regressive autism following vaccination resulted in legislation that absolved vaccine makers from liability and created a program which pays compensation for injury. As the class-action case wound its way through that system, most of those parents' claims were rejected until Hannah Poling. Her case was championed by her father, Jon Poling, MD, PhD, a neurologist and professor at the Medical College of Georgia. According to the 2011 article "Unanswered Questions from the Vaccine Injury Compensation Program: A Review of Compensated Cases of Vaccine-Induced Brain Injury" in the order to file a claim of injury in the Vaccine Injury Compensation Program, parents of injured children are pressured to blame any autism spectrum brain injuries on non-autism causes. Typical symptoms of autism such as brain swelling (encephalitis) and seizures have been compensated for as long as parents define them as side effects of the vaccine rather than calling them symptoms of regressive autism caused by the vaccine. Today 1 in 68 children has autism according to the CDC. Numerous studies listed at the US National Library of Medicine National Institute of Health, link vaccines to autism.

Another anti-immunization website, Mary Tocco's Educational Website Childhoodshots.com, under the heading "Do Vaccines Cause Autism" writes:

The autism statistics don't lie. No matter how you crunch the numbers, autism has increased faster than any other health problem ever facing children in our history. The increase of autism went from 1 in 10,000 children 25 years ago to 1 in 110 children and specifically 1 in 68 boys. [...] The one thing most of these children have in common is they all start vaccines within the first months of life and if a child is fully vaccinated they will get 38 vaccines by the age of 2. Most autism is diagnosed by the age of 18 months when development slows or stops as observed by parents. The true test would be to study the un-vaccinated and compare them with the vaccinated population. This is the one study that would really show how vaccines are affecting a whole generation of children. Until this independent study is done, can we ever be sure that

vaccines don't cause autism? After 30 years of vaccine research, I believe that the #1 cause of autism is the vaccines.

While a small number of the pro-immunization webpages address concerns regarding autism, the Stop Mandatory Vaccinations website brings up questions and concerns not previously mentioned. Whether the information presented above is truthful or accurate, the organization confidently and assuredly claims there is a link between vaccines and autism. The level of detail, and persuasive messaging used may be enough to cause the reader to believe what they are reading.

Ingredients

Another commonly used tactic among the anti-immunization webpages is to discuss the ingredients used in vaccines, and their potential to cause harm in humans. The anti-immunization websites typically argue that ingredients such as aluminum adjuvants, thimerosal (mercury), allergens, live viruses, bacterial toxins, and animal tissues may cause unknown side effects when used in vaccines. They write that the amounts of these ingredients used in vaccines have never been studied for safe injection limits, and may be causing undue harm to those who receive the vaccines. For example, the website Stop Mandatory Vaccinations writes:

However, those trace amounts [of mercury] still exceeds the FDA recommended amounts that can be ingested. Vaccines are injected rather than ingested. So is there a safe amount to inject? We don't know because that research has never been done. The FDA ordered such studies in 1982; the CDC still has not commissioned such a study. [...] Mercury, even in small trace amounts, is harmful. Exposure to any mercury is problematic because like aluminum, it also accumulates in the brain causing many forms of neurological damage that affects movement, learning, and social behaviors. Mercury is 500 times more toxic than lead and is second only to plutonium as the most toxic metal known to man. Mercury poisoning and the symptoms of autism are strikingly similar.

On the contrary, only a very small number of pro-immunization webpages mention ingredients, explain the function for each ingredient used in vaccines, and /or discuss the scientific evidence explaining safe toxicity levels of these ingredients. The CDC webpage “Infant Immunizations Frequently Asked Question” answers the question “What are the ingredients in vaccines and what do they do?” by answering:

A: Vaccines contain ingredients that cause the body to develop immunity. Vaccines also contain very small amounts of other ingredients—all of which play necessary roles either in making the vaccine, or in ensuring that the final product is safe and effective.

This answer is vague and does not address specific concerns that readers might have regarding individual ingredients. Additionally, this answer does not explicitly mention the ingredients and/or their purpose, which may be cause for suspicion for someone who had read alarming information on an anti-immunization website. However, the Canadian website Immunize BC provides a more thorough explanation surrounding vaccine ingredients:

Aluminum has been present in vaccines for over 70 years with no reported serious adverse reactions. Aluminum salts are added to vaccines to help them work faster, better and longer. Because we add aluminum to vaccines, significantly fewer antigens (pieces of the germ that the immune system recognizes) are needed to produce a good immune response. [...] Aluminum is present in the infant's body from birth, and in breast milk and in infant formula. For example, in the first 6 months of life, infants are exposed to approximately 4mg of aluminum in vaccines. In this same time period, they are exposed to approximately 10mg of aluminum in breast milk, 40mg in infant formula, and 120mg in soy formula. Aluminum is present in breast milk and in infant formula in similar amounts as in vaccines. This amount is very small and extremely safe for infants. [...] In B.C., thimerosal has not been used in any routine childhood vaccine since 2001, except for the flu vaccine. Thimerosal is a mercury containing preservative present in small amounts in the flu vaccine to prevent bacterial and fungal growth. If a person received a vaccine contaminated with bacteria or fungi, he/she could get sick. Did you know? Eating a can of white albacore tuna exposes you to two and a half times the amount of mercury in a flu shot, and the mercury found in vaccines is excreted from the body much faster. A large number of studies have shown no link between the use of vaccines containing thimerosal and harm to

children. These studies are posted on the Institute of Medicine of the National Academies website.

Given that the majority of pro-immunization webpages do not explain the purpose and function of vaccine ingredients, it is possible that a reader may only encounter the information given by anti-immunization webpages. This is cause for concern as these webpages are most often written to incite fear and anxiety over the safety of vaccines and their ingredients. It is therefore extremely important that other sources of information (such as health care professionals) are able to adequately provide correct information about vaccine ingredients to concerned parents.

Scientific References

Another highly used tactic of the anti-immunization webpages is to include scientific references and sources for their messages. Including names of physicians, researchers and/ or recognized research institutions adds an aura of legitimacy to their message and makes it more difficult for readers to distinguish between credible and unreliable sources. In turn, this may increase the level of trust for this source, and raise doubts about the pro-immunization websites that do not include reference information. This is particularly detrimental as many pro-immunization websites from recognized, credible health institutions do not provide scientific references, author, or source information, while websites such the National Vaccine Information Centre, and Stop Mandatory Vaccinations – websites that curate anti-vaccination material, and do. The anti-vaccination website Stop Mandatory Vaccinations utilizes this tactic by stating:

Dr. Michael Pakickero warns parents that some batches of the DPT vaccine are more toxic than others. And, Dr. John Menkis, the former head of pediatrics and neurology at UCLA, candidly acknowledged, "You will have permanent, irreversible brain damage, which was not present before [DPT] vaccination." Meanwhile, Michael Settonni, the show's premier research journalist,

estimated from government sources that "at least two children are reportedly killed or injured by the vaccine every day.

Personal Stories

Using personal examples, including emotional stories and/or videos to convince readers that vaccines are dangerous and/or unnecessary is used throughout the anti-immunization webpages.

For example, the website Childhoodshots, created by anti-vaccination personality Mary Tocco uses Mary's personal experiences as the basis of her argument against vaccines. The website describes Mary as a natural health advocate, and producer of the educational DVDs called, "Are Vaccines Safe?" and "Vaccine Risks, Responsibility and Rights". Her website states:

Mary Tocco has been in the natural healthcare field for over 35 years. She has been independently investigating vaccines and passionate about natural health and wellness as a lifestyle. She has five grown children and now seven grandchildren who are all raised natural, outside the medical model. Her research proves that vaccines do not protect, can cause injury and death and do not lead to life-long immunity to diseases.

The above excerpt is one of several examples of personal, emotionally charged stories, used as a persuasive communication strategy by the anti-immunization webpages retrieved in this study.

CHAPTER 5: DISCUSSION

5.0 Significance of Findings

Chapter five expands upon the key issues raised from the results chapter. The results from this study are compared to risk communication best practice, evidence informed risk communication guidelines, and previous studies addressing the role of communication within the context of vaccine hesitancy. While the risk communication products examined do achieve some risk communication objectives, overall there are a significant number of areas in need of improvement. Risk communication best practice is highly informed. It is crucial that at minimum, childhood immunization communication products produced for public dissemination follow these guidelines. Regular evaluation and assessment of materials is necessary to best inform the public, encourage informed consent, and increase parental confidence in vaccine decision-making. Reflecting upon the health belief model, using the risk communication best practice strategies available may in turn increase vaccine uptake in high need areas.

The results of the simulated search clearly indicate that both the location of the Google search (i.e. the computer used) and the search terms chosen greatly affect the results of the search. Several combinations of commonly used vaccine related search terms yielded anti-immunization webpages on the first page of results, while different computers also produced distinct results. This result is significant as it emphasizes the findings from other studies addressing vaccine hesitancy and decision-making. Parents have the responsibility of navigating an increasingly complex mediascape, in which conflicting information about vaccines, and vaccine-preventable disease constantly compete for attention. Readers who frequently encounter negative vaccine information through their online searches may be wary of recommendations made by their physicians or local health authorities, particularly if they feel that their physicians cannot adequately address concerns raised by anti-immunization advocates (Gullion, 2008).

Secondly, as presented in the previous chapter, anti-immunization websites such as the strategically named National Vaccine Information Centre, utilize several persuasive communication strategies that make it difficult for readers to decipher between legitimate and illegitimate information. These strategies include the use of personal stories, using an alarmist tone when describing vaccine side-effects, and citing seemingly scientific references. Research has shown that feelings about risk events can have greater influence on behaviour than thoughts (Finucane et al. 2000). As demonstrated in several studies, emotion inducing media, particularly feelings of fear or worry can increase participants perception of risk (Diefenbach, Miller, and Daly 1999; Lerner et al. 2003). Furthermore, Nyhan et al. found that the use of emotionally evocative imagery may strengthen beliefs in a vaccine/ autism link among certain groups of parents (Nyhan et al. 2014). Personal anecdotes and narratives may be more influential than previous research suggests, as they tend to be left unspoken in face-to-face conversation with health professionals (Rodriguez 2016). By definition, Charlton and Walston (1998, p.148) write that an anecdotal fallacy “privileges direct and recent experience even when such experience is poor in quality and unsupported or contradicted by other valid sources of relevant contextual knowledge” (Charlton and Walston 1998). The use of a central character in an anecdote, has been shown to increase estimations of risk and skew overall risk assessment (Cho and Friley 2014). This often means that for some vaccine-hesitant individuals, when comparing personal experience alongside scientific data, the former is more persuasive – perhaps due to inability to reconcile personal experiences with the scientific findings.

Additionally, Rodriguez found that when justifying beliefs based on research, anti-vaccination individuals active on online forums, tended to try and debate the mainstream science of vaccines, or questioned the trustworthiness of those who conducted studies (such as

pharmaceutical companies). This research found that anti-immunization webpages commonly reference scientific figures and/or provided the author's credentials, which emphasizes Rodriguez's findings: that these individuals frequently attempted to devalue findings in the mainstream scientific community and valorize the work of "independent" investigators and researchers (Rodriguez 2016). It has been shown that parental exposure to anti-immunization sites for even a few minutes increases perceptions of risk, and can reduce the likelihood that parents will vaccinate their children several months later (Betsch et al. 2010).

Risk communication research has shown that the message a communicator intends to convey is never the exact same message that the recipient receives. Several factors, both internal and external, affect whether the communication succeeds in achieving its purpose, such as: the skill and credibility of the communicator; the suitability of the message; the way in which the message is delivered; the receptivity of the audience, and distractions in the environment. *"Communicating Risks and Benefits: An Evidence-Based User's Guide"* advises pre-testing the messaging before promotion, as communication research has shown that intended outcomes are more likely to be met when targeted recipients are involved in the design and dissemination of health communication. This research found that one significant limitation of the risk communication products evaluated, is the reading level at which they are written.

Literacy levels, language, culture, and disability all affect one's ability to understand the health information they are given. Literacy is defined as (2005, p. 2) "using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential" (Kutner, Greenberg, and Baer 2005). Many webpages contain text written at levels higher than recommended for public dissemination, and much higher than recommended reading levels for health information. Literacy skills are generally lower among people with lower

education, lower income, who are members of a minority group, whose first language is not English, seniors, Indigenous peoples, and those who experienced disruptive childhoods (Statistics Canada 2011). Those with lower abilities to read or understand written materials face specific barriers in attempting to understand their health condition, prevent disease, manage medications, make health decisions for their family, access health services or understand their insurance policy. The World Health Organization describes health literacy as:

More than being able to read pamphlets and successfully make appointments. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment (World Health Organization 2016).

The US National Assessment of Adult Literacy (NAAL) found that approximately 43% of adults in the United States had basic or below basic prose literacy skills - the 2 lowest of 4 levels. This survey also found that those scoring in these two lowest health literacy categories (basic and below basic) were unable to correctly answer questions describing hypothetical scenarios of taking medications at certain times of the day, filling out patient information, and other important health tasks. Most adults with a high school education or less, and 13% of those with a college degree tested at these lower literacy levels. Furthermore, 20% of adults are estimated to read at the 5th grade level or below (Doak, Doak, and Meade 1996). Even those who tested at the intermediate level on the NAAL survey had difficulties with numeracy, such as being unable to understand health information on graphs and calculating health costs. Only 12% of the US population is considered health literate, meaning they can correctly answer questions on the set of health literacy tasks routinely required in modern medical systems.

Within the Canadian context, the 2003 International Adult Literacy and Skills Survey found that only 58 out of 100 Canadians aged 16-65 have the reading skills necessary for basic

everyday tasks. This means that 42% of working aged Canadians have lower literary skills than necessary to handle the information relayed to them on a day to day basis (Statistics Canada 2011). Helitzer and colleagues describe the serious “mismatch” that occurs between the literacy levels of the intended audience and the health materials that have been created for that audience (Helitzer et al. 2009). Most patient education materials and health care forms are written at unacceptably high reading levels (Fischhoff 2012; Helitzer et al. 2009). The health resources analyzed in this project are no exception. To promote informed consent, childhood immunization communication products must be written at appropriate reading levels, and tested for readability before dissemination.

For individuals to be adequately informed about their health options, they need risk and benefit information provided to them in numerical contexts. One significant limitation of solely using qualitative description is that there is a lack of consensus surrounding terms such as ‘low risk’. Whereas one person may consider a 10% risk low risk, others may not. Secondly, research has shown that without numeric risk and benefit descriptions (i.e. only using verbal descriptors), individuals experience exaggerated perceptions of risks and benefits, and are less able to identify safer options (Schwartz, Woloshin, and Welch 2007, 2009; Berry et al. 2003). Unfortunately, numeracy, or the ability to comprehend, use and, attach meaning to numbers, is not a universal skill. To make quantitative information easier to understand, it is essential that the information is presented in an accessible way. Making numbers more accessible is unlikely to have a negative effect on those with higher numeracy skills, as they can easily understand information presented in different formats. Secondly, information processing skills decrease under stress, thus even those with high numeracy levels can benefit from straightforward communication materials.

Overall, the pro-immunization webpages evaluated do not adequately provide

quantitative information. Recommendations for improving reader comprehension of numerical information include: making numbers accessible to readers of all skill levels; keeping denominators constant; keeping time frames constant; using pictographs and visual aids when possible; providing both positive and negative frames; and making the differences between baseline and treatment options clear (Fischhoff 2012). When providing numerical information, risks and benefits can be presented either as percentages (i.e. 10% of patients), or as natural frequencies (i.e. 10 out of 100 patients). Given a choice between percentages and natural frequency, studies have shown that patients interpret side effects as less risky when presented in percentages, rather than frequency. Peters and collaborators proposed that this is due to frequency formats eliciting greater personal connection compared to percentage formats, which are relatively abstract and meaningless (Peters et al. 2009). Presenting denominators, and time frames in a consistent manner is imperative for numeracy. A single denominator should be chosen when presenting options (e.g. 100 in 100,00 or 350 in 100,00) and denominators should be kept large to avoid using decimals. Similarly, to facilitate comparisons, timelines for risk and benefit information should be kept consistent. Clearly presenting differences between baseline and treatment risks is another tool for improved reader comprehension. One method to facilitate comprehension is to visually separate baseline risk from treatment risk, using separate pictographs. Lastly, providing both positive and negative frames is recommended. For example, stating “95% of people will acquire immunity from a single vaccine”. Meaning 5% of people may require a booster for life long immunity. This can be particularly important for readers with lower numeracy skills, as they are unduly influenced by whether an intervention is described in positive or negative terms (e.g. success rate vs. failure rate).

Another risk communication best practice is ensuring that all the critical information on a topic is accessible to the reader. Increasing reader comprehension by providing critical information first and foremost is one of the evidence informed best practices for improving health literacy (Fischhoff 2012). Several longstanding resources and references exist to inform best practice for designing health educational materials, and studies have shown that the majority of audiences, regardless of literacy level, prefer health materials that are clear and concise (Fischhoff et al. 2012). The ‘common knowledge’ effect is a communication pitfall that can cause misunderstandings with serious repercussions, particularly in the case of health communication (Epley et al. 2004). The ‘common knowledge’ effect is seen when experts and professionals in the health field exaggerate how much of their knowledge is shared by others. As a result, they may fail to communicate important aspects of their overall message. Providing informational materials that help parents understand the basic function and purpose of immunizations is a necessary first step in the decision-making process. Most importantly, providing critical information in a comprehensive manner empowers individuals to seek out further information, ask their healthcare provider questions, and feel confident in their vaccine decision-making ability. Providing critical information in an easy-to-understand, prominent manner is one risk communication best practice that pro-immunization webpages from both the simulated and purposive searches follow. However, this strategy is not sufficient on its own; risk communication best practice outlines several complimentary strategies for communication products.

A recent Canadian consultation study found that the most commonly cited recommendation among the surveyed immunization researchers, policy-makers and vaccine providers, was to ‘use research to debunk vaccine myths’ as the most effective approach for

persuading vaccine hesitant parents to change their beliefs and behaviours (Greenberg, Dubé, and Driedger 2017). One key parental concern cited in literature is that children receive too many vaccines, and that the child's immune system may become 'overwhelmed' or 'weakened' by the number of vaccines they receive (Dubé, Gagnon, et al. 2016a; Williams 2014; Heininger 2006; Rodriguez 2016; Dubé, Gagnon, et al. 2016b). Rodriguez found that the most common concern voiced by anti-vaccination advocates among the online message board ATS (AboveTopSecret) is that children receive too many vaccines on the recommended schedule, and that the bulk of studies only reviewed a single vaccine rather than the combined effects of all recommended vaccines (Rodriguez 2016). Another very common concern is that vaccines may cause autism. This myth continues to persist among both Canadian and American parents. One Canadian study found that even among parents of fully-vaccinated children, 28% believe or are uncertain whether there is a link between vaccine and autism (Greenberg, Dubé, and Driedger 2017). Another 2014 study indicated that less than half of Americans (44%) disagreed with the statement that (2014, p. 817) "doctors and the government still want to vaccinate children even though they know these vaccines cause autism and other psychological disorders" (Oliver and Wood 2014).

Anti-immunization websites are quick to claim a causal relationship between vaccines and autism, as demonstrated in the results. Mary Tocco's anti-immunization website writes that no independent studies examining vaccines as the cause of the autism have been conducted, and that after her 30 years of research she believes vaccines to be the primary cause of autism. For readers who do not have access to scientific literature, it is easy to believe her arguments as true. Unsurprisingly, recently published literature found that although serious vaccine related injuries are rare, more than twenty-five percent of parents surveyed agreed or were unsure about the

statement, “there is a strong likelihood that the MMR vaccine will produce serious adverse reactions” (Greenberg, Dubé, and Driedger 2017). These findings indicate that anti-vaccination messaging has been able to persuade parents of fully vaccinated children, and that some of their most dangerous claims, that vaccines will injure your child and can cause autism, have achieved a concerning degree of public significance (Greenberg, Dubé, and Driedger 2017). This myth is a particularly concerning for health authorities and health professionals as there is overwhelming scientific evidence to show that there is no link between vaccines and autism.

Addressing myths, such as vaccines causing autism, is demonstrated by several of the pro-immunization webpages, however the degree to which a myth is de-bunked, as well as whether the webpage includes original scientific sources, varies greatly. As described in the results section, both the Prairie Northern Health website and the Vaccinate Your Baby website address the question of whether vaccines cause autism. While the take-away message from both websites is the same, the Prairie Northern Health website provides much greater detail, citing several individual studies, from various countries, as well as addressing the specific concern regarding ingredients used in vaccines leading to autism. This detailed explanation of the current scientific evidence examining autism and vaccines may help parents feel more assured in the information they are reading. While reading levels, and understanding of scientific literature will vary greatly by readers, some hesitant parents may find the detailed explanation addresses their concerns more thoroughly than a generalized statement. Providing up-to-date scientific evidence regarding a particular concern, may help increase the trust in that institution, and in turn, in that institution’s recommendation (Wilson et al. 2008; Gullion, Henry, and Gullion 2008).

5.1 Necessity of Vaccine Risk Communication

Continued uncertainty about vaccine risks and benefits elicits the need for vaccine risk communication. Several qualitative studies exploring parental perceptions, facilitators, barriers, and attitudes to routine childhood immunizations found that parents wish to receive the necessary vaccine information prior to having to make a decision (Wilson et al. 2008; Miller, Verhoef, and Cardwell 2008; Luthy, Beckstrand, and Callister 2010; Gullion, Henry, and Gullion 2008; Glanz et al. 2013; Austin 2001). Glanz and colleagues identified three key components of the decision-making process: the timing of the decision (most parents begin making their vaccine decisions regarding their infant either during pregnancy or while making their birth plans), parents' constant re-evaluation of their decision, and lastly, that parents described seeking multiple sources of vaccine information as part of their evolving decision-making process. One participant in this study describes the high levels of stress involved with trying to find reliable information sources (2013, p. 484) by saying:

I am stressed about this. This whole topic is stressing me out more than you can even believe. I mean, half the stuff I can't even understand, but it's totally frustrating and stressful to think that, oh, great, now we have to worry about this. There are so many other things to worry about, too. I don't know, I wish we could have more choices (Glanz et al. 2013).

Risk information seeking is a significant step in the parental vaccine decision-making process. Health institutions are responsible for providing the necessary information for individuals to make informed decisions, and health communication products must be designed in a way to achieve this goal. Rather than utilizing scare tactics or shame parents for their decision, which have been found to be largely ineffective, and may in fact be counterproductive, (Nyhan et al. 2014; Sandman and Lanard 2003) the analyzed resources commonly choose to discuss the

significance of this decision, in particular why vaccines are important, and who the decision affects (their child, their family).

A recent survey found that low perceived vulnerability, or low perceived severity of diseases were the most frequently cited reasons for not vaccinating their children, as reported by vaccine-hesitant parents (Dubé, Gagnon, et al. 2016b). This uncertainty in the continued necessity for routine childhood immunizations has been mirrored by parents in several other vaccine hesitancy studies (Yaqub et al. 2014; Wolfe and Sharp 2002; Calandrillo 2003), including a Canadian study in which 17 percent of parents consider vaccination “less important today than in the past” (Greenberg, Dubé, and Driedger 2017). The authors write that this finding causes concern, given the resurgence of VPDs such as measles, mumps and whooping cough. The overall reduction in vaccine-preventable diseases (VPDs) as a result of widespread vaccination programs, has led to the majority of the Canadian population, as well as a significant proportion of health professionals, having no first-hand knowledge of the risks of these diseases (Dubé et al. 2013). Furthermore, messaging that promotes the successes in vaccine programs may promote the notion that VPDs no longer pose a threat to our population, regardless of vaccine uptake.

This greatly underlines the importance of health agencies and authorities to use risk communication best practice to establish message reliability with readers. Evidence suggests that an audience is most likely to believe sources that they perceive to be credible (expert, trustworthy, and concerned about the audience’s interests), likeable, appealing, and similar to them. Credibility is most impactful when it is established before the message is given (Gass and Seiter 2015). Including author’s credentials, providing scientific evidence and referencing specific scientific studies are all risk communication best practices to establish credibility. As

mentioned in the results section, very few pro-immunization webpages include these details. This is in stark comparison to the anti-immunization webpages that made a point to highlight specific studies, doctors and researchers, all which appear to validate their argument. It is extremely difficult for the general public to access scientific databases, and/or peer-reviewed scientific journal articles. Therefore, it is the responsibility of communication products intended for public audience, such as the webpages evaluated in this research, to not only bring the scientific evidence to light, but to explain the quality of scientific evidence available. The results of this thesis provide further evidence for strategies in which health agencies can employ to establish trust, empower readers, and promote confidence in vaccine decision-making.

Immunizations are a unique health intervention, as they are given to healthy individuals, usually infants and children, resulting in low public tolerance for potential risks. Perceived vaccine side effects receive as much media attention as real safety risks and can be difficult to dispel despite credible scientific evidence. Blanket claims of the safety of vaccine have proved to be remarkably ineffective in diminishing concerns regarding ingredients, side effects, the effect of multiple vaccines, or other specific concerns and highlights need for greater consideration of both the historical context and specific arguments against vaccination (Rodriguez 2016). Additionally, parents' decisions have been found to be motivated by *omission bias*, meaning they would feel higher regret if their child were injured from their action (getting the vaccine) than from their inaction (not getting it) (Meszaros et al. 1996; Asch et al. 1994; Ritov and Baron 1990; Bostrom 1998a, 1998b). Starr proposes that this is because individuals treat voluntary and involuntary risks differently, empathizing the responsibility of the public health community to accurately and explicitly communicate expected vaccine risks to parents (Starr 1969). Meszaros and colleagues found that this was coupled the fact that with non-vaccinating parents held

dramatically different beliefs about the possibility of serious vaccine side effects, while also believing they have a much better ability to prevent the disease (Meszaros et al. 1996).

Risk communication science states that the first step in any communication (2012, p. 45) “is to define risks, costs, and benefits in ways that allow people to construct stable, informed preferences” (Fischhoff 2012). This recommendation includes defining risks with multiple outcomes (e.g. outcomes or side effects experienced by different population groups), defining risks with multiple features (e.g. familiarity of risk, public views, certainty of risk, control of risk), and lastly, defining risks that may occur over time (e.g. conveying when these outcomes might occur). Trust in information source has been cited by many studies examining the parental vaccine-decision making process. An extensive review of vaccine hesitancy literature highlights that trust in information source plays a significant role in the vaccine decision-making process, particularly for parents who are hesitant to vaccinate their children (Yaquib et al. 2014). Moreover, trust in online sources adds another level of complexity to vaccine communication. Paige and colleagues found that significant socio-demographic disparities in perceived trust in online health communication channels and information sources exist at varying levels of eHealth literacy (Paige, Krieger, and Stellefson 2017).

There is an increasing demand for evolved forms of practitioner–patient (or parent) communication (McNeil and Arena 2017). These include using a full spectrum of modes of communication, verbal and non-verbal, written, imaging, and videoed through mediums such as electronic messages or webpages. These modes of communication allow for conversational flexibility that in turn allows both parties to listen closely and respond with questions, as well as answers that may allow for a more authentic transaction of information. These transactions encourage shared construction of meaning and empower both parties to actively engage in the

dialogue. However, accessibility to internet based information requires a minimum level of eHealth literacy (defined as “the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem” (Norman and Skinner 2006)). It is essential that information presented in electronic format is able to be received, and understood, by audiences of all levels of eHealth literacy.

While many pro-immunization webpages scored well on the IPDAS checklist items regarding webpage navigation, there remain outstanding areas for improvement. Items that were not as consistently well scored were: providing feedback for information entered, and the ability to interact with others through the webpage (e.g. discuss content with other readers through an online forum, leave a comment, or ask a health professional specific questions). Additionally, none of the webpages include a feature where readers could input specific health information and receive individualized feedback. It has been shown that parents making health decisions on behalf of their child require specific decision supports, including the need to talk with others in the same situation to share information, experiences and ideas (Jackson, Cheater, and Reid 2008). This component should also take into consideration cultural and/or linguistic adaptations based on the target population (Kreuter et al. 2004; Gowda et al. 2013; Gerend, Shepherd, and Lustria 2013)

While there is a significant variety of information provided by pro-immunization websites, anti-immunization webpages conflict readers as they emphasize the risks of immunizations and minimize the benefits. As outlined by the HBM, individuals’ health actions are influenced by their perceived susceptibility to the problem, perceived severity of the consequences of the problem, perceived benefits of the preventative behaviour, and perceived barriers to action. The new information provided by anti-immunization webpages may place just

enough doubt in readers' minds for them to shift closer to vaccine refusers on the vaccine acceptance scale. For the most part, regardless of their decision, parents choose what they think is best for the health of their child. Greenberg and colleagues (2017) found that the majority of participants (77%) who self-identified as holding anti-vaccine beliefs, considered only messages that "provide positive encouragement and emphasize that vaccines are strongly recommended, but ultimately the decision is theirs to make" as ones that might effectively persuade those with similar beliefs to vaccinate (Greenberg, Dubé, and Driedger 2017).

The public health information role of health institution and regulatory agencies is to provide the public with the necessary information in a timely, culturally and linguistically appropriate manner, to understand key issues and to help them make informed decisions about their health. Health institutions and regulatory agencies' communication strategies aim to engage, inform, and educate their audience, thereby empowering their readers to feel confident in their decision making. It is therefore incredibly important that the communication products they design utilize risk communication best practice to achieve that goal. Despite the rise in social media trends, and the increasing numbers of personal webpages and blogs, most parents of young children continue to depend upon traditional media and official health agency websites for up-to-date and credible information about vaccines (Greenberg, Dubé, and Driedger 2017). Interventions used to address VH that recognize how beliefs, perceptions, attitudes and knowledge play an important role in influencing behaviour, provide evidence for aspects that could be addressed through improved public health communications. For example, people who are identified as concerned, or 'on the fence' in their attitudes and beliefs are a target group for public health interventions, as this group has been shown to be more open to public health advice than those who adamantly refuse. This finding not only supports the necessity for accessible, and

timely risk communication products, it emphasizes the incredible opportunities to utilize evidence informed risk and benefit communication best practice.

CHAPTER 6: CONCLUSION

6.0 Contributions of this Study

The purpose of this case study is to evaluate publicly available childhood immunization informational webpages against risk communication best practice. Overall, it can be determined that several improvements to these communication products can be made. Informed by risk communication best practice guidelines, this research has been able to answer its previously stated research objectives. Effective and appropriate solutions to address vaccine hesitancy in Canada have yet to be established. The Vaccine Acceptance and Uptake Task Group (VAUTG), a sub-group of the Communicable and Infectious Disease Steering Committee (CIDSC) of the Pan-Canadian Public Health Network (PHN) has recommended that research focused on risk/benefit communications should be one of the avenues pursued to target vaccine hesitancy within Canada. In particular, they suggest that future research should examine how the scientific/public health community can effectively and efficiently communicate information to the general public and targeted/communities with sub-optimal uptake rates. This project provides a crucial first step for this direction of research within Canada.

The purpose of this study is to evaluate existing communication materials to identify where, and how, these materials could be improved based on risk and benefit communications best practice. Improving the means in which the necessary information on childhood immunizations is delivered to parents and caregivers is a definite priority. In turn, this may gradually reduce the disparities between the scientific consensus on immunizations and public opinion, leading to improved immunization coverage. Several strategies and frameworks for communicating with vaccine-hesitant individuals have been proposed (Williams 2014). One

study recommends speaking openly about the risks of vaccination, followed by providing additional accurate informational resources (Healy and Pickering 2011). Another strategy suggests classifying parents by their beliefs about childhood vaccines (i.e. unquestioning acceptor, cautious acceptor, hesitant, late, or selective vaccinator, or the refuser) and tailoring your communication efforts to the different categories (Gust et al. 2005). Jacobson and colleagues propose the C.A.S.E. approach (Corroborate, About Me, Science, and Explain/Advise) for discussing vaccines (Jacobson, Van Etta, and Bahta 2013). This approach suggests that specific concerns of the individual parent should be discussed, while encouraging providers to specifically explain why they are experts on the benefits and risks of vaccinations. The theory behind this method is that by first gaining parental trust through conversation, and then sharing the medical information and making a recommendation based on the data, the discussion will be more effective.

This research provides unique contributions to the literature. While there have been previous internet-based studies that assessed the type of vaccine information retrieved through parent simulated searches, none of these studies were conducted within Canada, and none chose to compare search results by location. Secondly, this evaluation is the first (to our knowledge) to gather evidence of risk communication strategies used by sources that are commonly found using vaccine related search terms, within a Canadian location. The first objective of this case study was to identify what immunization information is retrieved when simulating a search undertaken by a typical parent, using computers with different IP addresses, in multiple locations. From the results of our simulated search it can be concluded that both the location of the search (i.e. the computer used) as well as the choice of key words greatly influence the results. From our search, we found that while pro-immunization webpages were predominantly retrieved, anti-

immunization webpages and webpages that were neutral towards immunization were also found using common vaccine related search terms. It is unsurprising that the majority of retrieved resources were pro-immunizations, as the vast majority of public health institutions and health related media sources promote vaccine uptake. However, the finding that anti-immunization material continues to be retrieved using common vaccine related search terms is important. These materials will continue to have an effect on parents' vaccine decision-making process as long as there are discrepancies between expert and public vaccine risk perceptions.

The second and third objectives of this study were to evaluate a sample of the content of the webpages retrieved through the simulated search, and a sample of official public health agency webpages on childhood immunization, against risk communication best practice. This study summarizes the communication strengths and weaknesses of the evaluated routine childhood immunization webpages. Evaluation was done by using criteria sought from "*Communicating Risks and Benefits: An Evidence-Based User's Guide*" written by Fischhoff and colleagues, as well items from the International Patient Decision Aid Standards checklist. This study found that while many of the examined pro-immunization webpages excel at providing crucial vaccine information, addressing vaccine myths and parental concerns, and recognizing the significance of the vaccine decision making process, there remain many outstanding opportunities for improved communication and engagement with target populations. Secondly, webpages found through the purposive search utilize a greater number of risk communication best practices than those found through the simulated search. Lastly, the anti-immunization webpages retrieved employ a number of persuasive communication strategies such as inciting fear and worry when describing vaccine risks, using scientific references to support

their arguments, and including personal stories. This finding speaks significantly to the type of information on which parents may be exposed to prior to making their vaccine decision.

The fourth objective of this research was to compare and contrast the content retrieved between objectives 2 and 3 and assess potential implications for parental vaccine decision-making. Recommended risk communication strategies brought forward by this research include: communicate honestly about risk, including those associated with taking and not taking an action; asking readers what outcomes matter most to them; providing quantitative baseline and risk information; utilizing visual aids, providing authors' qualifications and references to scientific knowledge; including an interactive component to engage with health professionals or other parents; and pre-testing communications with target groups for reading levels and message effectiveness. This project also supports the importance of continuing to assess the reasons why parents choose to delay or refuse childhood vaccines, to design appropriate, timely communication interventions.

Although those who adamantly oppose vaccinations might be immune to public health influence, others who fall into the vaccine hesitant category are left with questions after encountering confusing information online. Communication literature has shown that in these, and in most instances, parental concerns should be met empathetically, while responding to the root cause of the concern. Vaccine-hesitant individuals, for the most part, are not opposed to the idea of vaccines per say, rather they are highly concerned for the wellbeing of their children (Rodriguez 2016). When such concerns are met with vague reassurances about vaccines, one may feel like their concerns are being ignored and seeds of doubt may begin to take root. This thesis emphasizes the importance of public health communications employing evidence informed risk communication strategies to ensure informed consent, empower risk management, and to

increase parental confidence in vaccine decision-making. These findings are significant to vaccine research network members, public health policy makers, and frontline health workers. Knowledge gained by this project is useful to Canadian public health agencies, regional health authorities and community organizations, and serves to enhance effectiveness of public health efforts to increase public vaccine confidence.

6.1 Recommendations

In addition to providing an evaluation of routine childhood immunization webpages, this research also serves to inform the development of future communication products. While the analyzed webpages provide a variety of information, there are outstanding opportunities for improvement. Utilizing the evidence provided in this report, the following suggestions for change have been put forward.

1. Vaccine risk communication products should first and foremost foster informed risk decision making for all stakeholders (e.g. parents and caregivers). To do this it is critical to define what the communication product is intended to accomplish. Messages containing instructions on appropriate or recommended actions must be specific, and provide readers with precise details regarding when, what, how and for how long.
2. The communication product should acknowledge the significance of the vaccine decision, while ultimately acknowledging that it is a parental choice. Health communication efforts should aim to create an environment that allows parents to explore evidence for effective shared decision making, while messages should provide parents with the tools they need to confidently make a decision. The IPDAS checklist suggests asking readers which outcomes matter most to them (both positive and negative outcomes

of the decision to, or not to vaccinate) which can help readers make a decision.

Additionally, the communication product should include suggested ways to talking about the decision with a healthcare provider.

3. It is important to measure the readability of communication products prior to dissemination. Research has shown that most health risk information can be well written at a 6th grade level without sacrificing content or style (Fischhoff 2012). There are over 40 different readability tests, with different levels of reliability and varying limitations. Fischhoff and collaborators recommend using at least two readability tests on the intended communication products. Content should be sampled, prepared, and tested according to the test instructions.
4. Vaccine resources should communicate honestly about risk, including quantitative information about both positive and negative outcomes of the intervention, compare outcome probabilities using the same denominator, time period and scale, describe uncertainty around probabilities, provide baseline and intervention information, and place probabilities in context to other risks.
5. Resources should include an interactive component, including but not limited to: a checklist of concerns or questions that parents may have prior to consenting to immunizations; individual feedback based on submitted information; or an opportunity to discuss with a healthcare professional. Interactive components should also take into consideration cultural and/or linguistic adaptations based on the target population (Kreuter et al. 2004; Gowda et al. 2013; Gerend, Shepherd, and Lustria 2013).
6. A systematic review of parental decision support needs found that parents require timely, consistent, up-to-date, evidence-based information tailored to the individual, delivered in

a variety of formats from trustworthy sources (Jackson, Cheater, and Reid 2008). This is in addition to literature that has shown that parents find it difficult to identify credible sources of online vaccine information. Therefore, webpages should provide authors'/contributors' qualifications (i.e. being identified as a pediatrician may increase level of trust in source) (Nyhan et al. 2014; Chow et al. 2017). The webpage should also include references for information, make note of important studies, describe the quality of current scientific evidence, and provide a lay summary of the evidence. Lastly, IPDAS recommends reporting how often the information is updated and when the last time the webpage was updated.

7. Health messages should be tested before dissemination. This step should include pre-testing with the target audience to ascertain whether the key messages are being understood as intended, as well as testing for recommended reading levels (reading levels 4-8 are recommended for public health messages). Risk messages should be tailored for the diverse audiences they are intended to reach, taking into account differences in and the influences of social, cultural and demographic backgrounds. This target population should include those who may be skeptical, or are hesitant to vaccinate if one of the overall goals of the messaging is to promote vaccine uptake (Nyhan et al. 2014).
8. Online health information should be tailored through a variety of trustworthy online channels according to diverse audiences' socio-demographic and eHealth literacy levels. Evidence suggests that significant socio-demographic disparities in perceived trust in online health communication channels and information sources exist at varying levels of eHealth literacy (Paige, Krieger, and Stelfox 2017). Vaccine research network members and policy makers should consider the socio-demographics and eHealth literacy

level of an intended audience when tailoring information through trustworthy online health communication channels and information sources.

9. Use pictographs and other visual aids when possible. This is particularly important when describing probabilities, comparing intervention options (such as recommended immunization schedules or different methods of receiving immunizations), and/ or comparing baseline and intervention risks. Using graphs, diagrams and other visual aids can help increase numeracy of the intended audience (i.e. the ability to understand, and apply meaning to numbers presented), as well as improve message comprehension of those with lower literacy.

6.2 Limitations and Future Research

While evaluation of communication products is integral to effective risk communication practice, vaccine hesitancy cannot solely be regarded as a symptom of ineffective communication efforts. It is important to recognize that informed health decision making includes informed refusal of public health recommendations, such as immunizations. This project is therefore limited in its utility to address causes of vaccine hesitancy that are not associated with lack of public knowledge regarding immunizations. Reviews of recently published literature have found that vaccine hesitancy is a multifaceted social phenomenon, composed of complex issues, including, but not limited to, poor public health literacy, discrepancies between public perception of risk and scientific assessments, cultural values, uncertainty in which information to trust, declining trust in pharmaceutical industry and potential conflicts of interest, as well as competing parental priorities, and a multitude of socio-demographic factors (Dubé et al. 2013). This project should be followed by additional research addressing vaccine acceptance and uptake in Canada.

Other limitations of this project include the limited evaluation of communication product reach, use and impact. Evaluation of communication product reach is limited by the search results produced based on the search terms used, search engine, number of search results examined and the location of computers chosen to conduct searches. The examined search results are not representative of all the webpages viewed by Canadian parents searching online for immunization information. Use is restricted by the data chosen to evaluate, including the categories used to code data throughout analysis. This evaluation is restricted to end-product evaluation, and was unable to provide analysis on product development or resources used. Lastly, impact of communication products was not evaluated by field testing or through the use of focus groups.

Several areas of future research could provide interesting lines of inquiry. First, completing a more comprehensive examination of childhood immunization communication products would be of value. Including broader search parameters would provide a wider view of the childhood immunization communication products available online, and completing similar analyses with an increased diversity of webpages may help identify those that successfully employ recommended risk communication strategies. This analysis could serve to inform future interventions. Second, it would be interesting to include vaccine hesitant parents, or those that identify as concerned by the information they have received, in a future study, to collect insight into their perspective of how information is presented. This could include an examination of both pro and anti-immunization webpages, to gauge which communication strategies they find the most effective. Lastly, it would be of value to further explore the process behind designing public health communications, particularly analyzing the perspectives of those who contribute to the information presented, as well as the evaluation steps taken prior to dissemination (e.g.

public perspectives, pre-testing). As it has been demonstrated that evaluation of communication products is extremely important to a successful message delivery, interviewing key informants on this process would provide insight into how, when and where future improvements to communications could be made.

APPENDIX A

Complete Simulated Search Results

Search conducted March 4th, 2017: At home laptop

Table 1. ‘vaccines’ + ‘childhood’ laptop simulated search

Search Result Number	Website Name	Link	Category
1	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro - non formal Source
2	CDC - Immunization Schedules	https://www.cdc.gov/vaccines/schedules/	Pro - Health Institution
3	CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro - Health Institution
4	Medline - Childhood Immunization	https://medlineplus.gov/childhoodimmunization.html	Pro -Health Institution (National Institute of Health)
5	FamilyDoctor.org - Childhood Vaccines: What They Are and Why Your Child Needs Them	https://familydoctor.org/childhood-vaccines-what-they-are-and-why-your-child-needs-them/	Pro - Health Academy (American Academy of Family Physicians (AAFP))
6	Caring for Kids - Vaccination and your child	http://www.caringforkids.cps.ca/handouts/vaccination_and_your_child	Pro - Health Academy (Canadian Paediatric Society)
7	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro - Health Institution

8	Wikipedia - Childhood immunizations in the United States	https://en.wikipedia.org/wiki/Childhood_immunizations_in_the_United_States	Pro - non Health Institution
9	Childhood Shots - Welcome to Mary Tocco's Educational Site	http://childhoodshots.com/	Anti
10	NHS- Childhood vaccines timeline	http://www.nhs.uk/conditions/vaccinations/pages/childhood-vaccination-schedule.aspx	Pro - Health Institution

Table 2. 'vaccines' + 'safe' laptop simulated search

Search Result Number	Website Name	Link	Category
1	vaccines.gov - Safety	https://www.vaccines.gov/basics/safety/	Pro - Health Institution (U.S. Department of Health & Human Services)
2	vaccines.gov - Be Informed	https://www.vaccines.gov/basics/safety/informed/	Pro - Health Institution (U.S. Department of Health & Human Services)
3	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-secure-eng.php	Pro - Health Institution
4	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
5	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro - Health Institution
6	CDC - Multiple Vaccines and the Immune System	https://www.cdc.gov/vaccinesafety/concerns/multiple-vaccines-immunity.html	Pro - Health Institution
7	CDC - Human Papillomavirus (HPV) Vaccine Safety	https://www.cdc.gov/vaccinesafety/vaccines/hpv-vaccine.html	Pro - Health Institution
8	Vaccineinformation.org - Vaccine Safety	http://www.vaccineinformation.org/vaccine-safety/	Pro - Health Institution (CDC)

			and the Immunization Action Coalition)
9	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro - Health Authority
10	immunize.org - Vaccine Safety	http://www.immunize.org/safety/	Pro - Health Institution (Immunization Action Coalition)

Table 3. ‘vaccines’ + ‘risk’ laptop simulated search

Search Result Number	Website Name	Link	Category
1	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution
2	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures.aspx	Anti
3	History of Vaccines - Understanding Risks	http://www.historyofvaccines.org/content/understanding-risk	Pro - Health Society (The College of Physicians of Philadelphia)
4	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
5	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
6	Immyounity - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro - Pharmaceutical Company
7	WHO - Balancing efficacy and safety	http://vaccine-safety-training.org/balancing-efficacy-and-safety.html	Pro - Health Institution
8	Healing Arts - Children's Vaccines:	http://www.healing-arts.org/children/vaccines/	Neutral - Health Centre

	Research on the Risks for Children and Possible Neurological Consequences		
9	NHS - Benefits and risks of vaccination	http://www.nhs.uk/Conditions/vaccinations/Pages/benefits-and-risks.aspx	Pro - Health Institution
10	WHO - What are some of the myths – and facts – about vaccination?	http://www.who.int/features/qa/84/en/	Pro - Health Institution

Table 4. ‘vaccines’ + ‘benefit’ laptop simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
4	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Organization
5	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro - Health Authority
6	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)

7	WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	http://www.who.int/bulletin/volumes/86/2/07-040089/en/	Pro - Health Institution
8	CDC - Why Immunize?	https://www.cdc.gov/vaccines/vac-gen/why.htm	Pro - Health Institution
9	CDC - Five Important Reasons to Vaccinate Your Child	https://www.cdc.gov/media/matte/2011/04_childvaccination.pdf	Pro - Health Institution
10	History of Vaccines - Why Vaccinate?	http://www.historyofvaccines.org/content/articles/why-vaccinate	Pro - Health Society (The College of Physicians of Philadelphia)

Table 5. 'immunization' + 'childhood' laptop simulated search

Search Result Number	Website Name	Link	Category
1	CDC - Immunization Schedules	https://www.cdc.gov/vaccines/schedules/index.html	Pro - Health Institution
2	CDC - Immunization Schedules for Infants and Children	https://www.cdc.gov/vaccines/schedules/easy-to-read/child.html	Pro - Health Institution
3	Medline - Childhood Immunization	https://medlineplus.gov/childhoodimmunization.html	Pro -Health Institution (National Institute of Health)
4	Immunize Canada - Immunization Schedules	http://www.immunize.ca/en/recommendations/schedules.aspx	Pro - Health Organization
5	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro - Health Institution
6	Government of Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information.html	Pro - Health Institution
7	Government of Canada - Provincial and Territorial	https://www.canada.ca/en/public-health/services/provincial-	Pro - Health Institution

	Immunization Information	territorial-immunization-information.html	
8	Government of Canada - Immunization schedule tool	http://www.healthy Canadians.gc.ca/apps/schedule-calendrier/index-eng.php	Pro - Health Institution
9	Manitoba Health, Seniors, and Active Living - Routine Immunization Schedules	http://www.gov.mb.ca/health/publichealth/cdc/div/schedules.html	Pro - Health Institution
10	Caring for kids - Vaccination and your child	http://www.caringforkids.cps.ca/handouts/vaccination_and_your_child	Pro - Health Academy (Canadian Paediatric Society)

Table 6. 'immunization' + 'safe' laptop simulated search

Search Result Number	Website Name	Link	Category
1	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
2	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
3	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-securite-eng.php	Pro - Health Institution
4	Alberta Health Services - Common questions about vaccine safety	http://www.immunizealberta.ca/i-need-know-more/common-questions/vaccine-safety	Pro - Health Institution
5	Alberta Health Services - Risks and Safety in Perspective	http://www.immunizealberta.ca/should-i-immunize-my-child/risks-and-safety-perspective	Pro - Health Institution
6	Think Twice - Immunization Ploys	http://www.thinktwice.com/ploys.htm	Anti
7	Government of Canada - Canadian Immunization Guide: Part 3 - Vaccination of Specific Populations	https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations.html	Pro - Health Institution

8	CDC - About the Immunization Safety Office (ISO)	https://www.cdc.gov/vaccinesafety/iso.html	Pro - Health Institution
9	Immunise Australia Program - Safety of Vaccines	http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/safety-of-vaccines	Pro - Health Institution
10	Safety of Vaccines Used for Routine Immunization of US Children: A Systematic Review	http://pediatrics.aappublications.org/content/early/2014/06/26/peds.2014-1079	Pro- Peer Reviewed Article

Table 7. ‘immunization’ + ‘risks’ laptop simulated search

Search Result Number	Website Name	Link	Category
1	CDC – Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution
2	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
3	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
4	Immunize Canada - Side effects	http://www.immunize.ca/en/vaccine-safety/vaccine-reactions.aspx	Pro - Health Coalition
5	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Coalition
6	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
7	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution

8	CDC - Making the Vaccine Decision	https://www.cdc.gov/vaccines/parents/vaccine-decision/	Pro - Health Institution
9	Health Talk - Weighing up the risk	http://www.healthtalk.org/peoples-experiences/pregnancy-children/immunisation/weighing-risk	Neutral - non Health Institution
10	Investopedia - Immunization	http://www.investopedia.com/terms/i/immunization.asp	Not applicable

Table 8. 'immunization' + 'benefits' laptop simulated search

Search Result Number	Website Name	Link	Category
1	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children's Immunization Coalition and the Colorado Department of Public Health and Environment)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro - Health Authority
4	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Coalition
5	Queensland Government - Benefits of immunisation	https://www.qld.gov.au/health/conditions/immunisation/benefits/index.html	Pro - Health Authority
6	Immunise Scotland - Why Immunise?	http://www.immunisationscotland.org.uk/why-immunise/index.aspx	Pro - Health Institution (NHS Health Scotland)
7	Government of Canada - Immunization and vaccines	https://www.canada.ca/en/public-health/topics/immunization-vaccines.html	Pro - Health Institution

8	Government of Canada - A Parent's Guide to Vaccination	https://www.canada.ca/en/public-health/services/publications/healthy-living/parent-guide-vaccination.html	Pro - Health Institution
9	WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	http://www.who.int/bulletin/volumes/86/2/07-040089/en/	Pro - Health Institution
10	CDC - Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013	https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a4.htm	Pro - Health Institution

Search conducted March 9th, 2017: University of Manitoba Library Computer

Table 9. ‘vaccines’ + ‘childhood’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	Medline - Childhood Immunization	https://medlineplus.gov/childhoodimmunization.html	Pro -Health Institution (National Institute of Health)
2	CDC - <u>Immunization Schedules</u>	https://www.cdc.gov/vaccines/schedules/index.html	Pro – Health Institution
3	CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro – Health Institution
4	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
5	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro – Health Institution

6	Kids Health – Immunization Schedule	http://kidshealth.org/en/parents/immunization-chart.html	Pro – non Health Institution (The Nemours Center for Children's Health Media)
7	Caring for Kids - Vaccination and your child	http://www.caringforkids.cps.ca/handouts/vaccination_and_your_child	Pro - Health Academy (Canadian Paediatric Society)
8	NHS- Childhood vaccines timeline	http://www.nhs.uk/Conditions/vaccinations/Pages/childhood-vaccination-schedule.aspx	Pro – Health Institution
9	FamilyDoctor.org - Childhood Vaccines: What They Are and Why Your Child Needs Them	https://familydoctor.org/childhood-vaccines-what-they-are-and-why-your-child-needs-them/	Pro - Health Academy (American Academy of Family Physicians (AAFP))
10	Wikipedia - Childhood immunizations in the United States	https://en.wikipedia.org/wiki/Childhood_immunizations_in_the_United_States	Pro - non Health Institution

Table 10. ‘vaccines’ + ‘safe’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	Vaccines.gov - Safety	https://www.vaccines.gov/basics/safety/	Pro - Health Institution (U.S. Department of Health & Human Services)
2	vaccines.gov - Be Informed	https://www.vaccines.gov/basics/safety/informed/	Pro - Health Institution (U.S. Department of Health & Human Services)
3	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-securite-eng.php	Pro – Health Institution
4	Immunize BC – Vaccine Safety	http://www.immunizebc.ca/facts-on-immunity/vaccine-safety	Pro - Health Institution

5	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
6	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
7	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro -Health Institution
8	CDC - Multiple Vaccines and the Immune System	https://www.cdc.gov/vaccinesafety/concerns/multiple-vaccines-immunity.html	Pro -Health Institution
9	Vaccineinformation.org - Vaccine Safety	http://www.vaccineinformation.org/vaccine-safety/	Pro - Health Institution (CDC and the Immunization Action Coalition)
10	Scientific American - Straight Talk about Vaccination	https://www.scientificamerican.com/article/straight-talk-about-vaccination/	Pro – non Health Institution

Table 11. ‘vaccines’ + ‘risks’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures.aspx	Anti
2	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro- Health Institution
3	CDC - Why Vaccines are Important for You	https://www.cdc.gov/vaccines/adults/reasons-to-vaccinate.html	Pro – Health Institution
4	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)

5	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
6	History of Vaccines - Understanding Risks	http://www.historyofvaccines.org/content/understanding-risk	Pro - Health Society (The College of Physicians of Philadelphia)
7	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
8	Immyounity - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro – Pharmaceutical Company
9	WHO - What are some of the myths – and facts – about vaccination?	http://www.who.int/features/qa/84/en/	Pro- Health Organization
10	Healing Arts - Children's Vaccines: Research on the Risks for Children and Possible Neurological Consequences	http://www.healing-arts.org/children/vaccines/	Neutral - Health Centre

Table 12. ‘vaccines’ + ‘benefits’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	Vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)

4	Vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
5	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Coalition
6	WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	http://www.who.int/bulletin/volumes/86/2/07-040089/en/	Pro- Health Organization
7	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
8	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro – Health Authority
9	ProCon.org - Should Any Vaccines Be Required for Children?	http://vaccines.procon.org/	Neutral – non Health Institution
10	NHS - Benefits and risks of vaccination	http://www.nhs.uk/Conditions/vaccinations/Pages/benefits-and-risks.aspx	Pro – Health Institution

Table 13. ‘immunization’ + ‘childhood’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
2	CDC - Immunization Schedules for Infants and Children	https://www.cdc.gov/vaccines/schedules/easy-to-read/child.html	Pro – Health Institution
3	CDC - Recommended Immunization Schedule for	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro – Health Institution

	Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017		
4	CDC - <u>Immunization Schedules</u>	https://www.cdc.gov/vaccines/schedules/index.html	Pro – Health Institution
5	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
6	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro – Health Institution
7	Prairie Northern Health Region - Childhood Immunization Information	http://www.pnrha.ca/bins/content_page.asp?cid=20-168-13032	Pro – Health Authority
8	Immunize BC – Vaccine Schedules	http://www.immunizebc.ca/vaccine-schedules	Pro – Health Institution
9	Alberta Health – Routine Immunization Schedule	http://www.health.alberta.ca/health-info/imm-routine-schedule.html	Pro – Health Institution
10	Government of Canada - Immunization schedule tool	http://www.healthycanadians.gc.ca/apps/schedule-calendrier/index-eng.php	Pro – Health Institution

Table 14. ‘immunization’ + ‘safe’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro – Health Coalition

2	Healthychildren.org – How Safe are Vaccines?	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/How-Safe-are-Vaccines.aspx	Pro - Health Academy (American Academy of Pediatrics)
3	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro - Health Authority
4	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro – Health Institution
5	Vaccinate Your Baby - Are They Safe?	http://www.vaccinateyourbaby.org/safe/index.cfm	Pro – non Health Institution (Every Child By Two - Carter/Bumpers Champions for Immunization (ECBT))
6	Think Twice - Immunization Ploys	http://www.thinktwice.com/ploys.htm	Anti
7	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-secure-eng.php	Pro – Health Institution
8	What to Expect – Are Immunizations Safe?	http://www.whattoexpect.com/child-vaccinations/are-immunizations-safe.aspx	Pro – non Health Institution
9	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
10	Immunize BC – Vaccine Safety	http://www.immunizebc.ca/facts-on-immunity/vaccine-safety	Pro - Health Institution

Table 15. ‘immunizations’ + ‘risks’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
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1	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro – Health Institution
2	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures-.aspx	Anti
3	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
4	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
5	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
6	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Organization
7	CDC - Making the Vaccine Decision	https://www.cdc.gov/vaccines/parents/vaccine-decision/	Pro – Health Institution
8	CDC - Possible Side-	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro – Health Institution

	effects from Vaccines		
9	CDC - Infant Immunizations FAQs	https://www.cdc.gov/vaccines/parents/parent-questions.html	Pro – Health Institution
10	Mayo Clinic - Childhood vaccines: Tough questions, straight answers	http://www.mayoclinic.org/healthy-lifestyle/infant-and-toddler-health/in-depth/vaccines/art-20048334	Pro – Health Institution

Table 26. ‘immunizations’ + ‘benefits’ University of Manitoba simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
3	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health &

			Human Services)
4	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Coalition
5	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro – Health Authority
6	Government of Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information.html	Pro – Health Authority
7	Government of Canada - A Parent's Guide to Vaccination	https://www.canada.ca/en/public-health/services/publications/healthy-living/parent-guide-vaccination.html	Pro – Health Institution
8	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
9	CDC – Why Immunize?	https://www.cdc.gov/vaccines/vac-gen/why.htm	Pro – Health Institution
10	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)

Search conducted Wednesday, March 14th, 2017: 21 Degrees Internet Cafe

Table 17. ‘vaccines’ + ‘childhood’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	Medline - Childhood Immunization	https://medlineplus.gov/childhoodimmunization.html	Pro -Health Institution (National Institute of Health)

2	CDC - Immunization Schedules	https://www.cdc.gov/vaccines/schedules/	Pro - Health Institution
3	CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro - Health Institution
4	Medline - Childhood Immunization	https://medlineplus.gov/childhoodimmunization.html	Pro -Health Institution (National Institute of Health)
5	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
6	Caring for your kids - Vaccination and your child	http://www.caringforkids.cps.ca/handouts/vaccination_and_your_child	Pro - Health Academy (Canadian Paediatric Society)
7	Government of Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information.html	Pro – Health Institution
8	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro – Health Institution
9	Kids Health - Immunization Schedule	http://kidshealth.org/en/parents/immunization-chart.html	Pro – non Health Institution (The Nemours Center for Children's Health Media)
10	FamilyDoctor.org - Childhood Vaccines: What They Are and Why Your Child Needs Them	https://familydoctor.org/childhood-vaccines-what-they-are-and-why-your-child-needs-them/	Pro - Health Academy (American Academy of Family Physicians (AAFP))

Table 18. ‘vaccines’ + ‘safe’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	vaccines.gov - Safety	https://www.vaccines.gov/basics/safety/	Pro - Health Institution (U.S. Department of Health & Human Services)
2	Vaccines.gov - Be informed	https://www.vaccines.gov/basics/safety/informed/	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
4	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-securite-eng.php	Pro -Health Institution
5	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
6	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro -Health Institution
7	CDC - Multiple Vaccines and the Immune System	https://www.cdc.gov/vaccinesafety/concerns/multiple-vaccines-immunity.html	Pro -Health Institution
8	vaccineinformation.org - Vaccine Safety	http://www.vaccineinformation.org/vaccine-safety/	Pro - Health Institution (CDC and the Immunization Action Coalition)
9	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro – Health Authority
10	National Foundation for Infectious Disease - Vaccine Safety	http://www.nfid.org/about-vaccines/safety	Pro – non Health Institution

Table 19. ‘vaccines’ + ‘risks’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures-.aspx	Anti
2	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution
3	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children's Immunization Coalition and the Colorado Department of Public Health and Environment)
4	History of Vaccines - Understanding Risks	http://www.historyofvaccines.org/content/understanding-risk	Pro - Health Society (The College of Physicians of Philadelphia)
5	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
6	<u>Immyounity</u> - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro – Pharmaceutical Company
7	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
8	WebMD - Should Your Child Get the HPV Vaccine?	http://www.webmd.com/children/vaccines/features/should-your-child-get-hpv-vaccine#1	Pro – non Health Institution
9	Healing Arts - Children's Vaccines: Research on the Risks for Children and Possible Neurological Consequences	http://www.healing-arts.org/children/vaccines/	Neutral - Health Centre
10	WHO - What are some of the myths – and facts – about vaccination?	http://www.who.int/features/qa/84/en/	Pro- Health Organization

Table 20. ‘vaccines’ + ‘benefits’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
4	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
5	WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	http://www.who.int/bulletin/volumes/86/2/07-040089/en/	Pro – Health Organization
6	CDC - Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013	https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a4.htm	Pro – Health Institution
7	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
8	ProCon.org - Should Any Vaccines Be Required for Children?	http://vaccines.procon.org/	Neutral – non Health Institution

9	NHS - Benefits and risks of vaccination	http://www.nhs.uk/Conditions/vaccinations/Pages/benefits-and-risks.aspx	Pro – Health Institution
10	History of Vaccines - Why Vaccinate?	http://www.historyofvaccines.org/content/articles/why-vaccinate	Pro - Health Society (The College of Physicians of Philadelphia)

Table 21. ‘immunizations’ + ‘childhood’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non-Health Institution
2	CDC - Immunization Schedules	https://www.cdc.gov/vaccines/schedules/easy-to-read/child.html	Pro – Health Institution
3	CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro – Health Institution
4	Nova Scotia Routine Childhood Immunization Schedule	https://novascotia.ca/dhw/CDPC/documents/13078_NsChildhoodImmPoster_En.pdf	Pro - Health Authority
5	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non-Health Institution
6	Immunize BC – Vaccine Schedules	http://www.immunizebc.ca/vaccine-schedules	Pro – Health Institution
7	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro - Health Institution
8	Alberta Health – Routine Immunization Schedule	http://www.health.alberta.ca/health-info/imm-routine-schedule.html	Pro – Health Institution

9	Manitoba Health, Seniors, and Active Living - Routine Immunization Schedules	http://www.gov.mb.ca/health/publichealth/cdc/div/schedules.html	Pro – Health Institution
10	Government of Canada – Immunization schedule tool	http://www.healthycanadians.gc.ca/apps/schedule-calendrier/index-eng.php	Pro – Health Institution

Table 22. ‘immunizations’ + ‘safe’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
2	Healthychildren.org – How Safe are Vaccines?	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/How-Safe-are-Vaccines.aspx	Pro - Health Academy (American Academy of Pediatrics)
3	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro - Health Authority
4	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro - Health Institution
5	Think Twice - Immunization Ploys	http://www.thinktwice.com/ploys.htm	Anti
6	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
7	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-securite-eng.php	Pro - Health Institution
8	What to Expect – Are Immunizations Safe?	http://www.whattoexpect.com/child-vaccinations/are-immunizations-safe.aspx	Pro – non-Health Institution
9	Immunize BC – Vaccine Safety	http://www.immunizebc.ca/facts-on-immunity/vaccine-safety	Pro - Health Institution
10	Stop Mandatory Vaccinations - The	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti

	Dangers Of Vaccines and Vaccination		
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Table 23. ‘immunizations’ + ‘risks’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro – Health Institution
2	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures.aspx	Anti
3	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
4	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
5	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro – Health Organization
6	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro – Health Institution
7	CDC - Making the Vaccine Decision	https://www.cdc.gov/vaccines/parents/vaccine-decision/	Pro – Health Institution
8	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
9	Immyounity - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro - Pharmaceutical Company
10	Mayo Clinic - Childhood vaccines: Tough	http://www.mayoclinic.org/healthy-lifestyle/infant-and-toddler-	Pro – Health Institution

	questions, straight answers	health/in-depth/vaccines/art-20048334	
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Table 24. ‘immunizations’ + ‘benefits’ 21 Degrees Internet Café simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more/info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Organization
4	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro - Health Authority
5	Government of Canada - Canadian Immunization Guide: Part 1 - Key Immunization Information	https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information.html	Pro - Health Institution
6	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
7	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
8	CDC - Why Immunize?	https://www.cdc.gov/vaccines/vac-gen/why.htm	Pro - Health Institution
9	CDC - Benefits from Immunization During the Vaccines for Children Program Era —	https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a4.htm	Pro - Health Institution

	United States, 1994–2013		
10	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)

Search conducted March 18th, 2017: Winnipeg Millennium Library

Table 25. ‘vaccines’ + ‘childhood’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	Medline - Childhood Immunization	https://medlineplus.gov/childhood-immunization.html	Pro -Health Institution (National Institute of Health)
2	CDC - Immunization Schedules	https://www.cdc.gov/vaccines/schedules/index.html	Pro - Health Institution
3	CDC - Immunization Schedules for Infants and Children	https://www.cdc.gov/vaccines/schedules/easy-to-read/child.html	Pro - Health Institution
4	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
5	Medline - Childhood Immunization	https://medlineplus.gov/childhood-immunization.html	Pro -Health Institution (National Institute of Health)
6	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro – Health Institution
7	Caring for Kids - Vaccination and your child	http://www.caringforkids.cps.ca/handouts/vaccination_and_your_child	Pro - Health Academy (Canadian Paediatric Society)
8	FamilyDoctor.org - Childhood Vaccines: What They Are and Why Your Child Needs Them	https://familydoctor.org/childhood-vaccines-what-they-are-and-why-your-child-needs-them/	Pro - Health Academy (American Academy of Family Physicians (AAFP))

9	Wikipedia - Childhood immunizations in the United States	https://en.wikipedia.org/wiki/Childhood_immunizations_in_the_United_States	Pro - non Health Institution
10	NHS - Childhood vaccines timeline	http://www.nhs.uk/conditions/vaccinations/pages/childhood-vaccination-schedule.aspx	Pro - Health Institution

Table 26. ‘vaccines’ + ‘safe’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	vaccines.gov - Safety	https://www.vaccines.gov/basics/safety/	Pro - Health Institution (U.S. Department of Health & Human Services)
2	vaccines.gov - Be Informed	https://www.vaccines.gov/basics/safety/informed/	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
4	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-securite-eng.php	Pro – Health Institution
5	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
6	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro -Health Institution
7	CDC - Multiple Vaccines and the Immune System	https://www.cdc.gov/vaccinesafety/concerns/multiple-vaccines-immunity.html	Pro -Health Institution
8	vaccineinformation.org - Vaccine Safety	http://www.vaccineinformation.org/vaccine-safety/	Pro - Health Institution (CDC and the Immunization Action Coalition)

9	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro – Health Authority
10	National Foundation for Infectious Disease - Vaccine Safety	http://www.nfid.org/about-vaccines/safety	Pro – non Health Institution

Table 27. ‘vaccines’ + ‘risks’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/gen/side-effects.htm	Pro – Health Institution
2	CDC - Making the Vaccine Decision	https://www.cdc.gov/vaccines/parents/vaccine-decision/	Pro - Health Institution
3	History of Vaccines - Understanding Risks	http://www.historyofvaccines.org/content/understanding-risk	Pro - Health Society (The College of Physicians of Philadelphia)
4	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures-.aspx	Anti
5	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
6	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
7	<u>Immyounity</u> - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro - Pharmaceutical Company
8	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
9	<u>vaccines.gov</u> - Safety	https://www.vaccines.gov/basics/safety/	Pro - Health Institution (U.S. Department of Health & Human Services)

10	Healing Arts - Children's Vaccines: Research on the Risks for Children and Possible Neurological Consequences	http://www.healing-arts.org/children/vaccines/	Neutral - Health Centre
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Table 28. 'vaccines' + 'benefits' Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
3	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children's Immunization Coalition and the Colorado Department of Public Health and Environment)
4	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
5	WHO - Vaccination greatly reduces disease, disability, death and inequity worldwide	http://www.who.int/bulletin/volumes/86/2/07-040089/en/	Pro – Health Organization
6	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
7	NHS - Benefits and risks of vaccination	http://www.nhs.uk/Conditions/vaccinations/Pages/benefits-and-risks.aspx	Pro – Health Institution

8	CDC - Benefits from Immunization During the Vaccines for Children Program Era — United States, 1994–2013	https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a4.htm	Pro – Health Institution
9	CDC - Why Immunize?	https://www.cdc.gov/vaccines/vacc-gen/why.htm	Pro - Health Institution
10	History of Vaccines - Why Vaccinate?	http://www.historyofvaccines.org/content/articles/why-vaccinate	Pro - Health Society (The College of Physicians of Philadelphia)

Table 29. ‘immunizations’ + ‘childhood’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
2	CDC - Immunization Schedules for Infants and Children	https://www.cdc.gov/vaccines/schedules/easy-to-read/child.html	Pro – Health Institution
3	CDC - Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017	https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html	Pro – Health Institution
4	CDC - <u>Immunization Schedules</u>	https://www.cdc.gov/vaccines/schedules/index.html	Pro – Health Institution
5	Nova Scotia Routine Childhood Immunization Schedule	https://novascotia.ca/dhw/CDPC/documents/13078_NsChildhoodImmPoster_En.pdf	Pro - Health Authority
6	WebMD - Immunizations - Childhood Immunizations	http://www.webmd.com/children/vaccines/tc/immunizations-childhood-immunizations#1	Pro – non Health Institution
7	Government of Canada - Vaccination for children	https://www.canada.ca/en/public-health/services/vaccination-children.html	Pro – Health Institution

8	Manitoba Health, Seniors, and Active Living - Routine Immunization Schedules	http://www.gov.mb.ca/health/publichealth/cdc/div/schedules.html	Pro – Health Institution
9	Ontario Ministry of Health and Long Term Care - Ontario's Publicly Funded Immunization Schedules	http://www.health.gov.on.ca/en/pro/programs/immunization/schedule.aspx	Pro – Health Institution
10	Immunize BC – Child Health Passport	http://www.immunizebc.ca/sites/default/files/graphics/child-health-passport2013.pdf	Pro – Health Institution

Table 30. 'immunizations' + 'safe' Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	Immunize Canada - Safety	http://www.immunize.ca/en/vaccine-safety.aspx	Pro - Health Coalition
2	Healthychildren.org – How Safe are Vaccines?	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/How-Safe-are-Vaccines.aspx	Pro - Health Academy (American Academy of Pediatrics)
3	Health Link BC - Childhood Vaccines are Safe	https://www.healthlinkbc.ca/healthlinkbc-files/childhood-vaccines-are-safe	Pro - Health Authority
4	CDC - Vaccine Safety	https://www.cdc.gov/vaccinesafety/index.html	Pro - Health Institution
5	Think Twice - Immunization Ploys	http://www.thinktwice.com/ploys.htm	Anti
6	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children's Immunization Coalition and the Colorado Department of Public Health and Environment)
7	What to Expect – Are Immunizations Safe?	http://www.whattoexpect.com/child-vaccinations/are-immunizations-safe.aspx	Pro – non Health Institution

8	Caring for Kids - Vaccine safety: Canada's system	http://www.caringforkids.cps.ca/handouts/vaccine_safety	Pro - Health Academy (Canadian Paediatric Society)
9	Immunize BC – Vaccine Safety	http://www.immunizebc.ca/facts-on-immunity/vaccine-safety	Pro - Health Institution
10	PHAC - Vaccine Safety	http://www.phac-aspc.gc.ca/im/safety-secureite-eng.php	Pro - Health Institution

Table 31. ‘immunizations’ + ‘risks’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution
2	National Vaccination Information Centre - Vaccinations Know the Risks and Failures	http://www.nvic.org/vaccines-and-diseases/Vaccinations--Know-the-risks-and-failures.aspx	Anti
3	Immunize for Good – Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
4	Immunize BC – Understanding Risk	http://www.immunizebc.ca/facts-on-immunity/understanding-risk	Pro - Health Institution
5	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Coalition
6	Stop Mandatory Vaccinations - The Dangers Of Vaccines and Vaccination	http://www.stopmandatoryvaccination.com/vaccine-dangers/	Anti
7	CDC - Making the Vaccine Decision	https://www.cdc.gov/vaccines/paerents/vaccine-decision/	Pro – Health Institution
8	CDC - Possible Side-effects from Vaccines	https://www.cdc.gov/vaccines/vac-gen/side-effects.htm	Pro - Health Institution

9	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
10	Immyounity - Vaccine Side Effects	http://www.vaccines.com/vaccine-side-effects.cfm	Pro - Pharmaceutical Company

Table 32. ‘immunizations’ + ‘benefits’ Winnipeg Millennium Library simulated search

Search Result Number	Website Name	Link	Category
1	vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
2	Immunize for Good - Benefits vs. Risks	http://www.immunizeforgood.com/fact-or-fiction/benefits-vs.-risks	Pro- Health Institution (Colorado Children’s Immunization Coalition and the Colorado Department of Public Health and Environment)
3	vaccines.gov - Five Important Reasons to Vaccinate Your Child	https://www.vaccines.gov/more_info/features/five-important-reasons-to-vaccinate-your-child.html	Pro - Health Institution (U.S. Department of Health & Human Services)
4	Immunize Canada - Benefits & risks	http://www.immunize.ca/en/publications-resources/benefits.aspx	Pro - Health Organization
5	Health Link BC - The Benefits of Immunizing Your Child	https://www.healthlinkbc.ca/healthlinkbc-files/benefits-immunizing-your-child	Pro - Health Authority
6	Vaccineinformation.org - Importance of Vaccines	http://www.vaccineinformation.org/vaccines-save-lives/	Pro - Health Institution (CDC and the Immunization Action Coalition)
7	Healthychildren.org - Weighing the Risks and Benefits	https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Weighing-the-Risks-and-Benefits.aspx	Pro - Health Academy (American Academy of Pediatrics)
8	CDC - Why Immunize?	https://www.cdc.gov/vaccines/vacc-gen/why.htm	Pro - Health Institution

9	Government of Canada - A Parent's Guide to Vaccination	https://www.canada.ca/en/public-health/services/publications/healthy-living/parent-guide-vaccination.html	Pro - Health Institution
10	NHS - Benefits and risks of vaccination	http://www.nhs.uk/Conditions/vaccinations/Pages/benefits-and-risks.aspx	Pro – Health Institution

Appendix B

Code Book

Code (Parent)	Code (Child)	Category	Definition
Definition of outcomes	Risks of not being vaccinated	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Clearly defines the risks of not being vaccinated. Clearly defines the risks of rejecting or delaying one or all vaccines. Can include the risks to child, family, or community. Defines the potential consequences.
	Risks of being vaccinated	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Clearly defines the risks of receiving one or all vaccines. Clearly provides understanding of the potential negative side effects of one or all vaccines.
	Risks of vaccine-preventable disease	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Clearly defines the risks of vaccine-preventable diseases. Provides definition for symptoms/ effects of one or all vaccine-preventable diseases.
Quantitative information	Negative effects	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Provides likelihood of any negative side effects from vaccines in quantitative terms.

	Positive effects	Emerged from data	Provides likelihood of positive effects (e.g. immunity from vaccines) in quantitative terms.
	Baseline vs. treatment	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Describes baseline (not being vaccinated) and treatment (vaccination) risks and benefits clearly in quantitative terms.
	Denominators constant	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	When using quantitative terms, denominators are kept constant (equal) for comparison of options.
	Visual Aids	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Pictographs and other visual aids are used to enhance comprehension of concepts.
	Provide both positive and negative frames.	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Provides positive outcomes and negative frames (in quantitative terms) for each action described.
Qualitative Information	Address parental concerns and myths	Pre-defined (Risk Communication Good Practices Supported by	Address common parental concerns/ myths and misinformation identified in literature. Concerns are addressed and explained.

		Scientific Research)	
	Relationships	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Clearly discusses relationships between actions and consequences, as well as other influential factors.
Health Literacy (e.g. Treatment Labelling)	Advertisements	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Mention or display of sponsored (i.e. pharmaceutical brands/ products), funded or advertising material, information or visuals.
	Auxiliary information	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Information not applicable to childhood vaccines, or the vaccine decision-making process (i.e. information external to what individuals need to know to make vaccine decision).
	Critical Information	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	The critical or need to know information about vaccines necessary to give informed consent. This includes the recommended vaccine schedule, possible side effects, mechanisms of immunity, potential risks, and description of vaccine-preventable disease.
	Decision-making process	Emerged from data	Discusses factors that influence the decision-making process.

	Purpose for use	Pre-defined (Risk Communication Good Practices Supported by Scientific Research)	Clearly explains the intended purpose for each vaccine (i.e. including the vaccine-preventable disease to which it protects).
Safety and Side effects	Autism	Emerged from data	Clearly addresses concerns related to vaccines and autism. Clearly explains scientific knowledge regarding vaccines and autism.
	Ingredients	Emerged from data	Provides information regarding vaccine ingredients, purpose of each ingredient. safety of ingredients.
	Responsible for safety	Emerged from data	Provides information on institutions responsible for monitoring and maintain safety of vaccines.
	Scientific evidence	Emerged from data	Provides scientific references for information on safety of vaccines.
	Blanket statement about safety	Emerged from data	A non-descript statement about the general safety of vaccines.

Personal Stories	Negative	Emerged from data	The use of a personal story or example (character included), that describes vaccines negatively.
	Positive	Emerged from data	The use of a personal story or example (character included), that describes vaccines positively.

Appendix C

Modified IPDAS checklist

Q1 Does the webpage describe vaccine-preventable illnesses? Y or N or N/A

Q2 Does the webpage list the options for immunizations? Y or N or N/A

Q3 Does the webpage describe the potential consequences of not getting vaccinated? Y or N or N/A

Q4 Does the webpage describe how immunizations work? Y or N or N/A

Q5 Does the webpage describe the procedure of how immunizations are given? Y or N or N/A

Q6 Does the webpage describe the benefits to immunizations? Y or N or N/A

Q7 Does the webpage describe the risks of immunizations? Y or N or N/A

Q8 Does the webpage include the chance of positive outcomes from immunizations? Y or N or N/A

Q9 Does the webpage include the chance of negative outcomes from immunizations? Y or N or N/A

Q10 Does the webpage include event rates specifying the population and time period (in above outcomes)? Y or N or N/A

Q11 Does the webpage compare outcome probabilities (i.e. Side effects from immunizations) using the same denominator, time period, scale? Y or N or N/A

Q12 Does the webpage describe uncertainty around probabilities? Y or N or N/A

Q13 Does the webpage use visual diagrams? Y or N or N/A

Q14 Does the webpage use multiple methods to view probabilities (words, numbers, diagrams)? Y or N or N/A

Q15 Does the webpage place probabilities in context to other events? Y or N or N/A

Q16 Does the webpage use both positive and negative frames (e.g. lives saved and potential side effects) for both getting and not getting immunizations? Y or N or N/A

Q17 Does the webpage ask readers which positive and negative outcomes matter the most? Y or N or N/A

Q18 Does the webpage ask readers to share what matters most with others? Y or N or N/A

Q19 Does the webpage provide steps to making a decision? Y or N or N/A

Q20 Does the webpage suggest ways to talk about the decision with a health professional? Y or N or N/A

Q21 Does the webpage include tools (worksheet, question list) to discuss options with others? Y or N or N/A

Q22 Does the webpage present information in a balanced manner (risks and benefits) of immunizations? Y or N or N/A

Q23 Does the webpage present information in a balanced manner (risks and benefits to immunization schedule)? Y or N or N/A

Q24 Does the webpage present risk and benefit information with equal detail (font, order, display of statistics)? Y or N or N/A

Q25 Does the webpage include authors'/ contributors' qualifications? Y or N or N/A

Q26 Does the webpage provide references for evidence used? Y or N or N/A

Q27 Does the webpage report steps to find, appraise, and summarize evidence? Y or N or N/A

Q28 Does the webpage report how often webpage is updated? Y or N or N/A

Q29 Does the webpage report last time webpage was updated? Y or N or N/A

Q30 Does the webpage describe quality of scientific evidence (including lack of evidence)? Y or N or N/A

Q31 Is the webpage written at a reading level understood by the target audience (grade 4-8)? Y or N or N/A

Q32 Does the webpage provide ways to understand the information other than reading (audio, video, in person discussion)? Y or N or N/A

Q33 Does the webpage provide a step by step way to move through the web pages? Y or N or N/A

Q34 Does the webpage allow patients to search through key words? Y or N or N/A

Q35 Does the webpage permit printing as a single document? Y or N or N/A

Q36 Does the webpage make it easy for users to return to original webpage after linking to other webpages? Y or N or N/A

Q37 Does the webpage help users to recognize a decision needs to be made? Y or N or N/A

Q38 Does the webpage help users know options and their features? Y or N or N/A

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