Understanding Perspectives of Risk Awareness

by

Byunguk Randon Park
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Research in risk awareness has been relatively neglected in the health informatics literature, which tends largely to examine project managers' perspectives of risk awareness; very few studies explicitly address the perspectives held by senior executives such as directors. Another limitation evident in the current risk literature is that studies are often based on American data and/or they are restricted to American culture. Both factors highlight the need to examine how senior executives (i.e., directors) who oversee or direct eHealth projects in Canada perceive risk awareness. This research explores and discusses the perspectives of risk awareness (i.e., identification, analysis, and prioritization) held by directors and project managers who implement Canadian eHealth projects. Semi-structured interviews with nine directors and project managers uncovered six key distinctions in these two groups' awareness of risk. First, all project managers valued transparency over anonymity, whereas directors believed that an anonymous reporting system for communicating risks had merit. Secondly, most directors emphasized the importance of evidence-based planning and decision making when balancing risks and opportunities, an aspect none of the project managers voiced. Thirdly, while project managers noted that the level of risk tolerance may evolve from being risk-averse to risk-neutral, directors believed that risk tolerance evolved toward risk-seeking. Directors also noted the importance of employing risk officers, a view that was not shared by project managers. Directors also believed the risk of too little end-user engagement and change management was the most important risk, whereas project managers ranked it as the least important. Finally, when directors and project managers were asked to identify and define the root cause(s) of eHealth risks, directors identified

the complexity of health care industry, while project managers attributed it to political pressure and a lack of resources where eHealth projects are concerned. This research proposes that the varied perspectives of risk awareness held by directors and project managers must be considered and integrated to properly align expectations and build partnerships for successful eHealth project outcomes. Understanding risk awareness offers a means to systematically identify and analyze the complex nature of eHealth projects by embracing uncertainties, thereby enabling forward thinking (i.e., staying one step ahead of risks) and the ability to prevent avoidable risks and seize opportunities.

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Dedication

For my family.

Thank you for your undying patience and support.

Thank you for encouraging me to pursue my dreams and aspirations.

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Chapter 1: Introduction and Motivation

1.1 The Need for eHealth Risk Management

Health Informatics is an interdisciplinary science that develops and assesses the methods and systems required to acquire, process, and interpret patient data with the help of knowledge from scientific research. The defining characteristics of health informatics are its patient-centric nature and its emphasis on the continuum of care and on the anytime/anywhere access to vital information that spans the lifetime of a patient (Imhoff, Webb, & Goldschmidt, 2001). Unfortunately, no universally accepted definition of health informatics is applied in the literature (Hersh, 2002). For the purpose of this research, then, the following terms are used interchangeably to denote *the interdisciplinary science that synchronously manages patient-centric information along the continuum of care via Information and Communications Technology (ICT) applications at the point of care:* health informatics, health ICT, and eHealth.

Ideal health care systems ensure continuity of patient care at all stages of delivery and at all points of care. To reach this ideal state, integrated care practices must communicate vital, non-redundant information about patients (Iakovidis, 1998) via Electronic Health Records (EHR). The EHR is a strategic vehicle used to retrieve, capture, store, manipulate, and transmit patient-specific information over the lifetime of a patient (Raghupathi & Tan, 2002). It integrates select health information from separate, interoperable systems such as Electronic Medical Records (EMR), Electronic Patient Records (EPR),and other Point-of-Service systems (Nagle, 2007) in settings such as hospitals, laboratories, pharmacies, and primary care centres (Iakovidis, 1998). This comprehensive, longitudinal record is required to redesign and transform today's health care; it allows relevant health information to be available when and where it is most needed even as it enables organizations to effectively manage and integrate care practices (Hersh, 2004; Leape & Berwick, 2005; Urowitz, et al., 2008).

According to Anderson (2007), the fragmented and inaccessible nature of patient health information adversely impacts the cost, quality, and safety of today's health care system.

Many stakeholders thus view eHealth applications as a fundamental, invaluable asset that can provide patient information on demand to health care providers, help health administrators manage rising costs, and improve health care quality and safety (Celler, Lovell, Basilakis, 2003). Indeed, Hillestad et al. (2005) estimates the efficiency savings produced from implementing an effective EHR system in the United States to be more than $77 billion per year. These cost savings arise from reductions in hospital length-of-stays, administrative transaction costs, drug and radiology usage, and adverse drug events. In a study conducted by the Centre for Information Technology Leadership, researchers estimated the overall financial return from ICT projects to be as high as $87 billion per year after initial investment costs are recovered (Hersh, 2004). Moreover, over a 15 year period, the net cumulative savings from EHR implementation and adoption is estimated to be as much as $371 billion, while the net cumulative savings from physician adoption could reach $142 billion (Anderson, 2007). These potential benefits prompted countries such as Canada, the United States, Australia, New Zealand, and a number of European countries to prioritize the effective execution of an EHR system. Canada's federal government instituted the Canada Health Infoway program to promote a collaborative EHR implementation approach to lead and fund many national health ICT implementations across the country (Cornwall, 2002).

Despite EHR's potential for enhancing the safety, quality, and efficacy of the current health care system, realizing those benefits is threatened by high implementation failure rates (Linton, 2002). According to Kaplan (2000), approximately fifty percent of health-care-industry information and communications technology (ICT) projects fail owing to foreseeable risks such as poor project management. While technical eHealth project risks must be addressed, it is also essential to recognize the non-technical cultural, political (Iakovidis, 1998), ethical, social, organizational, legal, financial, behavioural, and economic risks (Tang, Ash, Bates, Overhage, & Sands, 2006).

A study conducted by Ibbs and Kwak (2000) to assess the maturity of project management knowledge areas (i.e., scope, time, cost, quality, human resources, communications, risk, and procurement) found that risk management was the least

matured area. The study also showed that information systems (IS) and software development industries had the lowest rating of maturity, and suggested that efforts must be coordinated and invested in risk management (Ibbs & Kwak, 2000). If the health care industry is to successfully implement eHealth applications and fully realize the potential benefits of doing so, *all* risks associated with eHealth projects must be identified and addressed via appropriate risk management methods.

Chapter 2 reviews the current state of risk research in the health informatics literature to identify any gaps or omissions. This gap is then used to establish the research purpose and formulate the research objective and questions in Chapter 3. Chapter 4 then outlines the research's design and methodology, while Chapter 5 reports the research findings and results. The conclusion discusses the research findings and situates those results within the context of the current health informatics risk research literature.

Chapter 2: The Literature Review of Risk Management Framework and Its Applications

This chapter explores and reviews the current literature regarding the subject of risk management frameworks and the applications of risk awareness in the information systems (IS) and the health informatics industries. Specifically, the following topics are reviewed to properly establish the context, baseline, and foundations required for this research:

- Risk Tolerance: Balancing Risks and Opportunities
- Benefits of Risk Management
- Structures of Risk Management
- Building Trust: Risk Communications
- Risk Dimensions of eHealth
- Applications of Risk Awareness in the Literature (IS & Health Informatics)
- Summary of the Literature Review

This chapter identifies and analyzes existing gaps in the literature that this research addresses as it establishes an effective research context and foundation and then summarizes the results.

2.1 Risk Tolerance: Balancing Risks and Opportunities

Before risk management can be fully understood and applied, a working definition of *risk* must first be established. According to the *Oxford Dictionary*, risk is "a situation involving exposure to danger or the possibility that something unpleasant will happen" (*Oxford Dictionary*, 2009). While risks are generally associated with *negative* aspects of uncertainties, effective risk managers must also recognize and take advantage of *positive* aspects hidden within uncertainties that may offer unexpected opportunities. The management of negative risks is a form of insurance to reduce the effects of adverse events; the management of positive risks is a form of investment to create and expand opportunities. As with most investments, costs must not exceed the potential benefits of risk management (Schwalbe, 2006).

Extrapolating from the above points, then, the general definition of risk must include uncertainties that have both *positive* and *negative* impacts on a project's goals and objectives. In other words, the goal of risk management must be to maximize positive risks (i.e., opportunities) while minimizing negative risks (Schwalbe, 2006). To do so effectively, the source of a risk must be identified and eliminated before it becomes an expensive threat to a project's goal by, for example, engaging the entire organization (Boehm, 1991; McConnell, 1996).

While individuals and organizations aim to perfectly and practically balance risks and opportunities, this can be challenging in a collaborative setting, as different stakeholders possess different levels of risk tolerance (i.e., risk neutral, risk aversion, and risk seeking). These risk preferences are part of the Utility Theory of Risk, which explains the amount of satisfaction obtained from a potential payoff. Those who are Risk Averse possess a low level of risk tolerance, as no satisfaction is gained from high risks. Risk Seekers have a high tolerance for risks, as their satisfaction increases as more payoffs are at stake. Between these two preferences lie Risk Neutral individuals, who strive for a perfect balance between risks and payoffs (Schwalbe, 2006).

Many businesses and organizations exist and succeed because of their willingness to take risks that present great opportunities. Since all projects possess uncertainties with both positive and negative outcomes, the main concern for risk management is to decide which projects to pursue and then to manage their associated risks throughout the project life cycle (Schwalbe, 2006). However, managing risks as part of a large Information Technology (IT) project is a major challenge, as it is complicated by the unpredictable interactions between organizations and people. This factor, coupled with the increasing size and complexity of IT projects, render traditional management techniques infeasible (Pennock & Haimes, 2002).

2.2 Benefits of Risk Management

Risk management refers to *the art of identifying, analyzing, and responding to risks in order to successfully achieve a project's goals and objectives* (Schwalbe, 2006). While risk management plays a critical role in improving the success rates of projects while preventing runaways (Cole, 1995; Schwalbe, 2006), the practice is generally neglected, especially in the software industry (Schwalbe, 2006). However, the successful application of risk management can have a positive, valuable impact on processes such as project selection, scope identification, and cost/schedule estimations. It can also enable project teams and stakeholders to grasp the nature of the project, define its strengths and weaknesses, and integrate other fundamental project management knowledge areas (Schwalbe, 2006). Kulik and Weber's 2001 survey of 260 software organizations indicated that risk management principles and practices offer the following benefits:

- 80%: Anticipate and Avoid Problems
- 60%: Prevent Surprises
- 47%: Improve the Ability to Negotiate
- 47%: Meet Customer Commitments
- 43%: Reduce Schedule Slips
- 35%: Reduce Cost Overruns

Successful risk management integrates risk-oriented processes with a set of principled practices. Though numerous derivatives of risk management are described in the literature, all include the concepts of risk structure and risk dimensions (Boehm, 1991; Pennock & Haimes, 2002).

2.3 Structures of Risk Management

While many of the existing risk management structures within the literature may appear to differ, they all prove very similar in practice within the context of iterative practices. For instance, Boehm (1991) proposes a framework composed of risk assessment (i.e., risk identification, analysis, and prioritization) and risk control (i.e., risk management planning, resolution, and monitoring). Haimes, Kaplan, and Lambert (2002) offer the following breakdown structure: scenario identification, scenario filtering, bi-criteria

filtering and ranking, multi-criteria evaluation, quantitative ranking, risk management, safeguarding against mission critical items, and soliciting operational feedback. Pennock and Haimes (2002) stress the need for risk identification, filtration, assessment, management, tracking, and iteration. Alternatively, Schwalbe (2006) suggests the following processes: risk management planning, risk identification, qualitative and quantitative risk analyses, risk response planning, and risk monitoring.

It is apparent that having multiple risk management approaches and structures can prove challenging in practice. To develop a standard description and structure for risk management, the Association of Project Managers (APM) produced a generic process called Project Risk Analysis and Management, or PRAM (Chapman, 1997), consisting of the following phases: define, focus, identify, structure, ownership, estimate, evaluate, plan, and manage. For the purpose of this research, the risk management structures noted above have been synthesized into the following structure, which is then explored, defined, and described in detail:

- Risk Awareness and Assessment
    - Risk Initiation and Planning: Define, Focus, and Plan
    - Risk Identification: Search and Classify
    - Risk Analysis and Assessment: Structure, Ownership, Estimate, and Evaluate
    - Risk Prioritization and Filtration
- Risk Control and Management
    - Risk Response Planning: Response Plans for Risks and Opportunities
    - Risk Resolution and Implementation: Project and System Development Life Cycle
    - Risk Monitoring and Management: Risk Tracking, Safeguarding Against Mission Critical Items, Operational Feedback, and Continuous Risk Management

2.3.1 Risk Initiation and Planning

In this phase of risk management, individuals are responsible for initiating and planning the risk management approach; its main deliverable is the Risk Management Plan. This plan consists of the following topics, which allow teams to document procedures for managing risks throughout the project's life cycle: methodologies, roles and responsibilities, budget and schedule, risk categories, risk documentation, and risk probability and impact. To properly initiate and plan the approach, activities are discussed and assessed by reviewing project plans, scope statements, organizational assets, and environmental factors. In addition to project documents, it is also crucial for the project teams to review all policies that pertain to risks, risk dimensions, and lessons learned via periodic meetings early in the project (Schwalbe, 2006). This phase of risk management is accomplished by addressing the following sub-phases: Risk Definition and Risk Focus (Chapman, 1997).

- **Risk Definition**: This sub-phase identifies and implements clear activities that share all key aspects of a risk: consolidation, elaboration, documentation, verification, assessment, and reporting. Consolidation describes the collection and synthesis of all relevant project information such as strategies, objectives, and tasks. Elaboration defines the process of gathering new information to close any gaps identified during the consolidation. Documentation records all appropriate information. Verification ensures the quality and consistency of information to highlight all conflicting opinions. Assessment ensures its relevancy to the purpose of the project. Reporting releases and presents all verified documents to the relevant audience. The iteration of this sub-phase is important as it is often difficult to clearly define the central aspect of risks (Chapman, 1997).
- **Risk Focus**: This sub-phase separates the project and risk management strategic plans, which allows risk management to be given the same weight of importance at the operational level. The deliverable for this sub-phase is compiled via the Scope Definition and the Risk Management Tactical Plan. The scope is used to identify those individuals who are accountable and responsible for a given activity and to whom they are accountable, while justifying why the formal risk management plan was developed (i.e., for what purpose). The tactical plan is used

to identify which models and methods will be used to allocate available resources over time (Chapman, 1997).

While consolidation and elaboration are specific to the Risk Definition sub-phase, documentation, verification, assessment, and reporting are common to all risk management phases. During this phase, influence diagrams that explore the interrogative relationship of projects (i.e., who, when, where, what, how, and why) prove to be an excellent tool to clearly define and structure the risks (Chapman, 1997). Additionally, identifying the level of risk tolerance for all stakeholders is essential, as their unique risk preferences can influence the risk management approach (Schwalbe, 2006). Moreover, many projects also opt to include contingency plans, fallback plans, and contingency reserves. Contingency plans outline the predefined activities that must be implemented when the identified risks occur. Fallback plans are developed for risks that impact project objectives substantially; They are applied if/when risk reduction strategies prove ineffective. Contingency reserves or allowances define the allocation of resources to reduce potential cost or schedule overruns according to the project objectives (Schwalbe, 2006).

The completion of a risk management plan has a direct relationship to the effectiveness of risk management. As such, it is important to close all project risk gaps before moving on to subsequent phases of the risk management structure (Chapman, 1997).

2.3.2 Risk Identification

To effectively manage risk, all relevant project risks must be identified and defined. The purpose of this phase is to understand potential risk events that may negatively or positively impact a project by identifying risks and their sources, adverse effects, underlying mechanisms, responses, and finally, any potential secondary risks (Chapman, 1997; Schwalbe, 2006).

The main deliverable for this phase is the initial draft of a *Risk Register*, which consists of a list of risks and responses as per the project's goals and objectives (Boehm, 1991; Schwalbe, 2006). An appropriate risk register is classified, characterized, documented,

verified, and reported to provide a clear, common understanding of both positive and negative risks associated with a project (Chapman, 1997). This process involves understanding the common sources of risk and reviewing project and risk management plans, scope statements, environmental factors, and organizational assets (Schwale, 2006). To ensure that the appropriate information is successfully gathered to complete the initial draft of a risk register, search and classify tools and techniques are utilized: (Chapman, 1997)

- **Search**: This sub-phase begins with a documentation review to identify historic and recent organizational information and assumptions that may impact the project. Once all potential risks have been identified and reviewed, systematic information-gathering techniques and analyses such as interviews, brainstorming, and checklists are incorporated (Boehm, 1991; Chapman, 1997; Schwalbe, 2006). These techniques produce meaningful templates by helping to identify risks from previous projects with similar goals/objectives, forecast future risks, map risk interactions, reach consensus, and understand strategic implications (Schwalbe, 2006).
- **Classify**: This sub-phase involves structuring risks and responses to aggregate and disaggregate risk variables (Chapman, 1997). For large technological systems, multi-dimensional techniques are used to address multiple objectives, constraints, decompositions, and decisions (Haimes, 1981; Pennock & Haimes, 2002). To capture and classify risks, a Risk Breakdown Structure (RBS) is recognized for its usefulness by allowing categories to be considered from the Work Breakdown Structure (WBS). An RBS risk hierarchy may be ordered according to their highest, strategic significance (e.g., business, technical, organizational, project) or as per the Project Management Knowledge Areas (i.e., integration, scope, time, cost, quality, human resources, communication, risk, and procurement) (Schwalbe, 2006).

When identifying and defining the common sources of risks, the importance of continuous, iterative identification of risks based on the changing project environment must be recognized (Schwalbe, 2006). Stakeholder engagement and integration must also

be applied during this phase (Pennock & Haimes, 2002), as the root cause of many risks is a vague understanding of application domain expertise and the uncertainties of project scopes (Boehm, 1991). Once all potential risks have been identified and categorized via the above tools and techniques, one must then strive to understand which risks are most significant by carrying out a risk analysis and assessment (Schwalbe, 2006).

2.3.3 Risk Analysis and Assessment

Once all potential risks have been identified and categorized, risk analysis and assessment determines the impact of identified risks on the project's overall goals and objectives (McConnell, 1996). This phase is composed of the following sub-phases that are responsible for various deliverables serving different purposes: Structure, Ownership, Estimate, and Evaluate (Chapman, 1997).

- **Structure**: While the risk identification phase initiates the structure, this sub-phase completes it. Its purpose is to investigate assumptions and provide structures regarding the risk elements as simply as possible by refining risk classifications, exploring risk interactions, and generating risk orders/priorities to produce a set of documents and models that accurately capture risk relationships. This key deliverable seeks to understand the assumptions in risk response relationships and in preliminary baseline-plan activities (Chapman, 1997).
- **Ownership**: This sub-phase distinguishes risks and responsibilities, assigns accountabilities for the risks and responses owned/managed by clients and other individuals, and approves ownership and management that may be controlled by third parties. As such, its key deliverable outlines the ownership and the assignment of responsibilities to define the policy scopes and allocation plan; the former identifies the objectives of the ownership strategy, while the latter considers the particulars of the methods – a process that allows risk ownership policies to be transformed into operational contracts (Chapman, 1997).
- **Estimate**: Qualitative risk analysis estimates risk and response priorities by assessing the resources available to minimize expenditures on small risks while focusing efforts on complex uncertainties and responses (Chapman, 1997;

Schwalbe, 2006). The primary output is an updated risk register (Schwalbe, 2006) that contains the analysis of risks and their interactions via risk exposure values – the calculation of risk probabilities and their potential impact upon the cost, duration, and other project criteria (Boehm, 1991; Barki, 1993; McConnell, 1996; Chapman, 1997). These values are aggregated to produce a probability/impact risk matrix that determines risk priorities and magnitudes. It is advantageous to separate the matrix into positive and negative risks to ensure that both types of risk are considered (Schwalbe, 2006). It is also good practice to analyze the conditions associated with risk assumptions (Chapman, 1997). While qualitative risk analysis contains many challenges (e.g., the complexity of determining accurate estimates with often insufficient evidence), it provides a valuable stepping stone to identify risks that must be further evaluated on a quantitative basis (Boehm, 1991; McConnell, 1996; Haimes, Kaplan, & Lambert, 2002; Pennock & Haimes, 2002; Schwalbe, 2006). This sub-phase helps one quickly estimate risks to determine the course of action that best fits the changing project environment (Schwalbe, 2006). To enhance this estimation, the following techniques are commonly utilized: group-consensus or the Delphi technique, performance models, cost models, network analysis, statistical decision analysis, and qualitative analysis (Boehm, 1991).

- **Evaluate**: The evaluation sub-phase synthesizes and quantitatively evaluates the estimated results (Chapman, 1997) to create an updated risk register with revised risk rankings and detailed information supporting those rankings (Schwalbe, 2006). To numerically evaluate the probabilities of achieving project objectives and the impact of risks on the organization, the following data gathering and modeling techniques are utilized: interviews, expert judgements, probability distributions, decision tree analysis, sensitivity analysis, and simulations or Monte Carlo analyses (Schwalbe, 2006). These quantitative techniques assist decision makers by providing meaningful information and logical paths for obtaining predicted or actual values for risk metrics. Ultimately, they enhance the decision makers' situational awareness and remedy the mathematical shortfalls of risk exposure methodology (Haimes, Kaplan, & Lambert, 2002; Pennock & Haimes,

2002). As such, the results of quantitative analysis often influence the level of approved contingency reserves and may cause projects to be cancelled or redirected (Schwalbe, 2006). While quantitative risk analyses offer objective, accurate measurement of risk probabilities, they are both expensive and time-consuming (Boehm, 1991; McConnell, 1996). Thus, the selection of utilized techniques often depends on the project's nature and the availability of resources (Schwalbe, 2006).

When analyzing and assessing identified risks against overall project goals and objectives, the importance of concurrently and iteratively performing qualitative estimations and quantitative evaluations cannot be underestimated. Once all potential risks have been structured, assigned, estimated, and evaluated via the available tools and techniques, performing risk prioritization and filtration helps to rank the risks (Schwalbe, 2006).

2.3.4 Risk Prioritization and Filtration

The inherent hazard of risk management is identifying too many risks (Boehm, 1991); modeling and tracking all risks for a complex system can be very expensive to control and manage (Pennock & Haimes, 2002). The Risk Prioritization and Filtration phase effectively focuses risk management efforts and concentrates resources by identifying a manageable set of risks that are most likely to impact the overall goals and objectives of the project (Pennock & Haimes, 2002).

Based on the information gathered from the previous phases, this phase generates a list of prioritized risks that serve as the basis for risk control and management practices (McConnell, 1996; Haimes, Kaplan, & Lambert, 2002). Although the initial draft of risk prioritization is produced during the risk analysis and assessment phase, it serves a very different purpose here: during the analysis phase, more expensive and time-consuming individual risks are prioritized so they may be further evaluated quantitatively; this phase produces a manageable set of risks that could compromise the success of the project as a *whole* (McConnell, 1996).

To produce a list of prioritized risks gathered from the analysis phase and observe their relationships, all of the information is sorted. Because this sorting process includes probability and impact estimates that are inherently limited by their accuracies and/or driven by subjective opinions, the priority ordering may also be subjective. Consequently, this list is only roughly ordered, as high-impact risks may be assigned a higher priority than the evidence might suggest and/or prioritized according to some combination of synergistic risks that may have greater impact than the individual counterparts (McConnell, 1996). In addition to the identification of high-impact risks that require focused efforts and resources, this phase also filters low-impact risks (McConnell, 1996). The risk filtering, ranking, and management (RFRM) framework is a comprehensive, systematic approach used to prioritize and filter risks by applying qualitative and quantitative analyses. This framework provides decision makers with the ability to distinguish ordinal and cardinal analyses to adjust and modify risk levels by estimating the relative importance of all risk exposures (Haimes, Kaplan, & Lambert, 2002). Other popular tools and techniques include risk reduction leverage analysis, compound risk reduction, and group-consensus processes like the Delphi technique (Boehm, 1991).

When applying the risk management structure practically, the risk prioritization and filtration phase serves as a critical bridge connecting the practices of risk assessment and control. Once all risks have been properly identified, analyzed, and prioritized, a set of control activities must then be established to manage the high-priority risks (Boehm, 1991).

2.3.5 Risk Response Planning

Risk response planning involves the process of enhancing opportunities (i.e., positive risks) while reducing threats to protect project goals and objectives (Schwalbe, 2006). The focus of this phase is to develop a plan that coordinates and controls all significant risks by ensuring the plan for each risk is consistent with all of the other risks and with the overall project plan (Boehm, 1991; McConnell, 1996). This is achieved by defining risk strategies and identifying risk response options, as outlined below (Schwalbe, 2006).

The four basic risk response strategies for negative risks include the following: (Schwalbe, 2006)

- **Risk Avoidance:** Eliminates a specific threat by addressing the root cause.
- **Risk Acceptance:** Accepts the consequences of risk.
- **Risk Transference:** Shifts the consequences and responsibilities of risk to a third party.
- **Risk Mitigation:** Reduces the impact of risk by addressing the probability of occurrence.

The four basic risk response strategies for positive risks include the following: (Schwalbe, 2006)

- **Risk Exploitation:** Ensures that positive risk happens.
- **Risk Sharing:** Allocates risk ownership to another party.
- **Risk Enhancement:** Modifies the size of opportunities by maximizing the key drivers of risk.
- **Risk Acceptance:** Occurs when the team either cannot or chooses not to take action regarding risk.

Risk response strategies provide updated information to the risk register and the project management plan by refining risk responses, risk ownership, and risk status information, even as they determine contingency plans/reserves and residual/secondary risks. Here, residual risks refer to risks that remain after all responses have been implemented, and secondary risks represent the direct results of implementing risk responses (Schwalbe, 2006). While response strategies are developed by utilizing the outputs produced in the previous phases (Schwalbe, 2006), the plan is developed via tools and techniques such as risk-reduction checklists, cost-benefit analyses, and standard guidelines (Boehm, 1991). Updating and integrating the project plan and the risk register is an essential part of the risk response strategy and plan as it may influence the already defined tasks, resources, and time allotments (Schwalbe, 2006). Typically, project and risk management plans consist of the following subsets: (Chapman, 1997)

- **Base Plan:** A detailed, proactive action plan that addresses precedence, ownership, timing, and resource allocations.

- **Risk Assessment:** Threats and opportunities that are first analyzed and prioritized, and then listed, along with alternative responses.
- **Contingency Plan:** A detailed, reactive action plan that addresses precedence, ownership, timing, and resource allocations.

To ensure that concise, action-oriented plans are easy to monitor and control, the overall risk management plan should be organized into the following categories: who, when, where, what, why, and how (Boehm, 1991; McConnell, 1996). Once the best available option is determined based on its costs and benefits, its impact upon the system must be evaluated to avoid the possibility of eliminating future risk responses and to control the changing levels of interrelated risks. Risks initially identified as miniscule may become critical owing to other changes made within the system. Ultimately, the purpose of this phase is to develop a set of plans to manage the prioritized risks, and the risk monitoring/tracking phase manages the plan's effectiveness (Pennock & Haimes, 2002).

2.3.6 Risk Resolution and Implementation

The risk response plan is executed within an environment where risks can be eliminated or resolved (Boehm, 1991) so high-impact risks can be addressed (McConnell, 1996). Tools and techniques used to resolve risks include prototypes, simulations, benchmarks, mission analyses, key personnel agreements, design-to-cost approaches, incremental developments, surveys, and others that may have been established during the risk initiation and planning phase (Boehm, 1991). While risk resolution depends on the type of risks involved, a few generic methods include the following: (McConnell, 1996)

- **Avoid the Risk:** Do not perform risky activities.
- **Transfer the Risk:** Risks in one part of the project aren't as risky as in other parts of the project.
- **Buy Information About the Risk:** Investigate risks.
- **Eliminate the Root Cause:** If the design for a part of the system is challenging, transform it as a research project to eliminate it from the working versions.
- **Assume the Risk:** Accept risks.
- **Publicize the Risk:** Present risks and their impact to management, the marketing team, and customers.

- **Control the Risk:** Accept risks and develop contingency plans by allocating resources to the plan.
- **Remember the Risk:** Collect risk management plans for future projects.

The implementation of risk management is best practiced when risk management principles and project life cycle methodologies are integrated (Boehm, 1991). Although the level of required resources is at its lowest during the earlier project phases, the level of uncertainty is at its highest (Schwalbe, 2006) and project interpretations are subject to personal experience and opinions (Chapman, 1997). Despite these challenges, when done properly, integrating risk management into early phases of a project is invaluable (Chapman, 1997), as stakeholders have the greatest opportunity to influence project characteristics and outcomes at that juncture (Schwalbe, 2006). Identifying clear project goals and objectives and mapping their relationships with the project deliverables is an important aspect of successful integration (Chapman, 1997).

A project life cycle is a collection of phases and processes used to deliver projects. It generally defines stakeholders, deliverables, durations, and how each project phase will be controlled and approved. Although the type of project life cycle depends on the project's needs, common phases consist of concept, development, implementation, and close-out; each project phase then consists of the following processes: initiation, planning, execution, monitoring and controlling, and closing (Schwalbe, 2006). Many projects do not follow this traditional project life cycle, however, as variations that include these generic characteristics may be more flexible and adaptable to the dynamic conditions of projects and organizations (Schwalbe, 2006). Popular risk-driven models include the spiral model, which considers risks when determining the overall sequence of the life cycle activities (Boehm, 1991). Regardless of the selected life cycle, it is good practice to view all projects as sets of decomposed phases that connect the beginning and the end, thus measuring the goals and objectives (Schwalbe, 2006).

Just as organizational changes can impact projects, so can project changes affect organizations. Breaking a large project down into smaller projects and phases ensures

that the projects are compatible with organizational needs. Since organizations commit more resources as projects continue, management must evaluate a project's progress and potential for success at each phase, as well as whether it continues to meet organizational goals and objectives. Incremental assessment keeps projects under control and helps determine whether they should be continued, redirected, or terminated (Schwalbe, 2006) while ensuring that organizational cultures are able to gradually adjust to project changes (Boehm, 1991).

2.3.7 Risk Monitoring and Management

This phase represents the final stage of risk management (Chapman, 1997). Risks could be managed with ease if they remained static once the response plans were established. However, the reality is that risks are dynamic and continuously evolve as projects progress (McConnell, 1996). Identified risks may not materialize, probabilities of occurrence and loss may diminish, or redistribution of resources may be required as risk exposure values fluctuate (Schwalbe, 2006). This final phase monitors existing risks and identifies emerging ones to control progress toward established risk resolutions and plans by managing deviations via appropriate plans and necessary actions (Boehm, 1991; McConnell, 1996; Chapman, 1997).

The key deliverables for this phase include a set of diagnoses for: 1) the need to re-examine earlier plans, 2) the basis for control, and 3) the initiation of re-planning. Re-planning and change reports are only initiated after critical events occur. They take emerging trends and changes into account to iteratively measure a set of achieved performance targets related to the original prioritized list and the planned progress from previous phases (Chapman, 1997) using the following tools and techniques: risk assessment, risk audit, variance and trend analysis, reserve analysis, technical performance measurement, and periodic reviews known as risk and milestone tracking (Schwalbe, 2006).

- **Top Priority Risk Tracking:** This commonly used top-ten-watch list monitors and controls risks by allowing management to focus resources and efforts on high-leverage items (Boehm, 1991). It summarizes risk statuses, risk exposure

values, previous and current risk ranks, the number of risk appearances over time, and resolution activities taken to address risks (McConnell, 1996; Schwalbe, 2006). In addition, it covers low-priority risks having the *potential* to be placed on a top-ten list (Schwalbe, 2006). Risk tracking forces organizational management, project teams, and customers to periodically review the most significant risks and to revise risk awareness lists accordingly over the course of project life cycles (McConnell, 1996; Schwalbe, 2006).

- **Risk Milestone Tracking:** This type of chart displays risk exposure levels over time, as per the milestones of risk management plans. Specifically, it gathers a wealth of information regarding the anticipated risk levels for each milestone of risk management plans, compares the predicted and actual risk levels, and monitors risks via risk regions (i.e., observations, problems, and mitigations). Decision makers thus establish a new set of anticipated risk levels and revise plans when/if the actual risk levels exceed the predicted levels (Pennock & Haimes, 2002).

The above tools and techniques produce outputs such as requested changes; updated risk registers; updated project and risk management plans; recommended preventable and corrective actions; and organizational assets such as lessons learned (Schwalbe, 2006). While a list of lessons learned is a popular deliverable produced at the end of projects to ensure the success of future projects, it can also be produced after each major project milestone and utilized for the current project (McConnell, 1996).

Risks evolve over time as project priorities and requirements are modified. Additionally, it is unlikely that *all* risks will have been comprehensively identified, successfully prioritized, and perfectly addressed in planning during the first iteration of risk management. Continuous Risk Management emphasizes the importance of periodically reviewing risks, sources of risks, and consequences of risks by iterating the entire risk process to ensure that all remain valid throughout the project life cycle (Pennock & Haimes, 2002). Because periodically monitoring risks enables unexpected changes to be controlled and engaging stakeholders enables strategies to be reassessed according to the

evolution of risks, both are considered key factors in successfully completing projects on time and within allotted budgets. They enable management to efficiently direct limited resources in response to changing conditions and the multidimensional nature of project risks (Boehm, 1991; Pennock & Haimes, 2002).

To enhance continuous project risk awareness and to prevent stakeholders from ignoring project risks, organizations often appoint risk officers. For psychological reasons (as is the case with testing and peer reviews), it is beneficial to appoint designated personnel to play the role of devil's advocate and to then hold them accountable for investigating all the reasons why projects may fail; project managers and risk officers should thus be separate entities within projects and organizations (McConnell, 1996). To monitor and manage the effectiveness of risk management strategies, the status/ state of systems is regularly measured and assessed. This requires total organizational participation; the accuracy of metrics depends on the level of stakeholder engagement and collaboration (Pennock & Haimes, 2002).

2.4 Building Trust: Risk Communications

As stakeholders hold a major interest in project outcomes, they must periodically meet to discuss appropriate risk management practices that account for all perspectives of project risk. While risk information is important, knowledge of how systems operate is crucial as it provides the means to identify, estimate, predict, and utilize risk information (Pennock & Haimes, 2002). This is especially important for projects that develop a "system of systems." In such projects, not only is knowledge of system components important, but so, too, is knowledge of system boundaries and how they interact with one another to generate new sources of risks. Consequently, additional sets of knowledge derived from individuals at multiple levels of the organizational hierarchy are required to assess all risks (Pennock & Haimes, 2002). A determination must first be made regarding where the appropriate knowledge resides within the organization. The boundary types listed below control the flow of knowledge through and between organizations: (Ashkenas, Ulrich, Jick, & Kerr, 1995; Pennock & Haimes, 2002)

- **Horizontal:** Organizational sub-divisions often encourage private ownership of work while discouraging cooperation with other sub-divisions. Bridging this boundary enables one to communicate knowledge to other parts of the organization.
- **Vertical:** Levels of organizational hierarchy are commonly separated into upper management, middle management, and operations, a division that often prevents the communication of knowledge from upper management to the operations team, and vice versa. Addressing this boundary enables the operations team to understand the strategic significance of project and risk management, even as it allows management to understand operational constraints (e.g., available resources).
- **External:** Boundaries between participating organizations share many of the same challenges that exist horizontally within organizations. In such situations, each stakeholder must possess specialized knowledge of systems to ensure that all perspectives of different professions are integrated.
- **Geographical:** Communication tends to diminish as the physical distance between participating organizations increases. Trust must be established within and between all participating organizations to create a culture of joint responsibilities (e.g., collaborations).

Risk management facilitation is heavily driven by organizational culture. Trust is the key component that must be culturally embraced to successfully exchange information and knowledge. To achieve trust within and between the participating organizations, messengers of project failures and mistakes must not be penalized; it results in a loss of trust, and valuable observation, information, and knowledge regarding the state of projects can be lost (Pennock & Haimes, 2002). According to Nordean (personal interview as cited in Pennock & Haimes, 2002), this lack of trust and communication may be resolved by instituting *an* anonymous reporting system that encourages communication with the risk management team. This direct, unfiltered communications channel is invaluable in practice as the team is able to obtain raw data, information, and

knowledge (free of modifications and filtrations driven by politics and fear of repercussions) as they pass through the organizational hierarchy.

Organizational boundaries can be conquered when all stakeholders' knowledge is integrated (e.g., individuals from organizations, organizational subdivisions, and organizational hierarchies). This is often referred to as *total organizational involvement*, and it is used by the risk experts responsible for developing comprehensive project risk management plans. To build trust and encourage proactive participation of knowledge sharing, the entire organization must embrace and buy-in to the importance of risk communications and management. To ensure that valuable risk information and knowledge are transparently communicated without political restrictions driven by fear, anonymous reporting systems may be useful (Pennock & Haimes, 2002).

2.5 Risk Dimensions of eHealth

As mentioned in this chapter's segment, the *Benefits of Risk Management*, successful risk management integrates risk-oriented processes with principled practices. While many derivatives of these practices and processes have been proposed in the literature, they all share the following concepts: *risk management structure* and *risk dimensions* (Boehm, 1991; Pennock & Haimes, 2002). The risk dimensions specific to eHealth projects that require careful examination and consideration over all phases of the project life cycle are described and explored below.

2.5.1 Organizational and Cultural Risks

Organizational and cultural risks are attributed to health care entities that cannot ensure continuity of care, whether with or without information systems. Many cultures do not tolerate transparent sharing of information between general practitioners, specialists, nurses, and patients owing to longstanding layers of mistrust and conflict (Iakovidis, 1998). To succeed in the modern world, health care professionals and patients must develop new mindsets to raise levels of trust and collaboration (Tang, Ash, Bates, Overhage, & Sands, 2006). In response, many countries are now considering health care reform to re-establish shared care services and information exchange (Iakovidis, 1998). Conflicting organizational missions and disruptive clinical processes have also been

identified as key barriers to the implementation and the adoption of EHR (Hillestad, et al., 2005; Sicotte, Pare, Moreault, & Paccioni, 2006). As such, information systems must conform to the mission and processes of an organization, while workflows must be improved to avoid the obstruction of clinical processes (Hersh, 2004). To summarize, there is a growing need to effectively shift the cultural and organizational dimensions of health care environments in order to successfully implement and adopt EHR (Urowitz, et al., 2008).

2.5.2 Behavioral and Clinical Risks

These include acceptability and usability risks related to human factors and training issues. In practice, many health care professionals resist eHealth applications as they pose a threat to their control, autonomy, and authority and/or because they are not satisfied with information systems' user-friendliness, perceived utility, or performance (Sicotte, Pare, Moreault, & Paccioni, 2006; Tang, Ash, Bates, Overhage, & Sands, 2006). It is estimated that 79.3% of general practitioners (GPs) believe that vendors fail to deliver acceptable products, while 50% report that a lack of sufficient knowledge about how to use such systems is a major barrier (Anderson, 2007). As user acceptance largely depends on users' attitudes and expectations and the training they receive, proper change management principles must be applied to successfully control behaviour changes (Tang, Ash, Bates, Overhage, & Sands, 2006). Specifically, the literature shows that user-involvement during the presentation of EHR benefits and throughout the implementation process are key success factors (Hersh, 2002); Well-trained professionals must emerge to lead and focus efforts in health care settings if EHR benefits are to be fully realized (Hersh, 2004).

2.5.3 Technology and Standard Risks

The storage, maintenance, communication, and retrieval of multimedia information from heterogeneous platforms that are geographically distributed poses technological and standards-based risks. Due to conflict of interest by multiple vendors, many organizations use legacy systems where health information is trapped in what are referred to as silos (Anderson, 2007). As a result, there is little likelihood that vital health information will accompany patients to other health care providers, whenever and wherever care is needed

(Hersh, 2004). Centralized information management, reliable system interoperability, and EHR standardization are critical components of effective EHR implementations (Hersh, 2004; Hillestad, et al., 2005; Sicotte, Pare, Moreault, & Paccioni, 2006). System integration can be categorized into internal and external dimensions (Raghupathi & Tan, 2002). Internal system integration defines the degree to which systems are integrated with one another within an organization. External system integration describes the degree to which systems interact with outside organizations. Data redundancies and inconsistencies can be eliminated through EHR integration and standardization (Raghupathi & Tan, 2002).

2.5.4 Economic and Financial Risks

These are determined by the demand for, and the willingness to invest in, the EHR. In general, the health care market has been identified as a large industry, but not a profitable one owing to the lack of standards and other risks (Iakovidis, 1998). Over eighty percent of primary care physicians perceive a generalized lack of financial support to be the key barrier associated with health ICT projects, along with a misalignment of costs and benefits, poor executive buy-in, and high initial costs (Sicotte, Pare, Moreault, & Paccioni, 2006; Anderson, 2007). Anderson's 2007 study suggests that GPs who perceive health ICT as lacking financial support and incurring high initial investment costs were less likely to implement such a system. Overcoming these barriers requires subsidies and performance incentives from both payers and the government.

2.5.5 Legal and Confidential Risks

Issues regarding the authentication and the privacy of patient health information are obvious and well-known during EHR implementations; They are impossible to address without legislative interventions. The root cause of these risks can be observed in the legal implications of personal electronic health records and the patients' desire for privacy protection (Tang, Ash, Bates, Overhage, & Sands, 2006). However, it is essential to recognize that the perfect protection of patient privacy and confidential health information can never be *fully* achieved in any real world setting. Instead, the reengineering vision must be understood and new legal frameworks must be adopted to address issues of privacy and confidentiality (Hersh, 2004; Anderson, 2007) by exploring

possibilities such as digital signatures, system authentications, and data ownership (Iakovidis, 1998; Sicotte, Pare, Moreault, & Paccioni, 2006). Removing legal barriers, enhancing the security of medical data, and creating a health care culture that demands privacy and confidentiality are required to handle these legal risks (Hersh, 2004; Anderson, 2007).

2.5.6 Vision and Leadership Risks

A willingness to reengineer and transform health care delivery practices (toward improving quality and efficiency) on the part of health authorities and managers is a key component. Because most managers are caught between the demands for direct care and the pressure of cost-containment, the vision required to successfully implement and adopt an EHR is lacking (Iakovidis, 1998). The absence of an overall EHR strategic plan was reported by 66% of general practitioners as a major barrier to successful EHR implementations (Anderson, 2007).

2.5.7 Summary of eHealth Risk Dimensions

Health ICT applications were traditionally evaluated and managed based on technical and economic considerations, while social, cultural, political, and organizational dimensions were given little attention. However, evaluations that focus only on a few select technical and economic criteria are not enough to ensure successful project outcomes and fully realize the benefits of EHR. Understanding the relationship between individuals, organizations, and systems and their combined impact on project risks is important. Specifically, one of the major challenges with health ICT implementations is capturing these complex interactions, inter-relationships, and inter-effects; Recognizing all risk dimensions may help address this challenge (Kaplan, 1997). Integrating this concept into a health ICT project risk management framework helps create a strong foundation that could prove vital in improving project success rates and outcomes (Pare, Sicotte, Jaana, & Girouard, 2008).

2.6 Applications of Risk Awareness in the Information Systems and Health Informatics Literature

According to Brender et al. (2006), project failure is defined as the inability to attain the following:

- The ability of a system to positively contribute to the organization, the users, and the patients via extensive utilization and wide recognition without adversely affecting other system parts.
- User-readiness to persistently advance systems that are flexible and upgradeable (i.e., scalable) to manage the emerging demands and evolving practices of health care technology.

However, project risks can also be defined as the *uncertainties* that can positively or negatively impact project goals and objectives (Schwalbe, 2006), while risk factors can be characterized as contextual issues influencing project outcomes that can be reduced via intervening tactics (Pare, Sicotte, Jaana, & Girouard, 2008). To maximize opportunities (i.e., positive risks) and minimize threats (i.e., negative risks), a classified list of characterized and verified risks is produced that clearly documents and communicates those risks facilitates a common understanding of project uncertainties (Chapman, 1997). However, managing and controlling all identified project risks can become extremely expensive. Inability to control the escalating commitment of resources to risk management has been documented as one of the main reasons for project failures (Brockner, 1992). As such, it is essential to prioritize the identified project risks to: 1) generate a manageable set of risks 2) direct resources appropriately, and 3) attend to those risks that significantly influence project outcomes (Pennock & Haimes, 2002).

Although many tools and techniques can be used to identify and prioritize project risks, many are costly and time-consuming, requiring experts with an acute sense of risk awareness to initiate them. To address this limitation, risk professionals commonly use *checklists* that offer a simple means to identify, track, and control risks (Schmidt, Lyytinen, Keil, & Cule, 2001). The value of a comprehensive checklist is recognized by many experts as it enables rigorous control of projects to increase the rate of project

success (Schmidt, Lyytinen, Keil, & Cule, 2001; Pare, Sicotte, Jaana, & Girouard, 2008), thus the application of project risk identification and prioritization in the IS literature is explored next.

2.6.1 Risks in the Information Systems Literature: A Brief Overview

Since the 1970s, project management and IS implementation researchers have studied the factors that affect risks, but research carried out prior to the late-1990s is viewed as misleading by many professionals for the following reasons (Keil, Cule, Lyytinen, & Schmidt, 1998; Laitinen, Fayad, & Ward, 2000; Schmidt, Lyytinen, Keil, & Cule, 2001):

- Past papers were produced using out-dated literature based on irrelevant premises that do not correctly reflect today's computing and business landscapes;
- Past risk research has been criticized for not being properly grounded to systematically detect risks;
- Very few papers meaningfully categorize risks and risk factors;
- Very few studies systematically examine the relative rankings of risks and risk factors, as past studies did not use appropriate methods to produce valid and reliable rankings (i.e., lack of consensus on risks and risk factors and on their relative rankings);
- Very few systematic studies identify IS project risks by gathering the opinions of real-world professionals who are submersed in risk evaluations every day (i.e., practicality); and
- Only a limited number of cross-fertilization studies integrate and synthesize project risk management and IS implementation literatures to offer IS project risk management theories.

Owing to a number of similarities between the two bodies of literature, their unification can positively and significantly contribute to the practice of IS risk management. Consequently, many experts are calling for a re-examination of IS project risks and risk factors and of their rankings in order to address the changing technological and organizational landscapes of the 21st century (Schmidt, Lyytinen, Keil, & Cule, 2001).

To successfully conduct a study on IS project risks and their significance, one must understand the dynamic and evolving nature of risk as a project progresses (McConnell, 1996). Identifying and prioritizing risks too early in a project can lead to the misallocation of resources to symptoms rather than to root causes and to risk interdependencies (Brender, Ammenwerth, Nykanen, & Talmon, 2006). Within socio-technological systems, the nature of risk and the perceived level of risk significance can rapidly change as a function of many variables such as culture (time and environment) and control (Schmidt, Lyytinen, Keil, & Cule, 2001). In turn, this can influence the decisions made regarding how and where project resources should be allocated. To properly assess IS project risks in the 21st century and to develop appropriate risk strategies, the next section explores and investigates how risks and their relative rankings vary according to the variables noted by the following key researchers: Boehm (1991), Barki et al. (1993), Moynihan (1997), Keil et al. (1998), and Schmidt et al. (2001).

2.6.2 Risks in the Information Systems Literature: Perceived Effects of Culture and Control on Risks

Within the current literature, many of the published studies on IS project risks are based on American data and/or are restricted to American cultural norms (Hofstede, 1991; Schmidt, Lyytinen, Keil, & Cule, 2001). In other words, comprehensive lists of risks found within the literature are significantly limited by a lack of cultural perspective, which is ultimately shaped by time and place. Because the root cause of many failed solutions can be traced to differences in perceptions of risk, understanding how cultures define common risks is important (Hofstede, 1991).

To address this cultural matter, Keil et al. (1998) and Schmidt et al. (2001) produced comprehensive and authoritative lists of risks and rankings to explore how countries (i.e., cultures) perceive risks differently. These carefully explore and discuss how none of the fundamental questions regarding risk awareness were addressed prior to the late 1990s and the fact that no validated lists are available to understand the inherent cultural and socio-economic variations to risks.

To successfully redress this one-dimensional perspective of culture in the risk research, Keil et al. (1998) and Schmidt et al. (2001) selected Hong Kong, Finland, and the United States to contrast their cultural and socio-economic differences, as per Hofstede's Dimensions of Culture (Hofstede, 1980, 1991); these countries were also selected based on similarities in their levels of advanced ICT utilization to ensure a degree of validity (Schmidt, Lyytinen, Keil, & Cule, 2001). Their comparative research generated a list of 15 risks for Hong Kong, 23 for Finland, and 17 for the United States. The top five risks for each country are outlined in Table 1 (Schmidt, Lyytinen, Keil, & Cule, 2001):

HONG KONG	FINLAND	USA
Insufficient Project Commitment from the Top Management	Ineffective Project Management Skills	Insufficient Project Commitment from the Top Management
Inadequate Project Involvement by the Users	Insufficient Project Commitment from the Top Management	Misinterpretation of the Project Requirements
Insufficient Project Commitment from the Users	Inadequate Availability of the Necessary Project Knowledge/Skills	Improper Change Management Practices
Lack of User Cooperation	Improper Change Management Practices	Insufficient Project Commitment from the Users
Change in Top Management or Ownership	Little or No Planning	Ineffective Project Management Skills

Table 1: Adapted from Schmidt et al. (2001)

These relative rankings were consensually determined by selecting the risks that require the most attention and resources to successfully complete a project (Schmidt, Lyytinen, Keil, & Cule, 2001).

Keil et al. (1998) and Schmidt et al. (2001) also aggregated the risks garnered from the three countries' different cultural backgrounds and socio-economic conditions. This enriched the results of the study by extending the scope of the risks rather than relying on narrow, country-specific lists that may be subject to cultural bias. They produced a final, comprehensive list of 29 ranked risks according to the order of average ranks (i.e., degree of agreement regarding relative importance). Table 2 outlines the top 11 risks across the

three countries, as well as their respective levels of risk control (Keil, Cule, Lyytinen, & Schmidt, 1998; Schmidt, Lyytinen, Keil, & Cule, 2001):

RANK	RISKS	LEVEL OF RISK CONTROL
1	Insufficient Project Commitment from the Top Management	Limited Control
2	Insufficient Project Commitment from the Users	Limited Control
3	Misinterpretation of the Project Requirements	Complete Control
4	Inadequate Project Involvement by the Users	Limited Control
5	Inadequate Availability of the Necessary Project Knowledge/Skills	Limited Control
6	Insufficient Frozen Requirements	Limited Control
7	Changing Objectives and Scopes	Limited Control
8	New Technology	Limited Control
9	Failed User Expectation Management	Complete Control
10	Inappropriate or Insufficient Project Staffing	Complete Control
11	Conflict between Departments	No Control

Table 2: Adapted from Schmidt et al. (2001)

Although Canada was not included in this particular comparative research, a universal set of risks *may* exist; independent panels representing different cultures identified and selected a common set of the top 11 significant risks (Keil, Cule, Lyytinen, & Schmidt, 1998). This set may serve as a checklist for comparing and assessing risks in future IS implementation projects (Schmidt, Lyytinen, Keil, & Cule, 2001). However, it is interesting to notice the difference between this new set of prioritized project risks and the top ten risks that Boehm compiled in 1991, reproduced here in Table 3.

RANK	RISKS
1	Personnel Shortfalls
2	Inappropriate Budget and Schedules
3	Wrong Property and Function Development
4	Wrong User Interface Development
5	Goldplating (providing more than clients want/asked for)
6	Continuous Change in Requirements
7	Shortfalls in Components that were Externally Furnished
8	Shortfalls in Tasks that were Performed Externally
9	Shortfalls in Real-Time Performance
10	Straining Technical Capabilities

Table 3: Adapted from Boehm (1991)

In fact, the study compared and validated its list against the lists found in the literature from the following researchers for completeness: Boehm (1991), Barki et al. (1993), and Moynihan (1997). Owing to drastic changes in both the computing and the business landscapes since the 1970s, differences between current lists and those produced prior to the late-1990s were expected (Schmidt, Lyytinen, Keil, & Cule, 2001). While the analysis indicated some risks have remained relatively stable over time, others (e.g., technological risks) have either declined in importance or completely disappeared (Schmidt, Lyytinen, Keil, & Cule, 2001). Additionally, the analysis by Schmidt et al. (2001) found four unique risk categories not mentioned in previous studies: sponsorship and ownership, funding, development process, and planning. These unexplored risk categories reflect the dynamic and evolving nature of risk and the challenges risks generate over time (Schmidt, Lyytinen, Keil, & Cule, 2001). Understanding this risk classification can help develop appropriate mitigation strategies for a project (Keil, Cule, Lyytinen, & Schmidt, 1998).

Further to the impact of culture on risks, Keil et al. (1998) and Schmidt et al. (2001) also discussed the importance of perceived level of risk control as another fundamental criterion needed to understand the dynamic nature of evolving risks (as shown in Table 2 and 3). The level of risk control consists of outside, inside, and shared risks. Outside risks refer to the risks that cannot be controlled or monitored, while inside risks refer to those that can be. Shared risks refer to the risks with limited control or influence that require cooperation between project managers and the rest of an organization. Many project managers are challenged by shared risks that require cooperation and risk communication across organizational boundaries (as discussed in the previous section – Building Trust: Risk Communications). In their study, Keil et al. (1998) and Schmidt et al. (2001) observed that many outside risks were generally not selected or were ranked lowly, while many inside risks were ranked lower than the outside risks; the panelists selected and ranked *shared risks* over which they had limited control or influence highly (March & Shapira, 1987; Schmidt, Lyytinen, Keil, & Cule, 2001).

Keil et al. (1998) and Schmidt et al. (2001) offer a foundation to enhance the empirical understanding of risk and its variation across cultures (and control levels) as these were defined by practicing, experienced project managers in all three countries. Table 2's list of risks offers a valuable starting point and an excellent baseline to advance the investigation of risk awareness. This ranked list also offers a means to appropriately allocate resources to significant risks and to produce countermeasures against them. This list may also be used to develop software project assessment guidelines that are more grounded than the earlier checklists produced by Boehm (1991), Barki et al. (1993), and Moynihan (1997). The results, when combined and integrated with a risk management framework, could offer a strong foundation for future IS research (while being mindful of timely changes to the risk profiles and perceived risk significance as industries continue to mature). However, Schmidt et al. (2001) also recognized the value of extending the study by examining project risk awareness from the vantage point of other stakeholders (e.g., *senior executives*) and how they actually manage risks in the real world (March & Shapira, 1987; Schmidt, Lyytinen, Keil, & Cule, 2001).

2.6.3 Risks in the Health Informatics Literature: A Brief Overview

As the IS literature lacks project risk management theories in the implementation domain, Schmidt et al. (2001) investigated the foundations for theory development by presenting a starting point or baseline needed for the progression of IS project risk research. This research offers an updated list of ranked risks across cultures, enabling appropriate resource allocation to those risks that influence project strategies and outcomes (Schmidt, Lyytinen, Keil, & Cule, 2001).

As a sub-field of the IS literature, the health informatics literature also requires similar consideration, as very little is understood of project risk awareness within the health care domain. Much like the IS literature, it suffers from a lack of theories and studies related to project risk management; many are case studies focusing on the individual risks that are most significant to their own contextual conditions (Gruber, Cummings, Leblanc, & Smith, 2009). In other words, the existing literature has little to offer in terms of models

that structure risk in an integrated manner to support managerial actions preventing those risks (Pare, Sicotte, Jaana, & Girouard, 2008). This is not surprising. Linton (2002) notes that it is common for many fields of social science (i.e., organizational research) to have difficulty constructing generalizable theories.

This area of research is important in health informatics as practices that have proven to be successful in other environments have not always worked in other health care settings (i.e., they are not completely transferable) (Anderson & Stafford, 2002). This may be due to extant differences in political and risk-reward considerations. Specifically, while the politics of business is able to mandate success-oriented programs with an institutional authority, the politics of health care is complicated by the autonomy of professionals and by IT departments' lack of authority. Furthermore, while business executives are able to consider financial risks and their associated rewards to move organizations forward, health organizations are unable to make similar risk/reward considerations where patient care and safety are concerned (Anderson & Stafford, 2002). As such, health informatics warrants specialized studies that are specific to clinical environments (Gruber, Cummings, Leblanc, & Smith, 2009).

While the existing literature has little to offer to an integrated view of risk awareness, a few studies were identified for their relevance to this research. The next section of this literature review explores risk awareness that is specific to eHealth and Clinical Information Systems (CIS).

2.6.4 Risks in the Health Informatics Literature: Application of a Risk Awareness Framework in Clinical Information System (CIS) Projects

In 2006, Sicotte et al. proposed a new perspective on risks in the health informatics literature: the researchers empirically tested a risk analysis framework to identify the significance of risks and their influence on inter-organizational CIS project outcomes. Examined risks included those for the development and the acceptance of complex inter-organizational systems from the following stakeholders' point-of-view: managers, clinicians, and IT specialists. As the significance of risk varies across countries and

cultures (Schmidt, Lyytinen, Keil, & Cule, 2001), the inclusion of Franco-Canadian participants renders this study an excellent complement to the limited amount of cross-cultural research available at that time.

Risks are complex because many methods exist for defining and categorizing the multi-dimensional risk characteristics and the variables that influence the nature of risks. Conducting a rigorous review is thus important so health care organizations can identify and manage all significant risks and risk factors. In their research, Sicotte et al. (2006) thoroughly reviewed the literature to locate all relevant risks supported by empirical works to produce the following CIS risk framework:

RISK DIMENSIONS	RISKS / RISK FACTORS
Technological	Inadequate Resources regarding Local IT Knowledge
	Unreliable and Unsecure Networks
	Poor System Integration with Incompatible Software and Hardware
	Lack of Standard EHR
Human	Change Resistance
	Insufficient Computer Skills and Knowledge
	Negative Experience with Past IT Projects
	Unrealistic Expectations
Usability	Poor Perceived Ease of User
	Poor Perceived Usefulness
	Misalignment of the System and the Local Workflow
Managerial	Insufficient Resources (Human; Financial; Equipment)
	Lack of Skills and Knowledge by the Project Teams
	Inadequate Executive Support
	Unrealistic Project Timeline
Strategic & Political	Misalignment of Objectives and Stakes
	Inter-Organizational Conflict
	Power and Political Games

Table 4: Adapted from Sicotte et al. (2006)

The validity of the framework outlined in Table 4 was considered to be robust and complete, as no additional risks were found by Sicotte et al. (2006) that could be incorporated and organized within the taxonomy. This framework was then used for its applicability to health care environments in their longitudinal, multi-case study of two

large, inter-organizational CISs developed between 2001 and 2004 in Quebec, Canada. The objectives of both projects were similar – the new systems were expected to be utilized by the participating physicians in their clinical practice. Both systems shared the following features, as well: they were sub-components of larger EHR systems; information exchange was limited to laboratory and radiology results; they had access to a secure, high-band intranet deployed by the Quebec Department of Health; and they utilized data warehouse infrastructure to integrate patient data stored in their existing legacy systems. However, both projects suffered critical information exchange issues (i.e., governance for competing organizations, patient matching, and data standards). A technical interface was developed for both projects to address the lack of data standards, and a unique network identifier was assigned to ensure patient matching (Sicotte, Pare, Moreault, & Paccioni, 2006).

Sicotte et al.'s 2006 study identified common, initial risks prevalent in both projects and analyzed the relationship between the final levels of risks (as per Table 5's framework – associated risks are bolded) and the risk approach each project took. Given that Project A failed while Project B succeeded, this comparison offers a unique opportunity to understand the association/link between the relative performance of risk management practices and the CIS project outcomes. The following table summarizes the common, initial risks shared by both projects (i.e., baseline) and their final levels and approaches to risks.

RISK DIMENSIONS	TIME FRAME: LEVEL OF RISKS	RISKS AND APPROACHES
Technological	Initial (Both): Very High	**Technical Feasibility**: Unfamiliarity with the new application and infrastructure (i.e., Interoperable EHR). **In-House Shortage of IS Expertise**: Required outside experts as data reliability, security, and integration were not well understood. **Lack of Data Standards**: Transfer data between systems (HL7).
	Final (Project A):	**Underestimation of the Complexity and Time Frame**: Interface implementation for data integration, leading to

	High	increased cost.
	Final (Project B): Moderate	**Developed Realistic Implementation Plan**: Time frame and efforts were aligned with the complexity of tasks, meeting the schedule.
	Final (Both): Conclusion	**Well-Managed Infrastructure Risks**: External expertise and pre-existing secure and reliable telecommunication network. **Exchange of Health Data**: Technically feasible before the launch.
Human	Initial (Both): Moderate	**Change Resistance/User Expectation**: All participants volunteered to be part of the projects and were aware of the benefits. While many participants **Experienced Past CIS Project Failure**, realistic expectations were established collaboratively.
	Final (Project A): High	**Limited Relationship with System Users**: Suggested modifications to the information requirements were rarely taken into account. Only one project champion was selected, limiting his/her influence to his/her own hospitals. **Premature Requirements Gathering and Analysis**: These were gathered and analyzed too early, resulting in **Vague Vision and Understanding** of the new system and **Uncertain Context of Use**.
	Final (Project B): Low	**Strong Relationship with Physicians**: A strong relationship was built and maintained where each participating clinic selected a physician to become a project champion with specific responsibilities. This resulted in a significant **Sense of Ownership**.
	Final (Both): Conclusion	Users heavily influenced the project's success. The difference in human risk awareness led to different outcomes: The level of risks in Project A increased as the degree of user scepticism increased; the level of risks in Project B decreased as confidence increased.
Usability	Initial (Both): Low	**Perception of System Usefulness**: Considered less significant than the perception of user friendliness. Information and work usability domain evolved to become major concerns during implementations.
	Final (Project A): Very High	**Patient Consent**: Little patient consent was obtained as the project suffered delays and patient recruitment began late; the number of available patient information records was insufficient to generate interest. **No System Support**: While no support was provided for the *new* system, all existing support remained for the *old* system.
	Final	**Patient Consent**: Patient consent was obtained in time

	(Project B): Very Low	to provide the necessary patient information within the network database. **Perception Management**: Proactively increased risk awareness in system usability by obtaining user opinions; the system was tested and modified to enhance user satisfaction and response time.
	Final (Both): Conclusion	Both projects offered sufficient information/system usability. However, critical mass was perceived as significantly influencing user expectations. Work usability also had significant impact as the new **Workflow was Not Aligned** with the existing routines. While both projects shared a similar initial risk level, different risk management approaches influenced the project outcomes.
Managerial	Initial (Both): High	**Attitudes and Actions toward Risks**: The quality of management teams can influence CIS project outcomes. The initial level was high as team size, availability of expertise, and time constraints interacted to influence project outcomes.
	Final (Project A): Very High	The risk level increased due to its **small** team size, **insufficient** IT and PM expertise, and **lack** of dedicated time to manage the project.
	Final (Project B): Moderate	Coordinated effort was intensive and responsive owing to its **large** team size and **dedicated** full-time employees with the necessary IT and PM expertise.
	Final (Both): Conclusion	Both projects were **Limited by Budget and Schedule;** complexities were encountered from multi-organizational CIS implementation.
Strategic & Political	Initial (Both): High	**Network Infrastructure Development**: While this is a technological risk, the development of a collaborative relationship between the organizations is a strategic risk. The initial level was high as the *diversity* of the network influenced risks more than did its *size*.
	Final (Project A): High	The organizational **Missions and Sizes Varied** as the hospitals/clinics were distributed across three health regions.
	Final (Project B): Low	This project was **Homogenous in Nature** as it integrated GPs practicing in the same health region. The participating GPs were also members of the same regional division of a national association.

Table 5: Adapted from Sicotte et al. (2006)

Table 5 illustrates how two similar projects with common initial risk conditions can result in two very different CIS project outcomes, a result attributable to the performance of

risk management practices. This comparison demonstrates that effective risk response can lower risk levels. The CIS framework summarized in Table 6 clarifies why Project A failed while Project B succeeded (from the risk perspective).

PROJECT A (FAILED)	PROJECT B (SUCCEEDED)
Underestimation of the Complexity and Time Required	Development of Realistic Implementation Plan
Limited Relationship with System Users	Strong Relationship with Physicians
Vague Vision and Uncertain Use Context	Sense of Ownership
Lack of Patient Data in the System	Adequate Patient Data in the System
No System Support	User Feedback re: System Usability
Inadequate IT and PM Expertise	Necessary IT and PM Expertise
Heterogeneous Organizational Characteristics	Homogeneous Organizational Characteristics

Table 6: Adapted from Sicotte et al. (2006)

The nature of risks is fundamentally multi-dimensional, and it dynamically evolves as risks interact with one another. In their research, Sicotte et al. (2006) empirically determined (using the CIS risk framework) that the success of CIS implementation requires the ability to be aware of and manage several risks simultaneously (Sicotte, Pare, Moreault, & Paccioni, 2006). To successfully manage and control multiple risks at once, one must *prioritize* the identified risks and risk factors in order to allocate the appropriate resources to those that can significantly impact the project outcome (Pennock & Haimes, 2002). Consequently, the next section aims to explore the taxonomy of *ranked* CIS Risks and Risk Factors.

2.6.5 Risks in the Health Informatics Literature: Taxonomy of Ranked CIS Risks and Risk Factors

Comprehensive lists of ranked risks can help CIS projects monitor and develop plans to lessen the effects of the risks identified. Pare et al. conducted a study in 2008to help with the development of an authoritative list of ranked CIS risks by first compiling a summarized taxonomy of risks identified in the literature. The taxonomy reproduced in Table 7 is an extension of the CIS risk framework compiled by Sicotte et al. in 2006:

RISK	RISKS / RISK FACTORS

DIMENSIONS	
Technological	Introduction of a New Technology
	Complex/Unreliable Technical Infrastructure or Network
	Complex Software Solutions
	Complex/Incompatible Hardware
	Poor Software Performance
Human	Unrealistic Expectations
	Overall Resistance to Change
	Lack of Cooperation/Commitment from Users
	Lack of Computer Skills and Knowledge among Users
	Prior Negative Experiences with CIS Projects
Usability	Poor Perceived System Ease of Use
	Poor Perceived System Usefulness
	Misalignment of CIS with Local Practices and Processes
Project Team	Changes to Membership on the Project Team
	Lack of Project Leadership
	Lack of Required Knowledge or Skills
	Lack of Clear Role Definitions
Project	Large and Complex Project
	Scope Creep
	Changes to Requirements
	Insufficient Resources
	Lack of Project Champions
	Lack of a Formal Project Management Methodology
Organizational	Lack of Support from Upper Management
	Organizational Instability
	Lack of Local Personnel Knowledgeable in IT
Strategic & Political	Misalignment of Partners' Objectives and Stakes
	Political Games and Conflict
	Unreliable External Partners

Table 7: Adapted from Pare et al. (2008)

While this taxonomy illustrates the risks that have been documented and linked with the worst-case failures in the extant IS and health informatics literature, this compilation was not used as part of their research; it was only used as a means to compare its findings and results. Specifically, their research identified and prioritized CIS risks independently of previous findings (i.e., the Table 7 taxonomy).

In 2008, Pare et al. selected 21 members from a set of experienced project managers in Quebec, Canada, who had managed an average of 12 major CIS projects and spent an

average of 23 years working in the field of health care. A systematic and rigorous procedure was applied to identify and rank typical CIS project risks, one where data were extracted from participants via iterative and controlled feedback. They found that many of the extracted CIS risks included and/or were related to the initial risk taxonomy. The list contained a mix of risks, as many overlapped and/or referred to similar risks. This meant that a single risk often comprised several risk factors. Once similar CIS risk factors were categorized and organized into a single risk to eliminate all duplication, an initial list of CIS project risks was produced.

Comparing their findings (i.e., the initial list) with the taxonomy derived from the literature, Pare et al. (2008) discovered two additional risks: Negative Attitude of Project Team Members and Environmental Changes (i.e., Legal and Ethical Constraints). Specifically, projects can not only be compromised by user attitudes, but also by the attitudes of project teams; As health care is public in Canada, projects must consider legal and ethical constraints to include patient consent and clinical data sharing between organizations. This latter point suggests that changes in regulations can influence CIS project outcomes. Lastly, eight of the 29 risks listed in the initial literature taxonomy (outlined in Table 8) were no longer identified as relevant.

RISK DIMENSIONS	**RISKS / RISK FACTORS**
Human	Overall Resistance to Change
	Lack of Cooperation/Commitment from Users
	Prior Negative Experiences with CIS Projects
Project Team	Lack of Project Leadership
	Lack of Clear Role Definitions
Project	Changes to Requirements
	Lack of a Formal Project Management Methodology
Strategic & Political	Misalignment of Partners' Objectives and Stakes

Table 8: Adapted from Pare et al. (2008)

This process produced a combined list of 23 CIS risks, which were then circulated back to the participants for correction, additions, and validations to meaningfully *rank* the selected risks according to their relative significance to the successful outcome of CIS

projects. This was done in an iterative fashion until a strong consensus was reached. Table 9 lists the final rankings of the 23 risks that deserve the most attention from CIS project managers (Pare, Sicotte, Jaana, & Girouard, 2008).

RANK	DIMENSIONS	RISKS/RISK FACTORS
01	Project	Lack of Project Champions
02	Organizational	Lack of Commitment from Upper Management
03	Usability	Poor Perceived System Usefulness
04	Project	Project Ambiguity
05	Usability	Misalignment of System with Local Practices and Processes
06	Strategic and Political	Political Games and Conflict
07	Project Team	Lack of Required Knowledge or Skills
08	Project Team	Changes to Membership on the Project Team
09	Organizational	Organizational Instability
10	Project	Insufficient Resources
11	Technological	Poor Software Performance
12	Project Team	Negative Attitudes on the Part of Project Team Members
13	Human	Unrealistic Expectations
14	Usability	Poor Perceived System Ease of Use
15	Strategic and Political	Unreliable External Partners
16	Project	Large and Complex Project
17	Organizational	Environmental Changes – Legal and Ethical Constraints
18	Technological	Complex Software Solutions
19	Organizational	Lack of Local Personnel Knowledgeable in IT
20	Technological	Complex/Unreliable Technical Infrastructure or Network
21	Technological	Complex/Incompatible Hardware
22	Technological	Introduction of a New Technology
23	Human	Poor Computer Skills

Table 9: Adapted from Pare et al. (2008)

Their research indicated that most technological risks fell in the lower half of the final list of ranked CIS risks; they were considered less important and were rarely the main reason for failure. However, this may have been the result of the study's context; CIS projects are rarely designed and programmed internally, thus technological risks (e.g., software, hardware, and network/infrastructure) are normally transferred to vendors who are responsible and accountable. In contrast, project, organizational, and usability risks were

ranked highly by the participants. The top five CIS risks are examined in detail in Table 10.

DIMENSIONS: RISKS	DESCRIPTIONS
Project: Lack of Project Champions	Professional bureaucracy awards great decision-making powers to the professionals working in the operational centres. Thus, having physicians who actively and dynamically promote personal vision with IT-use allow projects to be manoeuvred around the approved barriers.
Organizational: Lack of Commitment from Upper Management	This was ranked as #1 by Schmidt et al. (2001). Much emphasis was placed on 'commitment', which was chosen over 'support for', indicating that upper management must play a strong and active role in CIS projects. The appropriate type and level of commitment must thus be ensured.
Usability: Poor Perceived System Usefulness	Professionals are resistant to making changes to anything that may negatively impact the quality of patient care and/or their professional status and discretionary power. The overall performance of users suffers if positive impacts are not reliably demonstrated.
Project: Project Ambiguity	Failure to communicate a consistent vision can result in missed opportunities for enhancing user readiness and managing changes. CIS projects are often challenged to articulate a clear vision when they only possess a general idea. To succeed, projects must provide a description of new principles/processes and how they will affect the organization and its goals.
Usability: Misalignment of System with Local Practices and Processes	This expands the user-technology interface by recognizing that professional work in a clinical setting is a collaborative effort. Thus, CIS must be designed as a function of work to be organized around this group contribution (via requirements in terms of individual and group management of clinical data and internal/external data sharing across teams and organizations).

Table 10: Adapted from Pare et al. (2008)

Pare et al. (2008) applied a systematic and rigorous procedure to identify and rank the typical CIS project risks in order to develop an authoritative list of ranked CIS risks. This prioritized checklist lays a solid foundation for future research in eHealth risk awareness and management. In addition to providing a comprehensive list of CIS risks and their significance, Pare et al. (2008) also unified the findings of the IS and the health informatics literatures, confirming many of the critical issues found in both industries; this indicates that both fields can greatly profit from a cross-fertilization of results to

provide a broader understanding of risks and their significance (Pare, Sicotte, Jaana, & Girouard, 2008).

One of the main limitations of their research study was its limited number of subjects. While the participants were selected for their vast experience as CIS project managers, they were not randomly selected (all came from the same region) and no claims were made about the sample's representativeness. As such, they recommended that additional studies be conducted with CIS leaders from other parts of the world to allow generalizability of their findings (Pare, Sicotte, Jaana, & Girouard, 2008).

2.6.6 Risks in the Health Informatics Literature: Application Type and Risks

Compiling a complete set of risks is an ongoing endeavour, and risk oriented research must expand by exploring other application domains (e.g., the eHealth field) (Schmidt, Lyytinen, Keil, & Cule, 2001). In responding to that mandate, Brender et al. investigated the following applications to understand how different domain types could influence the nature of eHealth risks in 2006:

- **Administrative Systems**: Hospital Information Systems and Patient Administrative Systems
- **Production Support Systems**: Laboratory and Radiology Information Systems
- **Clinical Systems**: Electronic Health/Patient Records
- **Decision Support Systems**: Knowledge-Based/Expert Systems and Decision Support Systems
- **Miscellaneous**: Others such as Education and Training Systems

Brender et al.'s objective was to identify and analyze the risks that influence application project outcomes in health informatics and to reach a consensus regarding which risks were critical. Nineteen participants from the European Federation for Medical Informatics (EFMI) Specific Topic Conference 2004 in Munich, Germany, contributed. This research observed the awareness of risks from the vantage point of health informaticians rather than that of project managers; Health informaticians take a holistic approach when addressing eHealth risks by bridging the relationships between health care professionals and administrative leaders (Brender, Ammenwerth, Nykanen, &

Talmon, 2006). Brender et al. (2006) compiled a final list of 27 risks from the participants, which were then analyzed and organized into the categories delineated in Table 11:

RISK CATEGORIES	RISKS
Functional: Comprehensive Functionality and High Usability	System Expectations are Not Met
	Users Feel Limitations in Expressing Themselves
	Not Meeting Moving Targets as Project Scope/Direction Changes
Organizational: Historical Context, Workflow Support, and Perceived Fit of Benefit and Cost	Organizational Contexts are Not Understood
	The Effects of New IS on Organization, Structure, and Work Procedures are Not Understood or Foreseen
	Work Procedures Change Too Often
	Personnel (who understand the organizational context) Do Not Govern and Control IS Development
Technical: Technology, System Architecture, and Development Process	Users Feel Limited in Expressing Themselves
	Restricted Technology that Limits Choice in Design and Implementation
	Poor Response Rate and Other Performance Measures
	Increased Time to Complete Tasks
	Failed Delivery of Functionality Support by the Vendor
	Poor Conformity Verifications with Requirement Specifications
Managerial: Sufficient and Available Funding, Flexible and Good Project Management, and ICT Introduction	Overaggressive Plans for Large-scale Implementations
	Decisions Made from Wrong Premises
	Unfulfilled Assumptions
	Improper Tendering
	Vendor Reorganization of the Business
Cultural: Promotion with a Direction and Vision, Openness to Innovation and Change	High User Expectations
	Assuming What Worked in One Organization will Work in Another
Legal: Willingness to Reform Health Care with the Appropriate Legislations	Low Priorities on Standards and Regulations
	Poor Compliance with Existing Laws and Ethical Rules of Conduct
Behavioral	Users are Overloaded
	User Acceptance is Underestimated
	Resistance Occurs Owing to the Fear of Losing Control
Economy	Inadequate Financial Power of the Vendor
Education	Inconsistency between Successive IS Versions

Table 11: Adapted from Brender et al. (2006)

Table 11's final list of risks were then iteratively analyzed and structured to determine how the significance of risks varied across the above eHealth applications toward successful project outcomes. Table 12's list outlines the risks that Brender et al. found to be the most significant for each eHealth application in 2006.

EHEALTH APPLICATION	**RISKS**
Clinical Systems	System Expectations are Not Met
	Performance Measures (i.e., Poor Response Rate)
	Users are Overloaded
	Assuming What Worked in One Organization will Work in Another
Decision Support Systems	System Expectations are Not Met
	User Acceptance is Underestimated
	Improper Tendering
	Poor Compliance with Existing Laws and Ethical Rules of Conduct
Administrative Systems	System Expectations are Not Met
	Inadequate Understanding of Organizational Context and the Effects of New IS on the Organization
	Resistance Owing to the Fear of Losing Control
Production Support Systems	System Expectations are Not Met
	Low Priorities on Standards and Regulations
	Poor Compliance with Existing Laws and Ethical Rules of Conduct
Education/Training Systems	Users Feel Limitations in Expressing Themselves

Table 12: Adapted from Brender et al. (2006)

The variation of risk significance across software applications suggests that risk priorities depend on the type of eHealth applications used (Brender, Ammenwerth, Nykanen, & Talmon, 2006). Specifically, application types can influence the nature of risks. Having said that, certain eHealth risks may also be universal; for instance, Not Meeting the System Expectations was identified as a critical component of all applications except for Education and Training Systems. Further to this finding, Brender et al. (2006) revealed that Clinical and Decision Support Systems were heavily challenged by a large number of risk criteria (40% of all identified risks), while other applications shared a smaller

percentage of risks (24–28%); Clinical Information Systems (CIS) represent one of the most risky software applications to implement.

While Brender et al. (2006) investigated many European cultures (from Scandinavian to Eastern European and Mediterranean countries), the sample size of participants from different countries was too small to generalize the research internationally. Nevertheless, Brender et al.'s research made a positive contribution to the existing literature by expanding the scope of countries and cultures studied.

2.6.7 Risks in the Health Informatics Literature: Application Size and Risks

As with publications in the IS literature, the majority of health informatics studies are limited to the risks found in large-scale projects; Small-scale projects are given little to no consideration (Laitinen, Fayad, & Ward, 2000; Chiang & Starren, 2002). It is also unclear from the literature whether the knowledge gathered from large IS projects can be translated and applied to small projects in the medical domain (Chiang & Starren, 2002). However, Laitinen et al. (2002) argue that small projects and organizations are fundamentally different (e.g., modifications to scope and scale can influence the type of methods and processes utilized). Chiang and Starren attempted to determine the degree of transferability and relevance present between large-scale IS projects and a small-scale project in health informatics in 2002.

Chiang and Starren (2002) compiled a conceptual risk framework for large projects described in computer science and management research to represent the collective opinions of more than 70 authors and project managers. This framework was then used to compare the risks noted in Chiang and Starren's study of a small EMR project at the Columbia-Presbyterian Medical Center by project team members as well as others who had no direct involvement with that project. The information in Table 13 is from Chiang and Starren's results comparing the significance of risks (provided as scores) between small and large projects.

RISK	RISKS	SCORE:	SCORE:

CATEGORIES		LARGE	SMALL
Organization	Inadequate Upper Management Commitment	3	0
	Vague Statement of System Objectives	3	0
	Insufficient Project Champions	2	3
	No End-User Commitment	2	2
	Insufficient Technology Infrastructure	2	2
	Poor Working Relationships with the Parent Organization	0	3
Vendor or System Developer	Poor Technical Skills	3	1
	Inadequate Understanding of the Project Scope or Requirements	3	3
	Project Team Turnover	1	3
Communication	Unrealistic User Expectations	2	2
	Poor Communication between the Project Team and the Organization	3	1
	Lack of User Involvement in the Project Plan and Design	3	1

Table 13: Adapted from Chiang and Starren (2002)

Notes. Large Project Risk Scores: 0 for No Citation; 1 for Less than 3 Citations; 2 for 3–4 Citations; 3 for 5–7 Citations.

Small Project Risk Scores: 0 for No Effect on Project Delay; 1 for Minimal Contribution to Delay; 2 for Moderate Contribution ; 3 for Significant Contribution

Although Chiang and Starren identified some common risks between large and small projects by (e.g., no end-user commitment and unrealistic user expectations), differences in their risk significance were also observed, as outlined below:

- **Significant in Large Projects but Not In Small Projects**
    - Inadequate Upper Management Commitment and Vague Statement of System Objectives
        - The difference in Inadequate Upper Management Commitment and Vague Statement of System Objectives may be attributed to the degree of separation in the organizational hierarchy (Chiang & Starren, 2002). Specifically, while a small project is able to work closely with upper management to obtain a high-level of commitment and to clearly articulate a well-defined set of system objectives, large projects are limited by their organizational layers.
    - Poor Communication between Project Team and the Organization

        - Many large projects interact with a diverse set of stakeholders in a number of ways. Due to its complexities, they utilize sophisticated tools for Communication between Project Team and the Organization. However, a formalized methodology is often unjustified and unsustainable for a small project, given its heavy administrative overhead in relation to its relative benefits. Small projects and organizations are able to naturally facilitate effective communication without a formalized methodology (Chiang & Starren, 2002).

- **Significant in Small Projects but Not in Large Projects**
    - Poor Working Relationships with the Parent Organization
        - A small project team faced challenges when working with its parent organization (due to the complexities of integrating the appropriate infrastructure and establishing consensus), a feature which is rarely cited in large projects as they do not often fall under the control of a large parent organization. Specifically, a small project team and a large, enterprise IT department may not share the same core goals and commitment to the project. Small project teams are able to benefit significantly when commitment and support are secured by project champions from their parent organization (Chiang & Starren, 2002).
    - Project Team Turnover
        - Project Team Turnover was considered significant for a small project; The stability of project teams is critical, as individual members often shoulder multiple, and sometimes onerous, responsibilities (Laitinen, Fayad, & Ward, 2000; Chiang & Starren, 2002). The loss of one team member can mean having to find a replacement capable of filling numerous roles.

Chiang and Starren's 2002 research determined that risks and their significance differed fundamentally between large health IS projects and small one. They suggest that: 1) the

knowledge gathered from one cannot generally be translated and applied to the other, and 2) the nature of eHealth risks may be influenced by the size of eHealth applications.

2.7 Summary of the Literature Review

Risks can be described as positive or negative uncertainties that either enable or hinder project goals and objectives. As such, risk management can be viewed as an investment that deals with risks against project failure while enabling opportunities facilitating project success (Schwalbe, 2006). Understanding Risk Awareness and Management represents a means to systematically identify and address the complex nature of projects by embracing uncertainties as part of organizational efforts.

Research in risk awareness has been relatively neglected in the health informatics literature compared to the field of business and information systems (Richards & Morse, 2007). Specifically, the existing literature lacks models that structure eHealth risks in an integrated manner to support managerial actions against risks. However, this specialized view is important, as practices that have proven successful in other industries have not always translated well to health care settings (Anderson & Stafford, 2002).

While the existing health informatics literature has little to offer to an integrated view of risk awareness, a few relevant studies have been explored in this chapter. Using a risk framework, Sicotte et al. (2006) empirically determined that the success of CIS implementation requires an ability to simultaneously be aware of and manage multiple risks. To successfully manage several risks at once, they must first be prioritized to allocate the appropriate resources to those that most impact the project outcome (Pennock & Haimes, 2002). In response, Pare et al. (2008) compiled an authoritative list of ranked CIS risks to establish a solid foundation for future research in risk awareness and management. Their research unified the Information Systems (IS) and the health informatics literatures by confirming many of the critical risks found in both industries, thus demonstrating that both areas benefit significantly from a cross-fertilization of results (Pare, Sicotte, Jaana, & Girouard, 2008).

2.8 Summary of the Literature Gap

To successfully conduct a study of risks and their significance, one must understand the dynamic and evolving nature of risks (McConnell, 1996). The nature of risks (i.e., perceived risk significance) can change rapidly as a function of risk variables such as culture, risk control, application type, and project size (Schmidt et al., 2001; Chiang & Starren, 2002; Brender et al., 2006). These variations of risks and their significance suggest that risk priorities are dependent on a number of risk variables. Understanding these variables and their impact on risk awareness can influence how decisions are made regarding where project resources are allocated. There is thus a need to identify other risk variables and understand how they may impact the nature of risks.

Many experts are calling for a re-examination of project risks and their significance to reflect the changing technological and organizational landscapes of the 21st century (Schmidt, Lyytinen, Keil, & Cule, 2001). Schmidt et al.'s 2001 study compared and validated their study's final ranked list against those found in the literature and determined that certain risks have either declined in significance or disappeared completely (e.g., technological risks). Schmidt et al. also suggest that many of the published risk research studies are limited by cultural perspective as they are often based on American data and/or are restricted to American culture. As the root cause of many failed projects can be traced to differences in the way professionals think about risks (i.e., risk awareness), understanding how project teams perceive risks and their significance in Canada is vital. While Sicotte et al. (2006) and Pare et al. (2008) explored risks and their significance from a Canadian perspective, their research was limited to Franco-Canadians. Risk research should expand to include Anglo-Canadian's perspectives.

While the research studies explored in this chapter examined risk perspectives held by project managers and members, department managers, IT specialists, clinicians, and health informaticians, this researcher was unable to source any studies explicitly addressing those held by senior executives. However, Schmidt et al. (2001) recognized the value of extending the scope of research to examine other stakeholders' (i.e., senior executives) project risk awareness and how they actually manage risks in the real world,

and Pare et al. (2008) recommended that additional studies be conducted with CIS leaders from other parts of the world.

A significant gap in the literature was identified in this chapter via the above limitations and future research suggestions: Little or no research seeks to understand risk awareness from the perspective of senior executives who have eHealth project experience within the Anglo-Canadian health care system. The next chapter establishes and formulates the necessary research objective and questions to address this gap. Specifically, the purpose of this research is to understand how diverse stakeholders identify eHealth risks and perceive their significance differently.

Chapter 3: Research Objective and Question

This study's objective is to explore and compare the unique perspectives held by stakeholders (i.e., directors and project managers) regarding their *risk awareness* of eHealth development projects. Specifically, this research:

1. Identifies significant eHealth project risks from the perspective of directors and project managers who currently practice or have practiced in Canada;
2. Identifies and analyzes who owns and/or is accountable for each risk and how that responsibility is communicated/coordinated between stakeholders;
3. Analyzes the risk factors identified and categorizes them into actual risks; and
4. Prioritizes the relative significance of the identified eHealth risks.

To achieve this objective, answers to the following question were solicited:

- Do directors and project managers who are, or have been, involved in (i.e., have overseen or managed) eHealth development projects differentially (1) identify, (2) analyze, and (3) prioritize risks and/or risk factors?

This inquiry has important implications and makes potentially significant contributions to the literature and to the health care industry. While the importance of risk awareness is well-documented in the literature, it remains at an infancy stage in the field of health informatics despite the fact that understanding how stakeholders perceive risks differently, even on projects with a common goal, significantly affects the outcome of eHealth development projects. For instance, if a director regards *policy* as her #1 risk while a project manager regards *education* as his first, the disagreement can result in an inappropriate allocation of resources and cause schedule delays and cost overruns. Comparing the perspectives of eHealth risk awareness held by directors and project managers who are now, or who have been involved in eHealth development projects in the past sheds light on this overlooked domain of risk awareness. The results may be used to improve stakeholder management and communications processes for eHealth development projects. The following list categorizes and outlines the potential or known benefits this research may offer to the participants, society generally, and the body of health informatics and risk awareness research resulting from:

- **Participant**: As a result of this research, each participant will discover which risks are important to his or her peers and to other stakeholders. By understanding where they stand in relation to the other members and groups, they will be able to make better-informed decisions. In essence, this research serves as a forum for collaboration to discuss the importance of each risk that can significantly influence the outcome of eHealth development projects.
- **Society**: As this research encourages the collaboration of risk management efforts between directors and project managers, it has the potential to increase the success rate of eHealth development projects. As a result, less tax dollars may be wasted on failed eHealth projects, and the number of health management applications that the public may benefit from should increase.
- **State of Knowledge**: As far as this researcher could determine, no studies examine the different perspectives of risk awareness held by directors and project managers in the health informatics literature. This research addresses this gap in the literature.

While some researchers may argue that different stakeholders' project priorities diverge according to their differing roles and responsibilities, others may contend that all stakeholders are working toward the same, common goal (here, risks refer to *uncertainties* that may prevent the achievement of the goal). An exhaustive literature search indicates that no research has yet been done in this area of health informatics. Thus, this research is designed to also answer the following question: Is there a difference in the type of eHealth risks and in how they are ranked by directors and project managers?

Chapter 4: Research Design and Methodology

This Research Design and Methodology chapter outlines and discusses the following:

- Sample and inclusion criteria
- Recruitment and access
- Procedure and setting
- Research data collection
- Research data analysis
- Summary and conclusion

4.1 Sample and Inclusion Criteria

To compare and contrast the perspectives of eHealth risk awareness held by directors and project managers who are or have been involved in (i.e., oversee or manage) eHealth development projects across Canada, the two populations who represent two of the most involved stakeholder groups in the development of eHealth solutions were invited to participate in the study. They possess valuable insights regarding eHealth risks that may significantly and positively influence the outcome of future eHealth development projects.

Even the most experienced researcher cannot accurately predetermine the appropriate sample size, as there is no statistical requirement mandating a specific number of subjects that will produce data saturation (Brink & Wood, 1998; Richard & Morse, 2007). In this research, data saturation began to appear by the ninth participant recruited. Saturation is a concept that was first developed within classical grounded theory, and it is achieved when no further major changes occur during the data collection and analysis phases after multiple rounds of reorganizations and modifications have been made (Clarke, 2003). There was no need to match the number of participants from each group (i.e., directors and project managers) as the research analysis is not influenced by sample size, but rather, by data saturation (Schmidt, 1997; Schmidt, Lyytinen, Keil, & Cule, 2001).

Individuals who met the following criteria were invited to participate:

- Able to read, write, and speak English;
- Have access to a phone and to the Internet;
- Over the age of 18 to be able to consent;
- Otherwise able to give informed written or verbal consent;
- Hold or have held the position of director, project manager, or the equivalent within the Canadian health care industry or similar settings;
- Have a basic understanding of Software Development Life Cycle (SDLC) and project management;
- Currently or previously responsible for overseeing or managing eHealth solutions; and
- Have the time required to commit to the research (i.e., 30–45 minutes per interview).

4.2 Recruitment and Access

A snowball sampling approach was employed to negotiate and gain access to the appropriate population of directors and project managers who had/have experience in overseeing or managing eHealth development projects and who possess knowledge related to eHealth risk management. The researcher also worked with his supervisor and committee members to identify potential contacts in the area of eHealth risk management who met the inclusion criteria.

As the point of entrance, the researcher recruited professors from the University of Victoria who were directors or project managers in the Canadian health care industry via email. These recruited participants were then asked to recommend and/or contact anyone they knew who had the appropriate background to participate in this research, as per the practice of snowball sampling (Goodman, 1961). The researcher then contacted potential participants via email to assess and confirm their fit with the inclusion criteria. The email addresses of professors, directors, and/or project managers who were initially contacted were in the public domain (i.e., their information was available online) and/or in the School of Health Information Science and Alumni email distribution lists. Given the

nature of snowball sampling, there was no need for the researcher to seek approval from other agencies such as community groups, First Nations, or local governments.

The researcher was solely responsible for recruitment, and there was no foreseeable relationship between the researcher and the participants. As such, the researcher was not in any perceived, actual, or potential conflict of interest regarding this research with the potential participants. The participants were fully informed of everything that was required of them prior to the research sessions, as each was provided with a consent form and an opportunity to ask any questions they may have had. No compensation was offered for participation in this research. The participants had the right to withdraw at any point in time without consequence or explanation.

4.3 Procedure and Setting

This section of the research design and methodology chapter outlines the research procedure and setting. As the point of entry, professors from the University of Victoria who are/were also directors or project managers in the Canadian health care industry were recruited. Emails were used to initially contact the participants, and phone calls were made or meetings were held to collect data via questionnaires and semi-structured interviews. Prior to each interview session (i.e., data collection), each participant was sent a preliminary list of risks and risk factors that the researcher compiled during the literature review. This step of providing a common baseline was important, as the two perspectives could not be compared without one. Additionally, a copy of the informed consent was provided with the invitation email for his or her reference. If the potential participant expressed interest in participating, the informed consent was then explained at the beginning of the interview and was then either obtained in person with a signature or verbally over the phone. The data relevant to the research question were then collected via semi-structured interviews, and these collected data were then analyzed using descriptive/topic coding and mean averaging. After collecting and analyzing the appropriate data in person or over the phone, the participants were then asked to recommend additional directors and project managers who might potentially contribute to

this research. The researcher then contacted those potential participants via email to confirm their fit with the list of inclusion criteria previously itemized.

The following summarizes the above procedure in step-by-step point form:

1. An invitation to participate was sent to each participant via email. If a potential participant expressed interest, a follow-up email was sent to confirm the interview.
2. The researcher read and explained the consent form to the participant at the beginning of each interview. Once consent was obtained in person or over the phone, the researcher obtained the participant's demographic and project information for contextual purposes prior to conducting the semi-structured interview.
3. A semi-structured interview (Appendix A) was then conducted either in person or over the phone, depending on the participant's location. An audio recorder was used during the interviews. To minimize the impact of this research on the participant's daily responsibilities and activities, interviews took place when and where it was most convenient to the participant. Interviews generally took approximately 45 minutes to complete.
    a. In-person interviews took place at the participant's workplace; and
    b. Phone interviews were conducted by calling the participant's office/workplace from the researcher's private residence.

Ending data collection too early (e.g., small sample size) may result in meaningless conclusions, while conducting too many rounds (e.g., large sample size) can tax resources and produce inauthentic results. As such, the researcher considered trade-offs between feasibility and potential gain when determining whether any further major changes either had or were likely to occur throughout the stages of data collection and analysis. The research ended when a lack of progress from data collection and/or analysis was observed (i.e., the data saturation point was reached). Moreover, this research had the following constraints: The researcher would stop collecting data if no significant additional material was gathered by the fifteenth participant *or* by the third month after data collection began. In this event, the researcher planned to consult with his supervisor and committee

members to produce the final list of ranked eHealth risks or risk factors based on the published literature and the semi-structured interviews.

4.4 Research Data Collection

The research data collection phase began by obtaining the participants' demographic and project information to set the context in which the responses to semi-structured interviews were based. Once this information was collected and understood, the necessary research data required to discover the key risks or risk factors that could hinder the development of eHealth projects in Canada were collected. This required identifying and describing any risks or risk factors that may have influenced the outcome of previous eHealth development projects, as well as understanding why they deserved the most attention and resources. Although participants were free to include as many significant risks or risk factors as they felt advisable, it is considered good practice to control the number of risks and risk factors identified by the participants. For this reason, each participant was asked and encouraged to identify approximately five significant risks or risk factors and then to briefly describe them. In addition, the participants were also asked to define risk, risk factor, and risk management. This step of identifying and describing these terms/concepts was used to modify, refine, and re-establish the baseline to reflect how participants used different terms to describe the same ideas or issues. The two sample groups' (i.e., directors and project managers) responses cannot be successfully compared without establishing this common baseline. To understand the perspectives of risk identification and analysis, the appropriate data were also collected regarding common risk deliverables, decision making, and ownership. Lastly, participants were asked to quantitatively prioritize and rank the identified risks or risk factors according to their degree of influence on project outcomes or according to a scale of required attention and resources (participants could not assign equal weightings to any of the risks they identified).

All research data were collected via semi-structured interviews. While face-to-face interview sessions were preferred, physically visiting all participants across Canada was not financially feasible. To address this geographical and financial constraint, participants

were contacted via telephone and asked to freely and independently identify, analyze, and prioritize what they thought the most significant eHealth risks or risk factors were. All semi-structured interviews were audio-recorded and then transcribed and coded in the later phase (i.e., data analysis). Each transcript was then used to structure and code the contents in preparation for data analysis. Additionally, the data collected from all participants were separated into their respective sample groups during the data analysis phase to compare and understand how risks were perceived differently by the two sample groups (i.e., directors and project managers).

Unfortunately, the identity of participants cannot be fully anonymous due to the nature of snowball sampling (e.g., a participant knew the identity of those who recommended him or her to this research). However, the researcher completely masked the identity of participants from other participants and the public by utilizing pseudonyms and modifying other identifying information and features during the transcription of interviews. All collected data were coded, aggregated, and summarized into a single list that represented the sample groups' perspectives rather than presenting the data individually. While the researcher is able to associate responses and other data to the individual participants (i.e., who said what), no one else is able to make this association. However, due to the nature of snowball sampling, this research was not able to guarantee complete anonymity and confidentiality.

4.5 Research Data Analysis

The researcher analyzed both the demographic/project questionnaire and semi-structured interview data. All interviews were transcribed and consolidated into Microsoft Word and/or Excel files to allow efficient comparisons.

The demographic data were analyzed by consolidating and comparing participants' gender, age, education, professional background, average years of experience, and average number of eHealth projects overseen or managed. Project characteristics were also analyzed to establish the context for research findings and results. Both demographic and project characteristics were analyzed using Microsoft Word and Excel programs.

To describe and unify similar terms, ideas, concepts, and risks or risk factors associated with eHealth projects, descriptive coding was used to properly analyze the collected data. Descriptive coding is a commonly used method in qualitative research that requires context awareness. It is often used in practice to store and access factual information about data by assigning information to specific categories (Richards & Morse, 2007). Descriptive coding was thus primarily used in this research to identify, describe, and unify similar terms to re-establish a common set of unique ideas, concepts, and eHealth risks or risk factors. While it is important to store as much information as possible, the researcher was also careful not to over-code.

To categorize the identified eHealth risks or risk factors from the perspectives of directors and project managers, or equivalents, topic coding was also used in this research. Topic coding is the most common and accessible technique used in qualitative research for *gathering, describing, categorizing,* and *retrieving* information by topic (Richards & Morse, 2007). This technique works by identifying and portraying data to reflect different ways of discussing topics and seeking patterns. As abstract ideas and general themes are sought in topic coding, categories are the primary focus of attention, as opposed to the data themselves (Richards & Morse, 2007). Naturally, this technique was used to create and refine risk categories. As it is often necessary to explore and access data by topic at any given point, this coding technique proves to be extremely useful for many qualitative research studies. For these reasons, topic coding was relevant and useful when categorizing the unified risk factors into eHealth risks.

Once all the identified eHealth risks, risk factors, and related ideas and concepts had been identified, described, unified, and categorized using the descriptive and topic coding, the next step of research analysis was to prioritize the results to produce a list of ranked eHealth risks and/or risk factors for each participating group by statistically converging and binding the data. As the ranking data in this research phase were primarily in a numerical format, data were analyzed and statistically manipulated using Microsoft Excel. To facilitate the process of determining and comparing the ranked lists to

understand and describe the perspectives of risk awareness from the two groups (i.e., directors and project managers), simple approximations of mean ranks (i.e., central tendencies) and the distribution of frequencies for each risk and risk factor were calculated. Specifically, eHealth risks or risk factors were listed in the order of average ranks and/or their frequencies of appearance. However, the mean ranks could potentially vary a little, as each participant independently ranked an *arbitrary number* of top risks and risk factors because the establishment of baseline and of ranking (Schmidt, 1997) were not separated. While it is important to establish and refine the preliminary baseline for each group before ranking to prevent participants from independently assigning and ranking an arbitrary number of risks or risk factors (Schmidt, 1997), this fell beyond the scope of the research owing to financial and time constraints.

The data collected from each participating group were separately analyzed and aggregated to ensure proper comparison. All collected data (e.g., audio recordings, transcripts, and coded data) and the identity of participants were stored inside the researcher's laptop under an encrypted, password-protected partition/drive in the researcher's office to ensure confidentiality. All paper printouts were securely stored in his private residence in a locked cabinet to protect participants from any potential backlash or repercussions. All electronic data and printed documents will be held for a period of five years after the study's completion, at which point, it will all be destroyed. As far as the researcher can foresee, the research data will not be analyzed, now or in future, by the researcher or by any other person for purposes other than this research project. The researcher does not anticipate this research to be used for any commercial purpose.

4.6 Summary and Conclusion

As a result of this research study, final ranked lists of unified eHealth risks and risk factors relevant to eHealth projects in Canada will be produced using common definitions and descriptions. These lists are important for understanding the perspectives of risk awareness (i.e., identification, analysis, and prioritization) held by directors and project managers, or their equivalents.

The reality represented by this qualitative research study is composed of a collection of shared assumptions and beliefs about the truth (Richards & Morse, 2007). From this philosophical standpoint, the final ranked lists represent a shared reality. As such, while this research may not produce objective ranked lists of significant risks or risk factors, it does produce distinguishably ranked lists as these are *perceived* by directors and project managers or equivalents, according to the concept of *inter-subjectivity* (Knoblauch, 2005).

The researcher has not applied for any research funding, nor has any notice of award been received. The researcher anticipates disseminating the research results via thesis; dissertation; class presentations; presentations at scholarly meetings; published articles, chapters, or books; Internet outlets; media; or directly to the participants involved. The latter may be done by sending a summary of the research (e.g., the final list of ranked risks and risk factors) to all participants so they can compare their own perspectives with that of their peers and other participants. This will benefit the participants by raising risk awareness and enhancing their risk management, communication, and collaboration practices.

Chapter 5: Research Findings and Results

In this chapter, the demographic characteristics of the study participants and the projects they have been involved in are described for contextual purposes. Findings from the qualitative interviews are also presented. The chapter is organized according to the following section headings to explore and understand the perspectives of eHealth risk awareness:

- Demographic Characteristics of the Research Participants
- Characteristics of the eHealth Projects Overseen and Managed by the Participants
- Definitions of Risk, Risk Factor, and Risk Management
- Benefits of Risk Management
- Key Deliverable(s) for Risk Management
- Risk/Opportunity Analysis in Decision Making
- Risk Officers and Risk Owners
- eHealth Risks and Risk Factors
- eHealth Risk Prioritization and Ranking Rationale
- eHealth Risk Root Causes

5.1 Demographic Characteristics of the Research Participants

Directors and project managers, or the equivalent, who have rich and diverse backgrounds were sought out and recruited to share their perspectives. This segment describes their demographic characteristics.

Nine participants were interviewed before saturation was declared by the researcher: three directors or equivalent, one chief executive officer, one chief project officer, one medical lead, one clinician-project consultant, and two project managers (PMs). Of these, six were male (67%) and three were female (33%). All age groups were represented; 33% were 50–59 years of age, 22% were 18–29 years of age, 22% were 30–39 years of age, 11% were 40–49 years of age, and 11% were 60–69 years of age.

The research participants were highly educated; 67% (n = 6) of the participants held one or more graduate degrees (i.e., Masters or Ph.D). Four participants held a M.Sc. in Health Information Science, one an MBA and an MPA, one a Ph.D in Policy, three had earned MD's in areas such as Critical/Intensive Care, Internal Medicine, Pulmonary Medicine, Endocrinology, Paediatrics and Neurology, and three held a B.Sc. in Health Information Science. Many held multiple graduate degrees, thus the number of degrees held exceeds the total number of participants.

The participants were also highly qualified; 33% had more than 30 years of experience, 33% had 10 to 30 years of experience, and 33% had 5 to 10 years of experience in the healthcare industry. Of the total participants, 33% indicated that they had been involved in 6 to 10 major eHealth projects, 33% had worked on 4 to 5 major eHealth projects, and the remaining 33% had been employed on 2 or 3 major eHealth projects throughout their careers in Canada and the United States. These projects included development and implementation of eHealth applications such as the Electronic Health Record (n = 2), Clinical Information Systems or Electronic Medical Records (n = 6), Tele-Health (n = 1), Tele-Pathology (n = 1), Integrated Technology (n = 1), and Computerized Handover Systems (n = 1). On average, participants in this research had 17.33 years of experience working with an average of 5.11 major eHealth projects.

This research recruited a broad sample of participants holding various roles and representing all genders and age brackets. The participants were found to be highly educated and experienced. Table 14 provides an overview of the research participants' demographic characteristics.

DEMOGRAPHIC CHARACTERISTICS		**FREQUENCY (%)**
Gender	Male	6 (67) – All 5 (55) – Director or Equivalent 1 (11) – Project Manager or Equivalent
	Female	3 (33) – All 1 (11) – Director or Equivalent

		2 (22) – Project Manager or Equivalent
Age	18–29	2 (22) – Project Manager or Equivalent
	30–39	2 (22) – All 1 (11) – Director or Equivalent 1 (11) – Project Manager or Equivalent
	40–49	1 (11) – Director or Equivalent
	50–59	3 (33) – Director or Equivalent
	60+	1 (11) – Director or Equivalent
Highest Education Degree	High School	0 (0)
	Bachelors or Equivalent	3 (33) 1 (11) – Director or Equivalent 2 (22) – Project Manager or Equivalent
	Post-Graduate Diploma	0 (0)
	Masters or Equivalent	5 (56) – Director or Equivalent
	Ph.D. or Equivalent	1 (11) – Director or Equivalent
Professional Background	Project Manager or Equivalent	3 (33)
	Director or Equivalent	6 (66)
AVERAGE YEARS OF EXPERIENCE AND NUMBER OF PROJECTS		
Average Years of Experience in the Health Care Industry		17.33 – All 22.33 – Director or Equivalent 7.67 – Project Manager or Equivalent
Average Number of Major eHealth Projects Overseen/Managed		5.11 – All 5.17 – Director or Equivalent 5 – Project Manager or Equivalent

Table 14: Demographic Characteristics of the Research Participants

5.2 Characteristics of the eHealth Projects Overseen/Managed by the Participants

As mentioned in the previous section, the research participants were responsible for overseeing and/or managing a number of eHealth projects throughout their careers. As their interview responses were based on an awareness of risk that had been shaped by their previous experiences, it is important to understand the contextual background of those eHealth projects. To establish this context for research findings and results, this section explores and describes the characteristics of eHealth projects that the research participants had recently been involved in (i.e., the last one to two projects). While the research participants were highly experienced with an average of five major eHealth projects throughout their careers, the most recent projects that they had overseen and/or managed included Clinical Information Systems or Electronic Medical Records (n = 6), Electronic Health Records (n = 2), Tele-Health (n = 1), Tele-Pathology (n = 1), Integrated Technology (n = 1), and Computerized Handover Systems (n = 1). Clinical Information System and Electronic Medical Record projects are described shortly, as they comprise 67% of the projects that the participants had recently either overseen or managed, while the other eHealth projects are briefly explored in more detail.

5.2.1 Clinical Information Systems/Electronic Medical Records

As health care agencies are often geographically dispersed and as clinicians become ever more dependent on systems that contain paper charts and other documents, the need for electronic solutions is rising. As such, Clinical Information Systems (CIS) and Electronic Medical Records (EMR) are often implemented by healthcare providers to address this need. The following quotation illustrates this growing trend:

> The clinicians have become reliant on this legacy system ... that contains documents and all of the paper charts.... Because there are agencies everywhere, having just one paper chart isn't sufficient. It needs to be electronic to allow for care to happen throughout the province. (Subject P01, Line 70)

Of the nine total participants, six (67%) – four directors or equivalent (67%) and two project managers or equivalent (67%) – were responsible for either overseeing or managing Clinical Information Systems (CIS) and Electronic Medical Records (EMR) projects, which included responsibilities such as project planning and system deployment. This research combined CIS and EMR into one category/concept (i.e., they are used interchangeably), as many of the implemented solutions functioned as both eHealth solutions. The following excerpts illustrate how participants viewed CIS and EMR as one solution:

> [It's] what you define as Electronic Medical Records ... but it also serves as a CIS.... It's a patient record, but it also integrates with other systems [to bring] information for clinicians.... It's really both. (Subject P02, Line 63)

> It's the EMR for [us], which is [EMR Product Name 1]. (Subject D07, Line 48)

According to the participants, the purpose and the expected outcome of CIS and EMR projects were to deliver an up-to-date, state-of-the-art electronic solution to increase the safety, efficiency, and quality of healthcare; The most critical features included admitting, patient registration, scheduling, tracking, pharmacy, labs, radiology, CPOE, and documentation. This is outlined in the following excerpt:

> The generic statement [of its clinical purpose] is increasing the safety, efficiency and quality of healthcare." (Subject D07, Line 57)

> For the CIS, we are trying to get our organization on the up-to-date, state-of-the-art CIS solution.... The mission is basically "One Patient, One Record."... That's sort of the overlying vision. CIS allows us to deliver care to patients. So it's admitting, patient registration, pharmacy, CPOE [and] documentations. All those things are in CIS. (Subject D01, Line 58)

> [The purpose is the] care of hospitalized patients and ... its most critical feature is CPOE or Computerized Physician Order Entry. (Subject D02, Line 65)

> We have already implemented registration, scheduling, and the emergency department tracking board.... This project that we're currently in is more about the clinical documentation and helping with the patient list. We're

> [also] pulling in results from other systems such as labs and radiology. (Subject P02, Line 80)

Of the six in total, five (83%) of these solutions were vendor-based, with one (17%) transitioning from an in-house to a vendor-based solution. Moreover, all six (100%) CIS/EMRs were either fully integrated or stand-alone solutions with interconnective capabilities. This is illustrated in the following quotations:

> In theory, [our system] is a stand-alone solution ... in the sense that they have separate databases [and] bills. But there is interconnectivity in terms of interfaces ... to various CIS [and their data]. (Subject D01, Line 82)

> It has 38 HL7 interfaces to other systems, but it's really the system that's in the middle. [It can] virtually [interact with] anything. We have it hooked up to Oracle databases, various CIS [and] a Patient Discharge Transfer System [in addition to] lots of in-house developed systems [such as] an old diagnostic imaging system. (Subject D02, Line 69)

> It's a patient record, but it also integrates with other systems [to bring in] information for clinicians. (Subject P02, Line 68)

To successfully implement the CIS/EMR solutions, two (33%) participants utilized best practices to directly support organizational vision and goals. The following quotations illustrate how an HIMSS (Healthcare Information and Management Systems Society) Adoption Model was used to support that:

> The goal of our [ICT] strategy is to move up to HIMSS EMR Adoption Model.... Our goal is to obtain all of the five [stages] by 2015. All of these [CIS and EMR] projects are working to move up that ladder to basically close the loop [on] medication and order entry. That's the overall organizational goal, and these projects that I manage directly support that vision. (Subject D04, Line 54)

> Our high-level vision and goal is to bring our hospital to level seven of the HIMSS [model]. (Subject P02, Line 76)

All six CIS/EMR solutions (100%) were provincially focused in scope, with some evolving out from regional solutions. While it was difficult to pinpoint the exact number of organizations that these CIS/EMR solutions were deployed to (owing to ongoing consolidation initiatives), these solutions were implemented to service

anywhere from six to16 facilities (e.g., adult hospitals, paediatric hospitals, ambulatory and outpatient clinics, community clinics, and other specialized provincial agencies). The number of expected users for each CIS/EMR solution varied between 1,000 and 20,000, which consisted of the following target groups: physicians, specialists, pharmacists, nurses, social workers, clerks, radiologists, technicians, and dieticians.

Many of these care-delivery-focused CIS/EMR solutions were multi-year initiatives, ranging anywhere from three to five years. However, participants indicated that this range is not definitive, as it is difficult to estimate exactly where the project starts and ends. The following interview excerpts illustrate this overall lack of concrete plans:

> Have you got a coin you want to toss? [Laughs] Well, there isn't a project charter for the CIS. We are guessing three to five years. (Subject D01, Line 155)

> [Laughs] Infinite.... It's just huge, so it's hard to [estimate]. We started working [in] 2003, and then it's just one thing after another.... In terms of project length, we have 4,000 to 5,000 clinics to do, so however long to roll that out.... Once that's done, we have to optimize and then upgrade. These things never end. (Subject D07, Line 94)

The expected project budget for these CIS/EMR solutions ranged anywhere from 20 million to 90 million Canadian dollars. Although some participants at the executive level were able to provide this figure, one participant was unable to disclose this information, and many simply did not know the total budget; they only knew the budget for the portion of a project that they were responsible for. The follow quotations were selected to illustrate how participants either had no information or only partial information when it came to the expected project budget:

> [I have] absolutely no idea.... It's one of my challenges. I don't actually know. For us, there is no budget for the province. They're starting to promise

> the Health Authority [and] we hear figures ... but none of that is concrete.... That would be just a shot in the dark. (Subject D01, Line 168)

> Per year, it's about eight million. I will say that the total budget ... that I quoted, the eight million, is for ... [ICT] cost alone. [This] does not include the clinical workflow change and business process redesign that's needed. I would say that [is an] additional cost [and] tend to estimate [by using the] 70/30 rule, in that 70% is funded by the business and 30%, which is the eight million is funded by ... [ICT]. So when you look at ... the big picture and this clinical change that's needed, it's a 20-million-dollar-plus initiative. (Subject D04, Line 106)

While all project funding came from the government, two (33%) of the participants were working on a business case to request funding from a large national organization and from other granting agencies. However, they indicated that most of their funding comes from the province, as funding from large national organizations or from other grants is either rare or insufficient. Of the six participants who had CIS/EMR experience, only two (33%) had a contingency reserve fund (10% to 12.5% of the total project budget) set aside in case of emergency. During one discussion, a participant also indicated that risks tend to be very well managed when the project is politically visible. The following excerpt illustrates this point:

> Yes, we do. About 10%. The project that I am on ... it doesn't have a whole lot of risks associated and is very well managed because it's very politically visible. (Subject P01, Line 119)

To summarize, six of the nine participants (67%) were responsible for overseeing and/or managing CIS and EMR projects, where the solutions were designed to service six to 16 facilities or 1,000 to 20,000 healthcare providers. These vendor-based, provincial solutions were either fully integrated or had interconnectivity capabilities to increase the safety, efficiency, and quality of healthcare. Many of these projects were multi-year initiatives, ranging anywhere from three to five years and costing anywhere from 20 to 90 million Canadian dollars; only 33% reported that they had a contingency fund reserve, ranging from 10% to 12.5% of the total

budget. The source of CIS/EMR funding was identified as coming directly from the government or indirectly from the government via various health authorities.

5.2.2 Electronic Health Record and Other eHealth Solutions

According to one participant, the Electronic Health Record (EHR) greatly complements CIS/EMR solutions, as was noted in an interview:

> The record is either [on] paper or [in the] existing electronic solution. As we start deploying [our CIS system] ... and put it all together into one package.... But there will still be data we need from other health authorities, doctor's offices, other areas that will sit in the [EHR]. We'll go to the [EHR] to take a look at that information because it won't sit within our own databases. [They] definitely complement each other. (Subject D01, Line 72)

However, the EHR implementation was considered to be in its infancy, as there was still a great deal of work to be done. One participant indicated that there needs to be more synergy and sharing of knowledge between health authorities. The following quotation explains this in more detail:

> On a scale of one to ten, EHR implementation in [Province X] is probably at a level two. It's not very well advanced.... There's got to be a lot more synergy and sharing of knowledge and understanding with each of the health authorities.... It is a work-in-progress and ...we'll be doing it for probably the next ten or 15 years. (Subject D05, Line 77)

Project characteristics for other eHealth solutions that the participants had previously been involved in are described briefly to provide context for these research findings. As only one or two participants were involved in these projects, they are outlined in Table 15 in more detail than was the case in the previous CIS/EMR section.

SYSTEM SOLUTION	EHR	TELE-PATHOLOGY	TELE-HEALTH	INTEGRATED TECHNOLOGY	COMPUTERIZED HANDOVER SYSTEM
# of Participants	2	1	1	1	1
Solution Provider	Vendor and in-house	In-House	Vendor	Vendor	In-House
Purpose and Outcome	To provide a web-based solution that contains provincial data	To expedite transmission and receipt of information	To expend the range of service to remote parts of the province	Integrated technology as part of a hospital and residential care project (construction) – digitizing workflow	Standardize all information that clinicians handover and to clearly present data to reduce inefficiency and inconsistency
Type of Solution	Integrated: repository from different sources	Integrated into the laboratory systems	Integrated	Integrated solution of standalone technologies: tele-health, OR system, bedside terminals, medication system, CIS and EHR	Standalone
Solution Network	Provincial gateway	Local solution	Province-wide system	Regional: Interconnected hospitals & facilities	Regional
Network Size	6 health authorities	1 hospital	10–15 sites around the province	4 hospitals and 2 facilities	4 hospitals
Targeted Organizations	Health authority	Hospitals	Hospitals and community/ primary care clinics	Acute hospitals, residential facilities	Hospitals
Number of Users	N/A	Approx. 100	N/A	N/A	200–300
Targeted Users	Healthcare providers	Pathologists, specialists, primary care physicians	N/A	Clinicians across 32 hospital departments	Clinicians, nurses or doctors across shifts
Project Length	N/A	5 years	Approx. 3 years	Approx. 4.5 years	Approx. 5 months
Total Budget	N/A	N/A	N/A	300 Million + (Canadian $)	N/A
Contingency Reserve Fund	N/A	10% of the total	10% of the total	N/A	None
Source of Resources	Government and Canada Health Infoway	Government and hospitals	Government	Public-private partnerships (P3), government (treasury) and Infoway (Indirectly)	Government

Table 15: Project Characteristics of Other eHealth Solutions

5.3 Definitions of Risk, Risk Factor, and Risk Management

To better understand the research findings, it is important for the reader to understand what the terms *risk, risk factor, issue, and risk management* mean for participants. While a number of these definitions are commonly used in the literature, this section of the chapter explores how these concepts are defined, understood, and described by the participating directors and project managers.

5.3.1 Definition of Risk

According to 89% (n = 8) of the participants (director = 5; project manager = 3), risk was defined as *the categorization or collaboration of all potential scenarios and risk factors that may increase the likelihood or impact of unintended/unexpected consequences that can result in harm to individuals (e.g., patients and users) or the project/system outcome*. The following excerpts from the interviews illustrate this definition:

> Risk is any scenario and ... they could be unintended harm to patients or [to] the staff in healthcare system. (Subject P03, Line 151)

> That is something out there [that] *could* negatively affect the success, implementation, and adoption of a project. (Subject D07, Line 117)

> Risk means anything that may go wrong with the project.... I think about risk in two ways: There is a risk factor which is the risk that the project itself will fail, and there is the risk of what that the failure will result in. There is ... the risk of impact versus the risk of the project itself. (Subject D02, Line 128)

Although the above definition suggests that all risks can be forecasted, identified, and categorized, it is important to note that the *biggest* risks for any project are those that are unknown and unanticipated. The following quotations illustrate this subtle, yet critical point:

> The biggest risk of all is *not knowing* that the risk exists. (Subject P02, Line 586)

> We know ... that things are going to happen, and we're willing to take that risk, if I can use that word. It's what we *don't know* that we have to start working on, in my opinion. [We] need to anticipate. (Subject D01, Line 206)

To understand the definition of risk in more depth, that definition has been broken into the following characteristics and traits:

- Collaboration of all risk factors that have been categorized and aggregated at a higher level;
- Unintended consequences or scenarios that can potentially cause harm to patients and/or staff;
- Unknown or unanticipated events that are more susceptible to problems;
- Anything that can increase the likelihood of projects going wrong; and
- Anything that can negatively impact project success or end-users.

There were no differences between how the directors and project managers defined *risk*.

5.3.2 Definition of Risk Factor

According to 78% (n = 7) of the participants (director = 4; project manager = 3), 'risk factor' was defined as *specific, tangible elements with common attributes of a risk that can increase the likelihood or impact of unintended/unexpected consequences. As such, risk factors of a risk can potentially act as a trigger that causes corresponding risk scenarios to occur*. The following excerpts from the interviews illustrate this definition:

> A risk factor is a specific element that would be attributed to the broader term [category] of risk. (Subject D03, Line 120)
>
> Risk factor is the primary event or [a trigger that causes] scenarios to unfold (Subject P03, Line 155)
>
> Risk factor means there [are] some characteristics of somebody or something that puts them at a higher risk [or] some type of a problem. [It's] something that increases the likelihood of a problem. (Subject D07, Line 121)

In summary, the above definition has been broken into the following characteristics and traits to understand the definition of risk factor in more depth:

- Specific elements that can be attributed to, or arranged within, the broader term of 'risk';
- Tangible characteristics that can increase the likelihood of a risk happening; and
- Primary triggering events that can cause various risk scenarios to occur.

There were no differences in the way directors and project managers defined *risk factor.*

5.3.3 Definition of Issue

While the purpose of this research was to define ‘risk’ and ‘risk factors’, as the terms are understood by the participants, 22% (n = 2) of participants noted differences between the definitions of ‘issue’ and ‘risk’. According to the two project managers, ‘issue’ was defined as *fully materialized risk factor(s) with tangible characteristics that have already occurred and need to be resolved, as they prevent a project/system from being successful*. The following interview excerpts illustrate this definition:

> Risk is something that hasn’t materialized yet. It’s something that you can forecast that potentially can impact a project.... Issue is something that actually has happened and you need to resolve it. A risk might or might not happen.... Issue is something that ... is tangible, and you have to resolve it. (Subject P02, Line 233)

> Issue to me is something that’s preventing my project from being successful. (Subject P01, Line 161)

Only the project managers or equivalents provided this definition of ‘issue’ and compared and contrasted it with the definition of ‘risk factor’.

5.3.4 Definition of Risk Management

According to 89% (n = 8) of the participants (director = 5; project manager = 3), ‘risk management’ was defined and described as follows: *Sustainable strategies and plans of action composed of redundant mechanisms.* These mechanisms are designed to: 1) safeguard (prevent/avoid) risks, 2) reduce the likelihood of risks occurring, 3) address unexpected challenges before they became issues, and 4) mitigate those negative consequences. ‘Risk management’ actively: 1) anticipates risk scenarios, 2) identifies/observes unknown risks, 3) prioritizes risk factors, 4) prepares response strategies, and 5) monitors/manages risks to ensure project/system completion without significant impact to patients or the workflow. The following excerpts illustrate this definition:

> I would say that is basically employing strategies and backup plans to prevent risks from occurring and becoming issues. (Subject P01, Line 167)
>
> If we implement a solution, [we] need to look at sustainability. (Subject P02, Line 164)
>
> Risk management ... is actively managing and monitoring those risks, whether that's looking at them periodically, prioritizing them, and ... finding how you may be able to mitigate those risks. (Subject D04, Line 146)
>
> By identifying the risk [and] finding ways to avoid those negative consequences or ... mitigating the risk ... and taking steps to lower ... the possibility of any negative consequences. (Subject D07, Line 129)

The researcher wishes to recognize and emphasize the importance of distinguishing system/clinical workflow from the above definition of risk management. To successfully manage risks, it is important to be aware of, and familiar with, the system and its clinical/business workflow. The following excerpts illustrate the importance of: 1) understanding workflows to properly manage risks, and 2) understanding risk management to ensure that eHealth projects proceed without adversely impacting patients and/or the workflow:

> Risk management is where you have the familiarity with the system and how ... work is done, so you can anticipate scenarios or observe them directly [to] act and work toward a solution to prevent them or catch them via redundant mechanisms. (Subject P03, Line 163)
>
> [It's about] making sure ... that the project proceeds without ... a significant adverse impact either on patients or workflow [and] trying to get a handle on unexpected challenges, ... looking at things that could potentially go wrong and [anticipating] what to do if something goes wrong. (Subject D01, Line 195)

To understand how risk management was outlined at the beginning of this segment, its definition has been broken down into the following characteristics and traits:

- Developing strategies to prevent or avoid risks from occurring and becoming issues;
- Having sustainable solutions in place to ensure project completion without significant adverse impact;

- Having a redundant mechanism in place that would safeguard against risks occurring by being familiar with the system and the workflow;
- Preparing backup plans of action if/when risks occur to mitigate unexpected challenges before they become issues;
- Anticipating scenarios (i.e., what could potentially go wrong) or directly observing risks to act and work toward a solution to prevent or mitigate risks; and
- Reducing the likelihood of an unknown risk or negative consequences occurring;
- Actively managing and monitoring risks by periodically identifying risks, prioritizing risk factors, and developing solutions to avoid or mitigate risks or negative consequences.

There were no differences between how directors and project managers defined risk management.

5.4 Benefits of Risk Management

While a number of benefits derived from practicing risk management are described in the literature, this section of the research findings outlines how the research participants describe its potential benefits.

According to 56% of the participants (director = 3; project manager = 2), the practice of risk management significantly enhanced their project foresight via preparedness and anticipation. One point that was often repeated by the participants was that problems are inevitable and are part of life. As such, it is best to proactively plan and evaluate rather than react to surprises. Having a principled approach often allowed the participants to engage in forward thinking and gain strategic insights. Ultimately, successful preparedness and anticipation helped participants prevent eHealth project risks and minimize their impact, as illustrated by the following excerpts:

> The bottom line is that every project goes off the rails in some way. Therefore, you need a plan to deal with the project when it goes off the rails. It's very much like the approach to medical error. There was a time when

> everyone thought that if you just worked really hard, you could avoid making mistakes. It turns out that mistakes always get made. There's a better understanding now that what you need is some kind of principled approach to addressing the problems that arise. So I don't think that problems arise because mistakes get made, necessarily, but problems arise.... It's the nature of life. It's better to anticipate how you will deal with those. (Subject D02, Line 148)

> It's imperative that you're aware and you're constantly looking outward ... to stay ahead of the game, be aware of what's out there ... to ensure that, as a project unfolds [and] evolves, you try and stay one step ahead of resolving any potential risk. A lot of people ... are pretty caught up in what they're doing [and that] they're not forward thinking enough to see what the potential risk that might be.... Risk matrix is one of the key tools ... as it helps people to look strategically beyond what they're doing today and for tomorrow. (Subject D05, Line 374)

According to 44% of the participants (director = 3; project manager = 1), the practice of risk management also significantly enhanced their management of projects, finances/resources, changes, and strategies. In particular, effective risk management practices ensured successful project delivery (on time, within budget, and without exceeding the original scope of the project), enabled financial protection and proper resource allocation, and ultimately, increased patient safety. These benefits are outlined in the following quotations:

> The big benefit is not having much harm ... to patients and staff, and then saving money as well. (Subject P03, Line 174)

> I would say that the most important benefit is the opportunity for successful completion of a project.... In addition to that ... there would be some resource benefits [and] there's timeliness issue.... Everything associated with the design, development, implementation, and operation of a project is based around risk. You have to have developed a mitigation strategy, implementation strategy, and go through the scenario plan, dealing with risk to ensure that you're aware of what those risks are and options or scenarios on how you resolve those risks. (Subject D05, Line 341)

Lastly, enhanced communications and awareness were also found to be major, realizable benefits according to 33% of the participants (director = 2; project manager = 1). Specifically, risk management helped participants communicate their

risk strategies to various stakeholders and appropriately manage their expectations by raising awareness. These quotations illustrate this point:

> Everyone gets on the same page.... You can teach people how to appropriately deal with risks so that they are not coming up unexpectedly in the middle of projects. (Subject D04, Line 157)

> To ensure that you stated everything that's kind of out of your control.... So that when something does come up, it can't fall back on to the project as a failure. It's documenting all the potential [risk factors] so everyone is aware, and to properly make decisions. (Subject P01, Line 172)

To summarize, the benefits of practicing risk management include the following:

1. **Foresight Enablement**
    - By preparing and anticipating, project foresight can be achieved. As a result, risk management enables forward thinking and offers strategic insight for its practitioners.
    - Noted by 56% of participants; 50% of directors, 67% of project managers.
2. **Effective Management**
    - Through risk management, its practitioners are able to properly manage their projects, finances, changes, and strategies. Specifically, it ensures successful project delivery on time and within the project's anticipated scope, while protecting their allocated resources.
    - Noted by 44% of participants; 50% of directors, 33% of project managers.
3. **Enhanced Communications**
    - Risk management ensures that proper risk strategies are communicated to the appropriate stakeholders. By raising awareness, expectations can be properly managed and risks can be effectively dealt with in a timely manner. Additionally, it can also support proper decision-making processes in multi-stakeholder settings.

- Noted by 33% of participants; 33% of directors, 33% of project managers.

There were no significant differences between directors and project managers in the way they perceived the benefits of risk management (i.e., 17% difference between directors and project managers for Foresight Enablement and Effective Management; 0% difference for Enhanced Communications).

5.4.1 Understanding Risk for Successful Project Management

This sub-section of the research findings briefly explores and describes the roles of risk information and management where the success of project management activities is concerned. Eight of the nine participants (director = 6; project manager = 2) expressed the importance of integrating risk information and management into project management practices to ensure that projects are completed effectively and successfully. Specifically, integrating risk identification, assessment, prioritization, and tracking and managing risks are critical aspects of project management, as described in these quotes:

> Every project has to complete a risk management plan, where you identify what the risk, the probability, and the impact of that risk is. (Subject D04, Line 205)

> What happens is, we have an intake process for projects, and one of those pieces is formalized risk evaluation. We'll go through and ... look at those risks and other areas related to that risk rating.... It's part of our project management. (Subject D01, Line 261)

> They [risk and project management] do tie together. [It] depends on what the risk is. (Subject P02, Line 239)

Project management activities need to consider and plan for all foreseeable risks and potential issues when preparing the project charter. In other words, proper risk mitigation strategies and activities for various project items need to be planned and integrated into a project plan to avoid surprises and setbacks. This cohesive approach allows the project lead to appropriately chart and map the project's dependencies and critical paths to ensure that projects ultimately proceed seamlessly within the proposed timelines. To deliver projects on time, the speed of

risk response is crucial. Planning risk strategies and integrating mitigation activities into an original project plan and timeline prevent projects from getting sidetracked, which reduces the likelihood of prolonging the expected timeline. As expressed below, risks often shape and influence the final project plan, activities, timeline, and outcomes:

> What we would regularly do is, we'll look at the risks that we were facing, and ensure that what we were doing on the project was addressing those risks. (Subject D02, Line 236)

> Everything associated with the design, development, implementation, and operation of a project is based *around* risk. You have to have developed a mitigation strategy, implementation strategy, and go through the scenario plan, dealing with risks to ensure that you're aware of what those potential risks are and options or scenarios on how you resolve those risks. (Subject D05, Line 344)

As mentioned earlier in this section of the research findings, risk management allows project leads to stay one step ahead of risks. As such, the success of project outcomes often depends on how well risks are understood and planned for. This point is well illustrated by the following excerpt:

> [Risks] can have a huge impact [on the project outcome]. If risks were not identified, and if there wasn't a scenario planning or pre-planning conducted to be aware of those risks, the chances of failure are increased significantly. (Subject D05, Line 284)

When it came to the role risk information and management played on effective project management, there was no significant difference between directors and project managers.

5.4.2 Understanding Risk for Successful Strategic Management

A question similar to the one asked in relation to successful project management was presented to the participants, this time to explore and describe the role that risk information plays within strategic management activities. While two directors mentioned that risk information is only used for project and *not* for strategic management, six participants (director = 4; project manager = 2) noted the importance of identifying risks

and planning mitigation strategies to protect strategic goals and assets. Specifically, risk information was identified as an important aspect of strategic management; It protects and ensures product viability and longevity, business and financial sustainability, system interoperability, and other policy-related considerations. Risk information was seen by participants to influence the strategic plan and its direction. This, in turn, had downstream effects and future implications and impacted the rest of the organization outside of the particular project:

> The major strategic goal of the project was the improvement of the quality of care. That really was the strategy. In order to deal with it, whether that was going to be the case, we had a number of processes in place. One was to use one member from each department.... There was also infrastructure to make sure that if something went wrong with the way that the system resulted in the care of the patients [the strategy], that would be reported right away to the project so that we could address whatever that problem was. (Subject D02, Line 254)

> [We] would determine whether the producers or the business entity is viable and going to be a going concern in the future. It also [helps] to try and understand the financial health of that organization and whether it will be around five years or ten years from now. It looks at whether the particular product is meeting a niche requirement within the organization that's being looked at.... It also examines the interoperability or linkage of it with other systems with which we have communications and linkage. (Subject D03, Line 167)

> It would hit your strategic plan or your strategic direction if the risk is something that involves the policy or involves the workflow change that potentially has downstream effects.... There's a risk and, within the project, it's just how you approach a risk or an issue within the project. But when those things are tied to something that's outside the project, it's organizational-wide, then that will impact your strategic direction. (Subject P02, Line 239)

During this phase of the research, a relationship between strategic management, project management, and risk management was evident. Particularly, projects are often defined, developed, and implemented to support and/or achieve strategic goals and objectives, while risk management helps to ensure that both short-term (i.e., project) and long-term (i.e., strategy) plans and assets are protected. In

addition to the extracts presented in the last two segments, the following quote illustrates this point very effectively:

> The strategic management for our project was defined, developed, and implemented, and that's where the project came in. So strategically, from a project management perspective, it is imperative that everyone be aware of what the risks are.... It's imperative that you're aware of that, and you're constantly looking outward and using that risk management and matrix to stay ahead of the game. Not only on a day-to-day basis, but even long term.... It's imperative that you be aware of [risks] strategically and on a day-to-day basis. (Subject D05, Line 368)

While two directors explicitly indicated that risk information plays no role in strategic management, 67% of the directors expressed its importance, as did 67% of the project managers.

5.5 Key Deliverable(s) for Risk Management

While a number of key deliverables were documented in the literature review chapter, this section of the research findings outlines the key deliverables produced in practice. According to 100% of the participants (director = 6; project manager = 3), the *Risk Register* (i.e., a central repository for all risks and responses as per the project goals and objectives) was found to be the key deliverable that all participants produced and maintained. The following interview excerpts illustrate the critical role the Risk Register plays in risk management:

> We have a risk registry that has the probability, impact, proximity, all divided to equate to red, yellow, or green.... It's the calculation. So we have probability ranked, impact ranked, proximity of how long out this risk could be, what it could hit. These are all calculated together to equate what the executives want to see, which is red, yellow, or green. (Subject P01, Line 209)

> On that risk register, each risk is looked at in terms of probability and impact, and then there's the mitigation strategy for each risk, and that's included in the management plan that's updated. Then, as key risks are highlighted or have the potential of becoming an issue, they are reported on a project status report that goes out to the executives on a monthly basis. We [also] have a rating scale and it's based on ... the discussion when the project starts. (Subject D04, Line 215)

While the term ‘Risk Register’ was used by 33% of the participants (director = 2; project manager = 1), other words were used by the rest of participants to describe a Risk Register: identification chart, risk mapping, risk charter, risk matrix, and issue tracker. The following quotes reflect these differing terminologies:

> I wouldn’t call it that [risk register], and I’m not sure if we would recognize it as a term. But in a sense, if you consider risk register to be a list of all the risk factors [with] mitigation strategy and measurement of where we were regarding that risk, then that’s the kind of tool that we used. (Subject D02, Line 278)

> Currently, what we really have is an issue tracker.... We log our issues, and some of them are really a risk.... We review them, and they’re assigned to team members and leadership to follow up on these items. (Subject P02, Line 255)

> We have a responsibility matrix spreadsheet and ... we separate our key areas into a number of [categories].... Then, within each of those areas, we identify what the risk event is, we talk about what the risk trigger is ... we identify who is responsible for that risk ... we identify on a mathematical basis and from a scale of one to five, the probability of occurrence of that risk ... and then we have the impact of that risk. [We then] multiply the probability and impact [to] come up [with] the exposure for us with that particular risk.... We also define what the response strategy would be to mitigate that risk.... Lastly, we also put it in the resource column to identify who is responsible for managing that risk. (Subject D05, Line 302)

A Risk Register is an important deliverable. It provides a clear and common understanding of the risks that any stakeholders can refer to, and it enables effective communications between stakeholders. Here, stakeholder contributions are important to gain multiple perspectives. As a working document, the Risk Register facilitates teamwork and collaboration. This, in turn, results in a collective ownership of risks, as opposed to risk being the responsibility of any one individual. These excerpts highlight these points:

> The group works on it together, the stakeholders.... They all sit together and come up with it collectively, so they own it together.... That’s the way it should be. (Subject D01, Line 602)

> Where all the people who are involved in the system sort of brainstorm or think of scenarios and whether they can imagine them failing or causing

> harm. Then, [by] ranking or weighting those scenarios by the likelihood or probabilities, we tend to focus on high risk or high danger. (Subject P03, Line 251)

> Those factors that you refer to are going to change as the project evolves, and some risks are going to reduce in strength or urgency, and others are going to get wrapped up. We have ... lots and lots of meetings. [In] our monthly steering committee meetings, we look at risks, we look at where it is, and for executives that are *not* part of the project, it helps them identify where the potential issues might be, and then, for those of us that are managing the project, it helps us to explain to those executives how we're dealing with mitigating what potential issues might come up. It's imperative that you be aware of that strategically and on a day-to-day basis. (Subject D05, Line 391)

While communication and collaboration is vital to developing a Risk Register, it is also important to avoid 'group think', defined by Janis in 1972 as the "psychological drive for consensus at any cost that suppresses dissent and appraisal of alternatives in cohesive decision making groups." Group think is discussed in the following excerpt.

> Another very important thing is to make sure that when discussing [or] applying these tools, we generally preferred not to do it as a group.... You are more likely to get some original perspectives if you ask everyone to independently think of all the failures that could happen and the likelihood.... Because sometimes, the group tends to just go down a certain linear sort of pathway.... So independence and then coming together [is important]. (Subject P03, line 266)

There is also a risk of this deliverable being limited to the internal knowledge and expertise of an organization, as external insights (i.e., garnered from other organizations' experiences) are often ignored. To address this form of organizational group think, the importance of understanding risks that other organizations have encountered was also expressed:

> I suppose what we could say is that we kept very close tabs on the literature to keep current on the kind of problems that other organizations were running into that got published. Plus, we normally go to several conferences a year and also used our networks at those conferences to make sure that we have our ears to the ground. (Subject D02, Line 269)

Lastly, it is important for a Risk Register to be as simple as possible. The risk with documenting and maintaining an extensive Risk Register is that stakeholders and/or executives can get lost in details (i.e., too much information). As described in the following participant quote, ensuring the simplicity and clarity of this communication document is critical:

> [Dashboard] is a very simplistic one. I don't like having ones that are too complex because people don't read them anyways.... This is presented to a steering committee every month, and those folks are then able to pretty quickly recognize what those risks are and if they have any questions.... It's just like a speedometer, where dashboards are used for financial management. It shows the evolution of a project ... the level of completion of the project in many different areas, and it also shows, of course, the risks that are what I call the medium and high risks. (Subject D05, Line 423)

There were no differences in the types of key deliverables that directors and project managers produced. The *Risk Register* was a key deliverable that constantly evolved through the multiple stages of risk management work. All participants developed and applied their own versions of the *Risk Register* to eHealth projects whether they were: 1) identifying, analyzing, and/or ranking risks, 2) assigning risk status and owner, and/or 3) formulating and managing risk response strategy.

5.5.1 Direct and Anonymous Reporting System

According to the literature review, a direct and anonymous reporting system is a tool that risk management teams utilize to enable open communications. Specifically, it reduces the information modification and/or filtration that often happens when information passes through an organizational hierarchy (Pennock & Haimes, 2002). Considering the key role that effective communications play in risk management, this section was designed to understand how research participants perceived the reality of such a reporting system's usefulness.

According to 100% of the research participants, no direct and anonymous reporting system was being utilized at the time of the interview. However, three participants (director = 3; project manager = 0) noted that such a communications tool would be

useful, as risk information is inevitably modified as it passes through the organizational hierarchy to the appropriate risk owner. The following quotations establish this point:

> I think you are right [referring to the issue of information modification]. I think it would've been a useful thing to have, but no, we did not have that for the project itself. We do have a reporting system for medical errors ... but during the project itself, we did not have anything like that.... I don't think I noticed any or a lot of filtering, but very much modification, yes. So we have a lot of argument, and they were definitely not anonymous. (Subject D02, Line 295)

> Yeah, I think that's a real problem [referring to the issue of information modification]. Because of the various hierarchical structures, there really is no original, objective description of [risks]. It does work its way up. (Subject D03, Line 200)

Expanding on the usefulness of an anonymous reporting system, six participants (director = 3; project manager = 3) expressed that they valued *transparency* over *anonymity*. These participants noted that anonymity is not necessary, as they already have both open and transparent communication practices and positive and supportive environments. Most agreed that a positive environment was vital for nurturing transparency across the organization, and that anonymity may be needed if there are poor team dynamics and large egos around the table. The following excerpts illustrate this point well:

> I don't think it is in our case [referring to the necessary of anonymity].... We're a pretty integrated team, and I don't see anybody doing that.... Our folks are aware of what we're dealing with. We have a very transparent organization, so we share everything. (Subject D05, Line 440)

> It's just mostly ... everyone helping out each other.... We've got a very positive working environment, and people tend not to be reluctant to speak out when they have ideas.... [Anonymous reporting systems] could be valuable if you've got poor team dynamics where people aren't able to express their opinions. But I'm sure that applies more with bigger projects and bigger egos. (Subject P03, Line 295)

> All the projects we've had were very transparent. But it's maintaining team communication and stakeholder communication. I personally never had the need for that, so I've never seen that.... If an issue or a risk ... is not

> anonymous, it's easier to follow up. I mean, [if] there is information that you've captured from an anonymous tip, if it's not clear or clarified, I don't know how you'd go back to that person and ask for clarification.... Within the project, it's important that we can identify the person who raised it and to do the proper follow-up. (Subject P02, Line 290)

While all participants expressed and agreed that maintaining clear communications between various teams and stakeholders is essential, a difference was observed between directors and project managers when asked regarding the usefulness or necessity for *anonymity* when communicating risk information.

- 33% of the total participants noted that a direct, anonymous reporting system would be useful, as risk information is modified when it passes through the organizational hierarchy.
    - 50% (n=3) of the directors or equivalent
    - 0% (n = 0) of the project managers or equivalent
- 67% of the total participants indicated that transparent communication practices were more important than anonymity so that a proper follow-up to clarify risk information could be conducted.
    - 50% (n = 3) of the directors or equivalent
    - 100% (n = 3) of the project managers or equivalent

To summarize, only 50% of the directors noted the significance of transparent communications, while 100% of the project managers affirmed its importance. According to the interview participants, this may have reflected the fact that project managers were responsible for identifying and understanding the details of risk information, something that would be difficult to achieve with anonymity. Additionally, considering that the purpose of a direct, anonymous reporting system is to enable open communications across the organization (Pennock & Haimes, 2002), and also observing that the participants already had positive and supportive environments, there was no obvious need for anonymity. While a difference was observed in the importance of transparency and anonymity by the participants, all believed that communicating information about risk is important.

5.6 Risk/Opportunity Analysis in Decision Making

In this section, information is presented about the techniques that are applied when assessing the balance between risks and opportunities. Specifically, the participants were asked how they ensured and achieved the proper balance between eHealth project risks and opportunities during their decision-making process (i.e., how participants decided if a risk was worth pursuing if the opportunity for a greater good was present).

According to 100% of the participants (director = 6; project manager = 3), *qualitative* decision making (experiential and non-linear) was preferred over quantitative practices (i.e., mathematic and linear). While it was noted that quantitative techniques are useful if all the required information (i.e., probability of risk occurrence and degree of risk impact) is available, there is simply not enough historical data to support quantitative calculations of risks. The following quotes highlight this limitation:

> There are [successful] projects that we've done that mathematically we shouldn't have done. That's why I have problems with using [linear] scales and the criteria.... However, the exercise is valuable because then it does bring to your attention risks you might not have thought of. (Subject D01, Line 304)

> That has been my experience [referring to qualitative approaches]. I would say a quantitative approach might ... be more accurate, but ... I haven't seen it implemented before. (Subject P02, Line 331)

While utilizing quantitative techniques (i.e., calculation of risk probability and its impact) have their merits in theory, this linear approach was not considered practical, as it does not take all risk elements into account. To account for this, 67% (n = 4) of directors expressed that all risk/opportunity decisions must be made using evidence-based planning and proven practices. In other words, participants were required to provide evidence/reference of risks and base decisions on proven practices (i.e., what other projects have done) to present a case that a particular project could succeed with value propositions. However, the challenge with evidence-based decision making is that much of the available evidence around risks and benefits is context sensitive and depends on factors such as organizational culture, as is described by participants in the following quotes:

> I think the problem I see with this [referring to quantitative techniques] is I'm not sure where we would apply that. I mean, every decision made is not ... a calculated risk. It's the decision based on evidence-based planning.... It's how we design and implement projects today.... It's fully justified, fully referenced.... We base everything on proven practices, on what others have done, from extensive learning, extensive networking, we do a lot of field trips where you go to facilities and look at how they design something. There's an incredible amount of discussions before we would move forward. (Subject D05, Line 467)

> [We] look at it from evidence-based decision making. We looked at what the evidence was that the project could succeed.... If we did everything right, that it could succeed and would be worth harvesting the opportunities. But certainly, we did not have a formal balancing process.... A lot of the literature coming out in the last five years or so would suggest that many of the risks as well as the benefits are extremely context-sensitive.... Most of these projects fail because of lack of engagement or lack of understanding of what the project is about. So it's very dependent on the culture of the organization.... It's that human context that I think makes it very messy. (Subject D02, line 322)

While evidence-based decision making involves reviewing quantitative and qualitative information, participants emphasised the qualitative aspects of risk (i.e., considering important lessons learned from how other teams and facilities designed and implemented similar solutions regarding stakeholder engagement and collaboration). However, when there was limited evidence available to support a decision that participants made, decision makers focussed on making the best of the limited evidence that was available and integrating expert opinions from a broad spectrum. Both the quotations above and those following exemplify this:

> If there is little evidence to support the utility of perceiving with a more risky situation, then it is very difficult to make the argument for it.... There has to be reasons to be able to identify why [one should] do it and [how] it may be mitigated. (Subject D03, Line 215)

> I mean, most things don't have evidence. If there's actual evidence, we'll use it.... It's of great use to being able to just make the best decision, given what information we have. Then, just because [of] the nature of projects, there tend to be always lots of people to get other opinions. (Subject D07, Line 237)

To address the challenges of a lack of information to support evidence-based decision making (i.e., lack of evidence and/or context-sensitive evidence), collective decision making (i.e., decisions based on group consensus by obtaining multiple perspectives and expertise) becomes a critical component of risk/opportunity decision making. This multi-stakeholder approach helps raise awareness of the project objectives and impacts for everyone involved in, and impacted by, the project, while learning and considering the environmental context. All participants (director = 6; project manager = 3) agreed upon the importance of obtaining as many points of view as possible and striving for group consensus from all those involved and impacted by the project. This is accomplished by utilizing extensive networks of stakeholders and subject-matter experts to understand the risk impact, and then communicating collectively formulated strategies to the executive members and senior core committees within an organization for their agreement, acceptance, approval, buy-in, and support. These excerpts clarify this process:

> When it comes to that, I think it's important to ask away and reach out to other groups if the risk is something that impacts other people downstream. If it is a risk factor that everyone else has assumed and think that it works, then we can assume that, because not assuming the risk will only stop the project, and nothing will change because everyone else has accepted it. (Subject P02, Line 315)

> Generally, trying to get as many points of view on the table as possible and ensuring that there is consensus building around the room with the individuals who might be wanting to seek a specific direction pursued that might be risky. (Subject D03, Line 212)

> We also have a core team that's made out of very senior folks on our project that make the final decision on what decisions are made. It goes through multiple layers to ensure that everyone that has knowledge, expertise, experience has the ability to look at that decision and be part of that decision-making process. (Subject D05, Line 488)

To summarize, while all the research participants (director = 6; project manager = 3) indicated that all available data must be utilized to make the best risk/opportunity decisions possible, the participants noted the distinct lack of

historical data to support quantitative calculations. In addition, while 67% of the directors emphasized the importance of evidence-based decision making, they also noted the fact that available evidence for risk/opportunity decisions is inherently heavily context-sensitive. To address these challenges, making the best use of the limited information available and integrating expert opinions from the broadest group possible was identified as being important. Consequently, all research participants (director = 6; project manager = 3) noted the importance of collective decision making via two-way communications between those who are involved and impacted by the project as a way to gather data when historical data is unavailable and to collect context-relevant information when the available evidence is inappropriate or inadequate. Once a decision is collectively made by multiple stakeholders and experts, the participants further noted the importance of achieving group consensus and securing executive support for the proposed solution before moving forward.

There were no differences between directors and project managers in the way they achieved this delicate balance between risks and opportunities. The exception was an emphasis on evidence-based decision making on the part of 67% of the directors and 0% of the project managers. This difference may be attributed to the fact that directors are more involved and experienced in making decisions that impact organizations, and that they are the ones held accountable for the outcome of such decisions. To ensure that decisions are robust, viable, and sustainable, producing proven strategies backed by evidence may be a critical component of directors' risk/opportunity decision-making process. This may also help ensure and secure the appropriate buy-in and commitment from all those involved and impacted.

5.6.1 Level of Risk Tolerance

While exploring how risk/opportunity decisions are made in practice, the level of risk tolerance (i.e., the amount of satisfaction obtained from a potential payoff) was mentioned by the participants to support their claims. To understand how decisions are

made when balancing risks and opportunities, this section presents the attitude toward risks (i.e., risk aversion, neutral, and seeking) held by the participants.

According to 89% of the participants (director = 6; project manager = 2), the health care industry generally has a risk-averse attitude, as failure to manage eHealth projects and/or implement eHealth solutions can potentially result in patient harm. It was also found that CIS projects that have greater political visibility tended to adopt risk-averse attitudes.

> We're in health care, so there is no such thing as gambling. It's a very serious situation … I would say we are probably risk-averse.... We're dealing with people's lives.... We're very conscious about systems, design, programs. We spend incredible amounts of time and money to ensure that we mitigate any potential risk or anything that's associated with our project. (Subject D05, Line 456)

> The kind of project that we were implementing is well described as [potentially] being dangerous to patients. There are a number of instances in the literature where patients have actually come to harm, specifically because the project was badly managed. That naturally creates an environment of risk aversion. (Subject D02, Line 314)

> I would say, specifically on the project that I'm on, because it's politically visible, we're very averse to risks, very cautious. But I would say, typically speaking on CIS projects, they are pretty neutral. They don't do as much risk analysis as should be done. (Subject P01, Line 226)

While the majority of participants stated that eHealth projects naturally tend to take risk-averse attitudes, three participants (director = 1; project manager = 2) added that this level of risk tolerance can also be risk-neutral depending on the type and phase of a particular project (i.e., not always one way or the other). As indicated in the above and below quotations, this is typically the case (i.e., risk-neutral), as risk management is only practiced at the beginning of projects, and teams tend to forget about risk registers and/or neglect other risk management responsibilities:

> I'd say we are probably neutral. We don't always seek risks unless issues come up. Other than initially at the project when they identify risks, projects don't often do a good job keeping on top of updating that *Risk Register*. (Subject D04, Line 246)

Four directors noted that the level of risk tolerance can also be risk-seeking (i.e., their satisfaction increases as more payoffs are at stake) depending on who you ask, what the scenario is, and how well or poorly a project is progressing. Specifically, while teams tend to be more risk-averse or risk-neutral when managing a project, they were more likely to be risk-seeking when developing the vision or the strategy, a perspective that is described in these excerpts:

> At the higher level, when it comes to looking at our strategy and decisions we make around what projects to take on and implement, we're actually more risk-seeking. We'll try and be a little bit more innovative; take risks implementing solutions that we think are going to have benefits in the long run. (Subject D04, Line 257)

> Me, personally, seeking, but that doesn't work well around here. So really, currently it's aversion but that changes.... It depends how good or bad things are going at the time. So if things have been going badly and all the risks have become issues, a bunch of risks continuously become issues, then you start trying [to get] away from risks.... The perceived impact of the opportunity, then, if it's going to have a great, positive impact, then you are more willing to give it a whirl. (Subject D07, Line 216)

> The fact that we did the project at all, though, was probably pretty gutsy. We obviously weren't risk-averse enough to actually become paralyzed by it, but the risk aversion reflects the kind of project that it was. (Subject D02, Line 309)

Understanding the level of risk tolerance held by stakeholders who are involved and impacted by a project is important, as this risk attitude typically dictates the type of project implemented and/or shapes the type of project it becomes. During the interviews, the researcher found that the health care industry is naturally risk-averse, but eHealth projects introduce risk-seeking behaviour, as such projects encourage innovation and value exploring uncharted territory. This mismatch of attitude toward risks may generate decision-making conflict when multiple stakeholders are engaged and affect how eHealth solutions are collectively handled.

To summarize, 89% of the participants (director = 6; project manager = 2) indicated that the health care industry generally has risk-averse attitudes, as their risk preference could result in patient harm. However, 67% of the project managers (n =

2) expressed that this level of risk tolerance may evolve into a risk-neutral outlook as projects progress and risk management practices are neglected. Two-thirds, or 67%, of the directors (n = 4) noted that risk-seeking behaviours were likely when developing a vision/strategy for projects.

5.7 Risk Officers and Risk Owners

As noted in the previous section, risk management is often neglected in practice. According to the participants, risk management is regularly applied only at the initial phase of projects when creating the *Risk Register*, and teams do a poor job of maintaining or keeping the *Risk Register* up-to-date. To understand why this is the case, this section identifies and describes risk officers and/or owners who are responsible and accountable for ensuring that risks are proactively managed and appropriately dealt with are identified.

According to 100% of participants (director = 6; project manager = 3), the organizations they worked for did not have a designated risk officer who was primarily responsible and accountable for proactively managing eHealth project risks and unintended consequences. This is illustrated in these excerpts from participant interviews:

> We pay very bad attention to risk in that sense.... I mean, they'll do a risk assessment, but on an on-going basis, nobody really manages it in the sense of being a risk officer.... It's not formalized in the sense of being a risk officer who is paying attention to those unintended consequences. (Subject D01, Line 218)

> Everyone sort of does that role in a sense.... We don't have a formal risk officer and some of the other projects I've consulted in, I've never heard actually of anyone who would have a risk officer designation. (Subject P03, Line 179)

While the organizations where participants worked did not have designated risk officers whose formal roles and responsibilities were to ensure that risks are properly and proactively managed, 100% of the participants expressed the need to have risk management responsibilities in someone's job description. Specifically, 56% of the participants (director = 67%; project manager = 33%) noted the

importance of having risk officers to enhance the overall success of eHealth projects. Alternatively, 44% of the participants (director = 33%; project manager = 67%) indicated that full-time risk management officers are not required, because the responsibility for risk management generally falls to project managers and because budget constraints do not allow for such a position.

> The problem today with cutbacks on resources, I think that individual's time could be balanced with other responsibilities as well.... I don't think we need a particular resource specifically, but it's definitely something that needs to be identified as a responsibility for someone. (Subject D05, Line 359)

> I know it's definitely beneficial [to have a designated risk officer]. I do hate to say it, but we're just not there just because of the cost and prioritizing work based on a limited budget. It's not something that we've looked at or will look at in the future. It's something we expect our project managers to be trained in. (Subject D04, Line 168)

> I think if you don't have one [referring to a risk officer], it is important that there be understanding within the project of who in the project is thinking about risk ... and usually those are the people closer to the top of the project. I think it' really important that they understand their shared responsibility with regard to risk. (Subject D02, Line 174)

100% of the participants (director = 6; project manager = 3), noted that risk management is a responsibility shared by various stakeholders. Specifically, risks were collaboratively managed and owned by stakeholders such as the IT department (director = 2; project manager = 1), project managers or coordinators (director = 3; project manager = 1), medical or project directors (director = 4), and executives such as CIOs, CMIOs, and COOs (director = 5). With this level of collaboration, it is important to maintain a delicate balance between encouraging sharing responsibility and still being able to hold someone accountable when/if risks cause problems:

> One doesn't want to defuse the responsibility in such a way that you can't hold somebody accountable. But you need to have partners and collaborators making sure that the project has got good participation and commitment. (Subject D03, Line 352)

> When you're speaking about [risk owners] in particular, ours is much broader.... You've got the CIO who will be responsible for some of those factors, you are going to have a finance manager who will be responsible for some, you should have a clinical lead who will be responsible, and probably the lead for that particular branch. (Subject D05, Line 666)

> The project manager should technically be responsible for all of these things, because that's the one person on the project that sees all the parts.... Funding wise, it's a project sponsor. [Change management is owned by] the project team. The team all together ... need to ensure that the user engagement is happening. (Subject P02, Line 421)

To summarize, 100% of the participants indicated that there is no such thing as a designated risk officer within their organization, but that risk management is always officially part of someone's responsibility. Specifically, 44% of participants (director = 33%; project manager = 67%) indicated that this is the responsibility of project managers, as they have a high-level understanding of projects. However, 100% of the participants (director = 6; project manager = 3) stated that group ownership of risk management is much more common in practice than individual responsibility and accountability of project risks. It is interesting to note that 67% of the project managers (n = 2) highlighted the partnership between project and IT teams (i.e., at the operational level) and no need for risk officers, while 67% of the directors (n = 4) emphasized the importance of collaboration between directors and executives (i.e., at the strategic level) and the need for risk officers.

While collaborations and partnerships play a vital role in encouraging participation and commitment to risk management, it is important to do so without defusing responsibility so much that no one can be held accountable. Failure to do so in a shared responsibility environment may result in risk management being neglected. In other words, if no one person (e.g., risk officer or project manager) is responsible or accountable for ensuring that risks are properly coordinated and managed, risk management becomes more of a reactive exercise than a proactive one.

5.8 eHealth Risks and Risk Factors

As mentioned in the 'Definition of Risk' segment of Chapter 5, 'risk' is defined as a *categorization of all potential risk factors or scenarios that have common attributes and characteristics*. In other words, risks do not materialize due to a single factor or scenario. It is often a chain of intertwined risk events or the interdependent nature of risk factors that ultimately lead to risks occurring. This definition was validated by participants when they were asked to identify and define risk factors that influenced their eHealth project outcomes, as their definitions of risk centred on how risks are interrelated. This section of the research findings outlines and describes the following risks and related risk factors that influence the outcome of eHealth projects, as perceived by the participants:

- Lack of End-User Engagement and Change Management
- Lack of Executive Sponsorship and Resource Management
- Lack of Organizational Trust and Partnerships
- Lack of eHealth Solution Alignment/Stability and Talented Professionals

5.8.1 Lack of End-User Engagement and Change Management

According to the research, this risk describes end-users' lack of strategic understanding of eHealth solutions with respect to an eHealth project's vision, objectives, or benefits. It contains 24.32% (n = 9) of the 37 total, non-unique risk factors identified by the participants (i.e., similar risk factors were identified by multiple participants). To summarize, this risk includes the following unique risk factors (i.e., addressing multiple appearances of similar risk factors by participants):

- Lack of User Engagement and Commitment/Buy-In
- Lack of Change Management and Post-Implementation Strategies
- Lack of User Support and Education/Training
- Lack of Responsiveness to User Feedback
- Lack of User Adoption and System Usage

According to 67% of the participants (director = 3; project manager = 3), it is imperative to engage end-users by effectively communicating the purpose and benefits of eHealth solutions, support and respond to user concerns, and ensure system usage and adoption to

facilitate user commitment and buy-in. Without proper user engagement and change management, organizations risk their eHealth solutions being used improperly (i.e., developing workarounds rather than using the system as designed) or not at all. Providing end-user support via education and training is critical from project initiation to post-implementation. Being responsive to end-user feedback and addressing user concerns and fears is another critical aspect. The importance participants ascribed to engaging users and managing change is reflected in these excerpts:

> The people who are going to be treating patients have to understand what the vision is [and] why you are using the system. If they are not engaged at all, nothing is going to happen.... This is especially true for physicians. They are the most resistant ... people in health care [that you may] get sabotaged on. (Subject D01, Line 351)

> Users who are frustrated and are distracted by the system may actually end up spending more time trying to figure out how to get around the system rather than spending the time taking care of patients.... If you create enough frustration, you lose the trust of the users. It's a lot harder to regain trust than it is to get it in the first place. (Subject D02, Line 484)

> If the final end-users ... don't really believe any concerns or fears that they have expressed are likely to be heard or addressed, then ... they may not have faith in the system, and they will likely go to workarounds because they don't trust it. (Subject P03, Line 368)

Organizations are able to secure end-user participation and long-term commitment by prioritizing early user engagement and continued support of users. This not only ensures successful completion of projects, but also builds trust and increases the likelihood of efficient system use by end-users following implementation. There were no differences between directors and project managers in the way they defined this eHealth-related risk and risk factors.

5.8.2 Lack of Executive Sponsorship and Resource Management

According to the research, this risk describes a lack of executive management and project accountability for eHealth solutions by participants. It contains 32.43% (n = 12) of the 37 total, non-unique risk factors identified by the participants (i.e., similar risk factors were identified by multiple participants). This risk includes the following unique risk factors:

- Lack of Executive Sponsorship and Buy-In
- Lack of Program Survivability and Shifting/Competing Priorities
- Lack of Resource Security and Responsibility/Accountability
- Lack of Strategic and Implementation Understanding
- Overaggressive Scope/Plans and Tight Timelines/Schedules

According to 78% of the participants (director = 5; project manager = 2), obtaining and securing executive sponsorship and buy-in is essential if project teams want to make any organizational change involving eHealth solutions.

First, as Canada's national economy fluctuates (e.g., the economic crash of 2008) or as government parties change, health care organizations are often required to reprioritize their goals and objectives where existing projects are concerned and reallocate their funding according to new priorities set by decision makers. To ensure that funding remains secure for existing projects and that projects survive, teams need executives who will champion the projects at the decision-making level to guard against shifting or competing priorities. Funding allocation is shaped by organizational priorities, and its importance is affirmed by these quotes:

> [As a result of the economy crash], the funding changed, the direction the government was going changed, so the whole project changed.... You have something that's a number one priority project that you are working on [and] somebody says, "the ministry wants you to do this now," so your resources get taken away to do something else. (Subject D01, Line 390)

> [We] won't be given the resources to do it, and some of the people you need are focused elsewhere.... You are not given the opportunity to do testing properly because somebody else says you can't, because they are doing something else.... We won't be able to implement it if there is no will of the organization. [If] there is no funding, then there are no people. (Subject D07, Line 284)

> If it's prioritized ... in response to those issues, then money goes with the priorities, and they have rapid response. If you haven't prioritized, that kind of follows, [and] it's not going to happen. (Subject P03, Line 398)

> It's more around authority.... To make changes, you need to go into areas across your organization, and [if] you don't have an executive there to do

> that, things aren't going to happen. And then, of course, the whole money piece as well. If there's additional funding you require above and beyond ... who is your champion? (Subject D01, Line 363)

Secondly, once executives secure funding and the required resources by championing eHealth projects as top priorities, it is then important to hold the executive sponsors responsible and accountable for the human and financial resources allocated. Resource accountability is depicted by these participant excerpts:

> The fiscal accountability in health care is a major concern and an issue.... We want to be able to ensure that we've got prudent management and responsible accountability for the decisions and commitments that are made. (Subject D03, Line 284)

> I guess another thing would be the cost of the program. We can get into scope creep at times.... Are you going to run into issues where the program dollars that we're budgeted are overspent or under-budget? (Subject D05, Line 548)

> Informatics projects end up having such a terrible reputation in terms of their timeliness and their cost overrun or meeting the objectives of the needs of the project.... If people are going to tamper with scope, time, or schedule, then there has to be a compensation made within either the time element or the scope element. (Subject D03, Line 288)

Lastly, even when organizations considered projects to be top priorities and proper resources were allocated to those projects, participants noted that projects may fail if executives overpromise by promoting overaggressive or overestimated plans that are simply unrealistic. Participants suggested that this was the result of a lack of strategic vision on the executives' part to fully understand who and/or what the eHealth solutions affect and what is required to develop and deliver new eHealth systems. In such instances, participants noted the perception that projects failed due to inadequate expectation management. This last point is illustrated by thsee excerpts from interview transcripts:

> Typically, leadership … tends to overpromise on the business side. They say that we can do things in X number of years, which impacts the business' ability to plan well [and properly]. Because they believe those overpromising,

> aggressive plans … projects end up appearing to be a failure when in reality, they weren't.... They were just overestimated, and no one questioned that overestimation coming from such a high level. (Subject P01, Line 255)
>
> There is a lot of top-down, executive leadership for the program, but often they [executive leadership] make timeline commitments without really understanding what's involved. (Subject D04, Line 290)
>
> In all fairness, the one I would say is the lack of understanding by executives.... I think, understanding the bigger picture. A lot of times, these folks will come in and they're very focused on their particular program, but they don't look outside the box at what impact it might have on other programs, other systems, where it is in relation to a community. (Subject D05, Line 526)

To develop and deliver successful eHealth solutions, participants indicated that executives must have a full understanding of the impact of the eHealth solutions they are responsible and accountable for, as well as what is involved and required for the implementations to be successful. Through proper sponsorship and buy-in, organizations are able to ensure that: 1) specific projects remain a top priority, 2) resources are properly allocated and budgeted to a project, and 3) there is no overpromise to create unrealistic expectations among stakeholders and end-users in terms of scope, cost, and schedule. No differences were noted between directors and project managers in the way they defined this risk and risk factors where eHealth projects are concerned.

5.8.3 Lack of Organizational Trust and Partnerships

According to the research, this risk refers to a lack of organizational trust between departments and stakeholder partnerships. It contains 16.22% (n = 6) of the 37 total, non-unique risk factors identified by the participants (i.e., similar risk factors were identified by multiple participants). To summarize, this risk includes the following unique risk factors:

- Lack of Trust between Departments: Politics and Culture
- Lack of Stakeholder Integration and Organizational Gap
- Lack of Relationships between Internal System Owners
- Lack of External Partnerships and Vendor Management

According to 44% of the participants (director = 3; project manager = 1), one of the biggest risks that a health care organization faces is a lack of trust built into and around the organization resulting from a lack of stakeholder integration of both internal and external parties. This point is illustrated by the following excerpt, followed by a detailed description:

> [It's about] not paying attention to *all* of the stakeholders and having them rush off [with] the projects. (Subject D01, Line 401)

First, as provinces move toward centralizing and consolidating health organizations and/or departments, a lack of trust between internal system owners and departments arises that is based on existing politics and culture. This issue is amplified when geographical distance increases organizational gaps or lack of engagement. These aspects are evident in the following excerpts:

> This is really political. [Our province] is such a complicated world now with so many organizations that are centralized, but they're also so separated from the business that they support. So [our organization] is the clinical side, but the [ICT] organization sits across the city from [us]. There has generally been little engagement between the two sides. I would say that just led to a lack of trust between the two. (Subject P01, Line 262)

> My biggest risk factor for the overall program, all the projects that we take on ... is the politics and culture that exists right now. With the ... consolidation, there's not full trust built-up across the hospitals and [ICT] departments that are involved. (Subject D04, Line 277)

Secondly, while the provinces are starting to develop and deliver *provincial-level* eHealth solutions, health authorities are only partially centralized and consolidated today. As such, these eHealth projects rely on resources that can be obtained from vendors and other external partnerships to drive and support these types of projects. However, the participants have noted that it is difficult to drive centralized eHealth projects in a decentralized environment. To address this concern, a proper external partnership and vendor management is needed to ensure the survival of vendor/external resources throughout the project lifecycle and the accountability of

vendor/external performance and their ability to complete and sustain the eHealth solutions implemented. The latter point is evident in these selected excerpts:

> We're trying to do a lot of provincial-type projects now and provincial roll-outs and deployments. However, we still have five health authorities that are not centralized.... We rely on resourcing from external people in order to make interfaces work and have success. [But] it's hard to drive when it's so separated. (Subject P01, Line 267)

> How long has the vendor been in business, and will they last? Are they going to stay in business long term, or are they going to go bankrupt? (Subject D05, Line 543)

> You got to ensure that vendor management and in the areas underneath is critical. Their performance, their ability to complete a project, [and] their ability to retain or maintain the program, if they're supporting it for you. (Subject D05, Line 640)

Through proper stakeholder integration and management of both internal and external parties (e.g,. system owners, departments, businesses, and vendors), organizations are able to close organizational gaps and build trust across departments and businesses. This is important not only to ensure that existing politics and cultures are tactfully addressed, but also to ensure that organizations have accountable and continued support to drive provincial-type solutions in a decentralized environment. There were no differences between directors and project managers in the way they defined this risk and risk factors where eHealth projects are concerned.

5.8.4 Lack of eHealth Solution Alignment/Stability and Talented Professionals

According to the research, this risk describes a health care organization's inability to align eHealth solutions with the businesses they serve appropriately and to implement stable and usable systems. It contains 27.03% (n = 10) of the 37 total, non-unique risk factors identified by the participants (i.e., similar risk factors were identified by multiple participants). To summarize, this risk includes the following unique risk factors:

- Lack of Client Requirement and Transition Management
- Misalignment of ICT/System and Clinical Workflow/Business Process

- Misalignment of Security/Privacy Legislations and Technical Systems
- Lack of System Interoperability and Technical Stability
- Lack of Tested User Interface and Poor Functionality/Design
- Lack of Skilled Professionals and Talented Human Resources

According to 89% of the participants (director = 6; project manager = 2), eHealth solutions must be properly aligned to: 1) the business processes or clinical workflows that they serve (i.e., user requirements), 2) other eHealth systems and performance standards (i.e., best practices), 3) security and privacy legislation established by governments (i.e., existing policy requirements), and 4) available human resource requirements (i.e., skilled/talented professionals).

First, health care organizations must ensure that their eHealth solutions align with the business processes or clinical workflows that they are designed to serve by managing and meeting all mandatory client requirements. The cause for this risk can be attributed to the above risks such as: 1) lack of change management, 2) lack of executive management, and 3) lack of organizational partnership, as described by participants in the following excerpts:

> Meeting the clients' needs, the transition or switchover from one approach or process to a new process [needs to be] extremely well rehearsed so that it's a flawless and easy transition.... We want to be certain that we're delivering the client's requirements through them in a way that's going to be without any kind of confusion or repetition. (Subject D03, Line 246)

> Misalignment of goals is, in a lot of projects, we see people charging off and saying, "I'm going to deploy this or that" without understanding where your organization is going. Six months into the project, the organization has changed what they are doing, and the project is a total waste of time. (Subject D01, Line 371)

> The [ICT] is run from a separate department, and the clinical workflow and the clinical process is run from the actual agencies and hospitals. There's often disconnect between the two, [so] breaking that gap is very important, and making sure you have both the [ICT] and the clinical groups at the table. (Subject D04, Line 282)

Secondly, organizations must ensure that their eHealth solutions align with other eHealth systems and the overall system performance standards. This includes technical standards and best practices that enable organizations to implement systems that are stable and usable. Failure to do so may result in end-users rejecting eHealth solutions and returning to the use of old processes used in their respective settings, as described in these quotes.

> The biggest risk I've seen ... is that the user interface is poorly designed. Then you have garbage in, and risks can happen from that.... The next one down in terms of risk would be poor functionality and poor design.... You may have the interface built reasonably well, but if the tool has some issues behind the scenes, it's not appreciated. That can be very risky, especially if it's not always transparent as to how the tool gets the results it gets. (Subject P03, Line 352)

> [It's] lack of connectivity, lack of integration with other technologies ... the inability of the program to effectively work, be operated properly. (Subject D05, Line 520)

> In health care delivery, having accurate, precise information available [so] the clinicians are able to deal with the clinical circumstances they find in front of them is absolutely paramount. So the quality and the access to information in a dependable standardized format is absolutely essential. (Subject D03, Line 279)

> By technical failure, I mean just that the system doesn't work at all ... or it's unstable. So there's a lot of downtime.... It's the simplest form of failure. The system just doesn't work, and then everyone just goes back to the way that they were doing things before, [wasting] a lot of time and a lot of money (Subject D02, Line 497)

Thirdly, eHealth solutions must meet and comply with strict security and privacy legislation that has been established by governments. As eHealth solutions contain patients' sensitive, personal information, this ability to meet the established policies and legislation requirements is paramount, as the following quote illustrates:

> It's probably around the security and privacy legislation, so meeting the standards of the province is very tough. Legislation places rigorous [requirements] and is a challenge to meet.... It's the technical ability of a system to actually be as secure as what is required. Most systems aren't compliant with that. (Subject D04, Line 287)

Lastly, and most importantly, health care organizations must be able to recruit and assign appropriate, talented professionals to properly align the business, standards, and policies with eHealth solutions. While executives may be responsible for championing solutions and securing the required funding for a project, this activity is different from recruiting a talented professional who is the right fit for the tasks at hand. These excerpts highlight this requirement:

> Even if you do have the people, the implementation will be poor, because they're not necessarily good at their job. (Subject D07, Line 293)

> The right skill sets to make the project happen. It's the number one thing. It doesn't matter if you have anything else. If you don't have the right people, you just can't get the project off the ground. Oftentimes, if you get little funding, you can still hire the right skill sets to make something happen. So without the right talent, it's very difficult to make something happen.... It becomes attracting the right talent who fit the job. (Subject P02, Line 360)

To successfully develop and deploy eHealth solutions, organizations must ensure that eHealth solutions are properly aligned with various client/business and policy/legislation while meeting established technical/design standards and best practices. To do so, organizations must be able to attract, recruit, and utilize talented professionals who are capable of performing the required work to successfully align and deliver the eHealth solutions. There were no differences between directors and project managers in the way they defined this risk and its related risk factors where eHealth projects are concerned.

The researcher wishes to emphasize that the risk of eHealth Solution Alignment is often the product of the above-mentioned risks, which include a lack of user engagement, executive management, and organizational partnership. In other words, while risks and risk factors have been categorized and described in terms of their common characteristics and relationships, it is apparent that many of these risks and risk factors are inherently and significantly interdependent.

5.9 eHealth Risk Prioritization and Ranking Rationale

As mentioned in previous sections, collective ownership of risk management is commonly practiced. However, it is also important to recall the difference in the level of risk tolerance held by each participant and to understand its implication on the collective ownership of eHealth risks. To effectively delineate this somewhat delicate balance, Table 16 illustrates how the participants prioritized the significant eHealth risks and risk factors.

EHEALTH RISKS AND THEIR RANKINGS	D1	D2	D3	D4	D5	D7	P1	P2	P3	DR*	PM*	ALL*
Lack of End-User Engagement and Change Management	#1 #4	#1 #2	-	-	#2	-	#4	#4	#3 #4	**2.0**	**3.8**	**2.8**
Lack of Executive Sponsorship and Resource Management	#2 #5	-	#2 #3	#4	#1 #5	#1 #2	#1	#2 #3	-	**2.8**	**2.0**	**2.6**
Lack of Organizational Trust and Partnerships	#6	-	-	#1	#4	-	#2 #3 #5	-	-	**3.7**	**3.3**	**3.5**
Lack of eHealth Solution Alignment/Stability and Talented Professionals	#3	#3	#1	#2 #3	#3	#3	-	#1	#1 #2	**2.6**	**1.3**	**2.2**

Table 16: eHealth Risk and Risk Factor Rankings from the Research

D = Director
P = Project Manager
DR* = Ranking average as indicated by directors or equivalent
PM* = Ranking average as indicated by project managers or equivalent
All* = Ranking average as indicated by both directors and project managers, or equivalent

According to all nine participants (i.e., directors and project managers, or equivalent), a *Lack of eHealth Solution Alignment/Stability and Talented Professionals* was perceived as the most important eHealth risk while *Lack of Organizational Trust and Partnerships* was seen as the least important risk. Table 17 summarizes Table 16 according to how the two participant types ranked risk priorities:

RISK RANKING	BOTH DIRECTORS AND PROJECT MANAGERS	DIRECTORS	PROJECT MANAGERS
#1	Lack of eHealth	*Lack of End-User*	Lack of eHealth Solution

	Solution Alignment/Stability and Talented Professionals	*Engagement and Change Management*	Alignment/Stability and Talented Professionals
#2	Lack of Executive Sponsorship and Resource Management	Lack of eHealth Solution Alignment/Stability and Talented Professionals	Lack of Executive Sponsorship and Resource Management
#3	Lack of End-User Engagement and Change Management	Lack of Executive Sponsorship and Resource Management	Lack of Organizational Trust and Partnerships
#4	Lack of Organizational Trust and Partnerships	Lack of Organizational Trust and Partnerships	*Lack of End-User Engagement and Change Management*

Table 17: Summary of eHealth Risk Priorities/Rankings per Participant Type

The difference in the relative importance of eHealth risks as perceived by directors and project managers in Table 17 is interesting. Specifically, Lack of End-User Engagement and Change Management was seen as the #1 eHealth risk by directors, while it was only ranked fourth by project managers. This may be due to the divergent boundaries of the participants' responsibilities and accountabilities, as this director indicates:

> This is classic in project management. We put everything in the projects, and when everybody is gone, how do you manage the users after? Who are you going to look after? What's the strategy for post-implementation and user support if there are things going on? There is no strategy there. The project itself might be successful, but the actual on-going use, it dies. (Subject D01, Line 379)

With the exception of the Lack of End-User Engagement and Change Management risk, directors and project managers did not differ in how they relatively ranked eHealth risks.

To further understand why participants ranked eHealth risks the way they did, the ranking rationale supporting their risk prioritization/rankings is explored using the categories of Risk Dependencies and Perceived Control of Risks.

5.9.1 Ranking Rationale: Risk Dependencies

According to 89% of the participants (director = 5; project manager = 3), risks and risk factors were ranked based on the nature of risk dependencies and relationships. Specifically, risks were ranked highly if they were likely to result in other risks occurring that would affect the overall project's success (i.e., those with the potential to cause a significant ripple effect). The below excerpts from participant interviews illustrate the importance of properly identifying which fundamental root causes could potentially result in further multiple risks affecting the rest of the project:

> It's funny, because we don't have resources because of shifting priorities.... Its consequences are not enough resources. (Subject D07, Line 270)

> [It's] what I've seen that caused the biggest ripple effect. (Subject P03, Line 378)

> In all fairness ... [It's] number one, because I think all the other ones kind of trickle down after that. (Subject D05, Line 526)

> The overaggressive plans to implement have caused the lack of relationships and trust all around.... Relationship and trust between system owners, that's basically a core foundational issue. If we don't have even internal systems working well between our business owners and our business ... then how can we potentially have relationships with other external partners? (Subject P01, Line 284)

An important distinction between risk dependencies and relationships is that low-ranked risks depend on high-ranked risks, but not vice versa. According to the participants, organizations are unable to address low-ranked risks without addressing high-ranked risks. In other words, the success of projects depends on addressing high-ranked risks rather than low-ranked risks. Projects may completely fail if high-ranked risks (i.e., show-stoppers) are not resolved, but only the quality may suffer if low-ranked risks are not addressed. To summarize, participants' recognition of the scope or magnitude of the potential impact the ripple effect may have on eHealth projects is illustrated by these quotes, which describe various highly ranked risks:

> All of these that I've mentioned, they're actually showstoppers to a project.... A lot of projects may name things like user buy-in or something like that, which ... may impact a piece of the project. I think these, like the politics and the culture, can impact the whole project itself. (Subject D04, Line 298)

> [Human] resources, even if you have everything else, given the right skill sets to make the project happen, it's the number one thing. It doesn't matter if you have anything else. If you don't have the right people, you just can't get the project off the ground. Oftentimes, if you get a little funding, you can still hire the right skill sets to make something happen. So without the right talent, it's very difficult to make something happen. (Subject P02, Line 360)

> It's really important to make sure that the client's needs are met. So that's where we are most vulnerable.... Fiscal only because there is a bunch that's allocated for the project and if it exceeds contingency or etcetera, then it runs the risk of being cancelled. If it is cancelled, the issue of timeliness becomes tertiary. (Subject D03, Line 264)

> You need to have the knowledge, understanding, support, [and] commitment of team members, your executives, and your sponsors before you move forward with any of these kinds of projects. Because if you don't have that, regardless of whether or not the product is a good product, all the other factors ... are going to be lose-lose. (Subject D05, Line 588)

Risks were considered significant (i.e., highly ranked) by participants when they were perceived to be the root cause of other eHealth risks and had the potential to cause a massive ripple effect. Specifically, risks were ranked highly if they resulted in multiple risks to occur and/or significantly impacted the overall success of projects. As such, organizations must be mindful and meet project objectives and expected outcomes to ensure that all of the essential, fundamental risks that could most impact all parts of eHealth projects are addressed. There were no differences between directors (83%) and project managers (100%) in the way they perceived the role that risk dependencies and relationships plays on risk prioritization where eHealth projects are concerned.

5.9.2 Ranking Rationale: Perceived Control of Risks

According to 33% of the participants (director = 2; project manager = 1), risks and risk factors were ranked based on the perceived control of risks. Specifically, risks were perceived relatively higher in rankings when participants had no perceived control over

them. For instance, while technical challenges and legal/confidentiality risks are always important to any eHealth project, they were generally ranked relatively lower, as they are much easier to control and/or significant resources are usually allocated to address them. The following quotes illustrate the role that perceived control of risks plays on risk prioritization:

> It's interesting you got the legal and confidential risks here, which is really interesting, because it always is a risk on our project, but it's probably one of the least risks we worry about, because it's one of the ones we do the most work on.... Most of the time, we have to do a privacy impact assessment anyhow. It's something that we pay a lot of attention to, so that's why it didn't even make [it onto the list of risks]. (Subject D01, Line 421)

> Technical challenges for these systems, nowadays at least, are much easier to control and therefore are less ... I think having a pan-Canadian EHR or pan-World EHR would be a lovely thing. I don't think it's bad. On the other hand, I think the ability to standardize at that level is simply not achievable in the next 20 years. So I think we ought to get on with solving the problems that are right in front of us, where we know that 10,000 Canadians die every year in hospitals. (Subject D02, Line 450)

These excerpts from participant interviews clarify how risks were ranked relatively lower if they were perceived to be completely manageable or if adequate resources were allocated to properly address them. Interestingly, eHealth risks were also ranked significantly lower if addressing them was completely unachievable. This included eHealth risks that project teams believed they had absolutely no influence over and/or little or no feasible mitigation plans, a situation these two excerpts describe:

> I would put that one down lower because ... it's easier to add more education and training than it is to solve some of these other risks. And political gains and power conflict, I put last, because it's basically unsolvable for that respect. (Subject P01, Line 292)

> If you create enough frustration, you lose the trust of the users, and it's a lot harder to regain trust than it is to get it in the first place. I've worked on a number of projects where, if you lose enough trust, then you never, ever come back from that. (Subject D02, Line 488)

In addition to risk dependencies (i.e., root causes and ripple effects), the significance of eHealth risks depends on the perceived control of risks. Specifically, risks perceived to be either completely manageable or completely uncontrollable were ranked relatively lower, while risks in-between the extreme ends of the spectrum were ranked higher (i.e., difficult, but not impossible to control). No difference was observed between directors (33%) and project managers (33%) in the way they perceived the role that perceived control of risks plays on risk prioritization where eHealth projects are concerned.

5.10 The Root Cause(s) of eHealth Project Risks

According to Rooney and Heuvel (2004, p. 45), root causes are "underlying, are reasonably identifiable, can be controlled by management and allow for generation of recommendations." As noted in the previous research findings section, eHealth risks are ranked the highest when they are considered a potential root cause of other risks that could impact the overall project's success. Both the complexity of the health care industry and political pressure combined with a lack of resources were perceived as major root causes of many eHealth risks by the participants.

5.10.1 Complexity of Health Care Industry: The Root Cause as Perceived by Directors

According to 56% of the participants (director = 5; project manager = 0), eHealth risks arise from the complex mixture of heterogeneous personalities, cultures, organizations, and environments that leads to a lack of stakeholders' relationships, interaction, coordination, and integration. This social and organizational complexity of the health care industry results in almost every decision being contingent on other projects and their decisions (i.e., numerous interdependencies), a state of affairs described in the following excerpts:

> [It's] related to the complexity of medical care. Everyone wants to make medical care sort of like the banking system or the airline industry. But there is pretty good analysis to suggest that it's more complicated than that.... It's the organizational complexity and almost every decision being contingent on something else. (Subject D02, Line 557)

> There's a wide variety of cultures within stakeholders, so when you look at stakeholder management, that's why there is risk.... You have many people involved in patient care, so that can lead to different levels of risk. It's really around complexity.... You have people who are keen to embrace change, for example, and who are willing to try new things. You've got people who have been here for 30 years, don't want any change. (Subject D01, Line 464)

This social and organizational complexity is amplified when project teams are limited by organizational structure/size and politics/ego. When organizations are too large and rigidly structured (i.e., too many red tape/decision points), project teams lack the agility or nimbleness to make timely and effective decisions. In other words, organizations may reach decision paralysis and be unable to make any real decisions when there are too many priorities and opinions/egos to consider, as illustrated by these quotes:

> [We are] an extremely large organization.... So two things: we have to take the entire province into perspective, which stops your ability to actually make decisions – too many people are involved. And then just any decision wouldn't work with such a grand scale if there's any change required. Moving an organization of that size, inertia is a problem. It's structured to not be very nimble.... It's somewhat paralyzing.... They can only do so much work, so the competing priorities get to be a problem. (Subject D07, Line 330)

> I would say it's two words: Human Beings.... I don't think it matters what you do and what you're building. It all comes down to people, and it comes down to their egos, and it comes down to organizational behaviour. Everything else flows from that.... The bottom line is the individuals, the personalities. (Subject D05, Line 688)

The social and organizational complexity of the health care industry is a root cause of many eHealth risks, and this situation is amplified when the size of an organization becomes too large and/or is rigidly structured (i.e., many opinions/egos to consider). However, an important distinction between directors (83%) and project managers (0%) was observed regarding their perceptions of this complexity as the root cause where eHealth projects are concerned. This distinction is explored in Chapter 6.

5.10.2 Political Pressure and a Lack of Resources: The Root Causes as Perceived by Project Managers

According to 33% of the participants (director = 0; project manager = 3), eHealth risks also arise from a lack of eHealth resources/talents and from governmental political pressure, leading to miscommunication and the emergence of risk. The following excerpts from participant interviews describe this feature:

> The main cause of the first one would be pressure from [a government], political pressure.... The second one – the cause of mistrust – that would've been due to the first one, which is ... miscommunication and dishonesty. The next one, poor control and management of external partners, again, probably it's caused by virtue of [a government] and how it's been deployed and how hours have been allocated. (Subject P01, Line 326)

> I think they all sprout from the scarcity of resources, right? I mean, if you have all the people in the world that you can hire, then those issues will go away.... I think the funding cycle and the way funding [is] distributed has always been an issue. (Subject P02, Line 455)

> The root causes, always inexperienced people jumping into it, not necessarily knowledgeable, without enough time or resources to do it right.... It's just not doing it right because you are not qualified and you haven't put in the time and resources to get it right. (Subject P03, Line 445)

Political pressure and lack of resources/talents within the health care industry are root causes of many eHealth risks. However, a difference was observed between directors (0%) and project managers (100%) in the way they perceived these to be the root causes of many risks where eHealth projects are concerned. This distinction is also explored in Chapter 6.

Chapter 6: Discussion and Conclusion

This study's objective was to explore and compare the unique perspectives held by stakeholders (i.e., directors and project managers) regarding risk awareness within eHealth development projects. The research answers the following question: Do directors and project managers who are or have been involved in eHealth development projects (1) identify, (2) analyze, and (3) prioritize risks and/or risk factors differently?

This final chapter: 1) provides answers to the above research question by discussing the different perspectives of eHealth project risk awareness held by directors and project managers, 2) situates the research findings and results within the context of the current literature, 3) outlines the contributions of the research to health informatics education and practice, 4) discusses the research limitations, and 5) suggests future research directions. These perspectives are presented using the following categorizations:

- Research Discussion
- Research Contributions
- Research Limitations
- Future Research
- Conclusion and Recommendations

6.1 Research Discussion

The researcher wishes to emphasize that the risks and risk factors collated from the results of the literature review and then from the research participants' data were independently analyzed and compiled, as per the approach taken by such researchers as Pare et al. (2008). This separation was deliberately designed to limit the influence of the literature (i.e., theories, best practices, and past studies), as this researcher sought to understand the current state of eHealth risk awareness (i.e., what they are doing versus what they should be doing). This section, then, compares, validates, and integrates the two independent lists of risks/risk factors (i.e., the literature vs. the research findings and results), identifies the gap that exists between the literature findings and the current state of affairs, and provides possible explanations and/or recommendations for those gaps.

6.1.1 Definition of Risk

According to the *Oxford Dictionary* (2009), a risk is a "situation involving exposure to danger or the possibility that something unpleasant will happen." This definition aligns with how directors and project managers who participated in this research defined risk in this study, namely: the categorization of all potential scenarios and factors that may increase the likelihood or the impact of unintended/unexpected consequences that can result in harm to individuals and/or to project outcomes.

While risks are generally associated with negative uncertainties, risk managers must recognize and take advantage of any positive aspects that may be hidden within uncertainties to seize opportunities. The risk management literature suggests that a general definition of risk must include uncertainties that have both positive and negative impacts to a project's goals and objectives (Schwalbe, 2006). While the research participants described negative uncertainties (e.g., harm and failure) in their descriptions, many participants did not include positive uncertainties (i.e., opportunities) in their descriptions. This suggests that in health informatics, the understanding of risk may fundamentally be one-dimensional, as practicing professionals view risks as being negative rather than positive to maximize the benefits of using risk management practices. This may occur because the understanding of risk by directors and project managers in health informatics is still in its infancy as compared to other industries.

It was interesting to note participants' perception that the unknown/unanticipated uncertainties presented the biggest challenge to eHealth projects. This view of unknown uncertainties is echoed by Donald Rumsfeld (2002) when he famously made the following statement in his US Department of Defense News Briefing: "There are known knowns – there are things we know we know. We also know there are known unknowns – that is to say, we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know."

6.1.2 Definition of Risk Factor

According to Pare et al. (2008), risk factors are characterized by contextual attributes and issues that may influence project outcomes. This definition aligns with how both stakeholder groups (i.e., directors and project managers) who participated in this research defined risk factor as having specific and tangible attributes that can increase the likelihood or the impact of unintended/unexpected consequences (i.e., potential triggers that may impact eHealth project outcomes). While no gap was identified in the way the literature and the research defined risk factor, the research participants emphasized the risk factors' relationships with risk (i.e., a risk is a high-level categorization of specific, tangible risk factors with common risk attributes).

6.1.3 Definition of Risk Management

Risk management refers to the art of identifying, analyzing, and responding to risks in order to successfully achieve project goals and objectives (Schwalbe, 2006). This definition aligns with how both stakeholder groups (i.e., directors and project managers) in this research defined risk management: a set of sustainable strategies and plans of action composed of redundant mechanisms to identify, avoid, prevent, reduce, mitigate, safeguard, and address unexpected risks before they become issues, a process that requires being familiar with the system and the workflow.

However, the definition of risk management provided by research participants is also challenged by the same one-dimensional view of risk as discussed above. Specifically, Schwalbe (2006) describes risk management that deals with negative uncertainties as a form of insurance to reduce the impact of adverse events, while those that deal with positive uncertainties are viewed as an investment to create and expand opportunities. As such, the goal of risk management is to maximize positive uncertainties, while minimizing the negative ones (Schwalbe, 2006). However, the descriptions provided by research participants suggested that they were much more likely to perceive risk management as a form of insurance rather than as an investment. This may be explained by the fact that the current state of knowledge of eHealth risk management is still at a relatively immature stage.

To encourage a multi-dimensional view that has the potential to maximize the benefits of risk management, this fundamental understanding of risk and risk management that recognizes both negative and positive uncertainties should be communicated to practicing professionals in order to expand the scope of their definitions and risk management considerations.

6.1.4 General Benefits of Risk Management

While the practice of risk management is important for improving the success rates of projects and preventing project runaways (a term used to describe out-of-control projects), the practice is generally neglected, especially in the software industry (Schwalbe, 2006). However, successfully applying risk management processes can generate valuable and positive impacts by: 1) enabling project teams and stakeholders to thoroughly grasp the nature of a project, 2) defining its strengths and weaknesses, and 3) integrating other fundamental project management knowledge areas (Schwalbe, 2006). According to both stakeholder groups (i.e., directors and project managers) involved in the research, the benefits of risk management can be categorized according to the following themes: 1) Foresight Enablement, 2) Effective Management, and 3) Enhanced Communications. These themes align with the benefits of risk management outlined by Kulik and Weber (2001), who gathered data from more than 260 software organizations, as summarized in Table 18:

RESEARCH FINDINGS	KULIK & WEBER (2001)
Foresight Enablement (56% total: 50% directors; 67% PMs)	Anticipate and Avoid Problems (80%)
	Prevent Surprises (60%)
Effective Management (44% total: 50% directors; 33% PMs)	Reduce Schedule Slips (43%)
	Reduce Cost Overruns (35%)
Enhanced Communications (33% total: 33% directors; 33% PMs)	Improve the Ability to Negotiate (47%)
	Meet Customer Commitments (47%)

Table 18: Similarity of Risk Management Benefits

The belief that problems are inevitable/expected and that proactively planning for them was a far more effective strategy than simply reacting to surprises was reported by most of the research participants, sometimes more than once. According to the participants in

this researcher's study, the practice of risk management significantly enhanced their project foresight via preparedness and anticipation. The participants also affirmed that risk management enhanced their ability to manage projects, finances, resources, changes, and strategies. In particular, effective risk management helped to ensure the successful delivery of projects on time, within budget, and in scope. Lastly, research participants also noted that enhanced communications were a major, realizable benefit of risk management. Specifically, risk management ensured that appropriate risk strategies are communicated to the appropriate stakeholders. By raising awareness, expectations can be managed and dealt with in a timely manner and the appropriate decisions can be made based on consensus (i.e., negotiating requirements and resources).

A minor difference in the benefits of risk management was observed when comparing this study's research findings with Kulik and Weber's 2001 results. Specifically, Kulik and Weber (2001) indicated that their equivalents of enhanced communications (Improving the Ability to Communicate– 47%, and Meeting Customer Commitments – 47%) was more beneficial than was their equivalents to effective management (Reducing Schedule Slips – 43%, and Cost Overruns – 35%). This may have resulted from contextual factors (i.e., different types of participants/environments). However, foresight enablement and the equivalents used by Kulik and Weber (Anticipate/Avoid Problems – 80%, and Prevent Surprises – 60%) were unanimously identified as being a major benefit by both the literature and by this research study.

6.1.5 Benefits of Risk Management on Project and Strategic Management

According to the participants, risk management enabled forward thinking and offered strategic insights. To better understand these points, this thesis research details how risk management benefitts project and strategy management.

From a project management point of view, integrating risk management is critical to eHealth project success, as it allows project leads to stay one step ahead of risks and this minimizes risk impact. Often, a project's successful outcome depends on how well risks are understood and planned for. As such, project management activities must consider all

foreseeable risks and potential issues to avoid surprises and setbacks when creating project plans and charters. This integrated approach to project and risk management is a key component of success, as risks often shape and influence the final project plan, activities, timelines, and outcomes.

From a strategic management point of view, risk information is crucial; It protects strategic goals and assets by ensuring product viability and longevity, business and financial sustainability, system interoperability, and other policy-related considerations. This integrated approach of strategic and risk managements is important, as risks often influence the strategic plan and direction of eHealth projects when there are future implications or downstream effects that impact organizations outside of a particular project. According to both stakeholder groups (i.e., directors and project managers), risk management protects both short- and long-term goals, plans, and assets.

6.1.6 Key Deliverable(s) for Risk Management

To successfully protect project and strategic goals, plans, and assets, eHealth project teams produce and maintain major key deliverables. According to both stakeholder groups (i.e., directors and project managers) interviewed in this research, a risk register was found to be a key deliverable produced in the real world. This aligns with the literature, as Schwalbe (2006) also identified a risk register as a major deliverable for identifying and managing risks. Table 19 compares risk register items derived from the literature with those noted by this research's participants:

RESEARCH FINDINGS	SCHWALBE (2006)	DESCRIPTIONS (SCHWALBE, 2006)
---	ID Number for Risk Event	A unique descriptor used to sort and search for specific risk events.
Risk Event	Name and Description of Risk Event	As the name of a risk event is often abbreviated, it helps to include a detailed, explanatory description.
---	Risk Category	Category under which the risk event falls.
---	Source of Risk	The root cause of the risk.
Risk Probability	Probability of Risk Occurring	There might be a high, medium, or low probability that a certain risk event will occur.
Risk Impact	Impact of Risk to	There might be a high, medium, or low impact

	the Project	upon project success if the risk event actually occurs.
Risk Ranking	Rank for Risk Event	The rank is usually a number, with 1 representing the highest risk.
Risk Strategy	Potential Responses	A potential response to the risk event.
Risk Trigger	Triggers for Risk	Indicators or symptoms of actual risk events.
Risk Owner	Risk Owner	A person who takes responsibility for the risk.
Risk Status	Status of Risk	Answers the following questions: Did the risk event occur? Was the response strategy completed? Is the risk still relevant to the project?

Table 19: Comparison of Risk Register Items (Descriptions Adapted from Schwalbe (2006))

While the research participants included the majority of risk register items as outlined by Schwalbe (2006), the following were not part of participants' risk register item lists: Identification Number, Risk Category, and Source of Risk. While these differences are minor (they could be considered part of risk event and/or risk strategy), it suggests there is room for improvement in current risk registers to ensure that all risk information is included as part of their continuing effort to identify, define, and manage risks.

According to the research participants (i.e., directors and project managers), a risk register serves as a critical communication tool, as it is an important part of the project status reports shared with stakeholders and executives. For those responsible for managing projects, it helps explain how risks are being addressed and what potential issues may arise. For those not directly involved, it helps identify and understand any potential issues so they can be reviewed collaboratively in meetings. This working document also helps participants track changing risks as projects evolve (the relative urgency of risks may fluctuate as the project evolves). Understanding this evolution of projects and the project evolution's impact on risks is essential, as it facilitates the proper identification, definition, mapping, management, and communication of these evolving project risks from multiple perspectives in a timely manner. These participants' perspectives regarding communications and project evolution align with the literature; Chapman (1997) describes a risk register's key role in clear communications, while

Schwalbe (2006) expresses the importance of continuous, iterative identification of risks based on changing project environments (as projects progress).

While this research found the risk register to be a key deliverable produced, it also showed that other major deliverables suggested by the literature were not being considered as part of participants' risk management efforts. For instance, a Risk Management Plan is an important artefact, as it allows project teams to document procedures for managing risks throughout the project lifecycle by assessing and discussing project plans, scope statements, organizational assets, and environmental factors (Schwalbe, 2006). While the participants described how risk management is integrated into project management plans, no participant indicated the existence of a risk management plan in their organizations. However, this separation of project and risk management plans allows risk management to be allotted the same weight of importance at the operations level (Chapman, 1997) as project management is. In addition, Schwalbe (2006) noted the importance of defining and having a contingency reserve set aside in case of an emergency to properly allocate resources in order to reduce costs and schedule overruns. However, this research shows that only two participants (one director; one project manager) had such a contingency reserve set aside (i.e., 10 to 12.5% of the total project budget). This gap between the literature and this research suggests that the application of established knowledge in the area of risk management is still in its infancy in the field of health care. As the established knowledge in the literature continues to grow, practicing professionals must receive appropriate training in recommended risk management practices to increase their awareness and their ability to ensure eHealth project success.

6.1.7 Risk Officers and Risk Owners

According to the participants, risk management is often neglected. Specifically, risk management is often applied only at the initial phase of a project when a risk register is created, and teams generally do a poor job of maintaining or keeping it updated. This may be attributed to an overall lack of accountability and responsibility where risk management is concerned. According to Chapman (1997), another key deliverable that

assigns accountability and approves ownership is produced during the risk analysis phase, when risk ownership policies are transformed into operational contracts.

To enhance continuous project risk awareness and to keep stakeholders from neglecting risk management, organizations often appoint a specific risk officer (McConnell, 1996). For psychological reasons, it is beneficial for organizations to appoint designated personnel to this task and hold them accountable for playing the role of devil's advocate and investigating all the reasons why a project may fail. As such, it is important for project managers and risk officers to be separate individuals within projects and organizations (McConnell, 1996).

While the directors and project managers interviewed for this research noted that organizations did not have designated risk officers whose formal roles and responsibilities include proactive management of risks, all participants agreed there is a need to have risk responsibilities assigned to a specific individual. However, a difference was observed regarding who should be responsible for managing risks beyond the initial project stage. While more than half of the directors (67%) noted the importance of appointing risk officers, more than half of the project managers (67%) indicated that a separate, full-time risk officer is not required, because on-going risk management responsibilities fall under their purview.

Despite this distinction regarding who should be accountable and responsible, all of the participants noted the impact limited budgets had on acquiring designated risk officers and that it should be a responsibility shared by various stakeholders (i.e., IT, project managers, directors, and executives) rather than an individual responsibility. It is interesting that more than half of the project managers (67%) highlighted the partnership between project and IT teams (i.e., at the operational level), while more than half of the directors (67%) emphasized the collaboration between directors and executives (i.e., at the strategic level). This distinction may be because directors and project managers worked closely with their respective partners to meet their responsibilities.

While collaboration and partnerships are vital for encouraging participation and commitment, one must do so without defusing it in such a way that organizations cannot hold anyone accountable. In a shared responsibility environment, risk management may be neglected. If no one person (e.g., risk officer or project manager) is accountable for ensuring that risks are properly coordinated and managed, risk management may become more of a reactive than a proactive exercise. This may explain why current risk management practices are often neglected in eHealth projects, why not all recommended deliverables are produced, and why those that are produced quickly become outdated. To address this issue, risk management must be given the same importance as project management at the operational level so conflicting priorities and limited budgets can be dealt with. Such organizational attention to risk management ensures that appropriate, talented individuals are hired, training is provided, and efforts are made to successfully apply risk management practices in real world settings.

6.1.8 Direct and Anonymous Reporting System

As has been established, a risk register serves a critical communications function, and risk management is a responsibility shared by multiple stakeholders through collaboration and partnership. As stakeholders hold major interests in project outcomes, they must periodically meet to discuss appropriate risk management practices that take all perspectives of risks into account (Pennock & Haimes, 2002). These discussions are important for projects that develop a system of systems (e.g., EHR as a system of CISs and EMRs), as the knowledge of system and organizational boundaries (i.e., horizontal, vertical, external, and geographical) plays a critical role in understanding how they flow and interact with one another to generate new sources of risks (Ashkenas, Ulrich, Jick, & Kerr, 1995; Pennock & Haimes, 2002). According to Nordean (personal interview as cited in Pennock & Haimes, 2002), anonymous reporting systems enable open communications and build trust between the organizational boundaries. This direct, unfiltered channel of communications is invaluable; It enables project teams to obtain raw data and information about risks free of modification and/or filtration driven by politics and fear as information and knowledge pass through the organizational hierarchy.

Considering how the participants (i.e., directors and project managers) viewed risk management as a shared responsibility and expressed the importance of communications, collaborations, and partnerships for its practice, this researcher sought to understand the current state and the usefulness of such reporting systems in today's eHealth project settings. While no direct, anonymous reporting system being utilized in practice was reported, half of the directors (50%) noted that such a communication tool would be useful, as risk information is modified in the real world as it passes through the organizational hierarchy to the appropriate risk owner(s). However, half of the directors (50%) and all of the project managers (100%) stated that they valued transparency over anonymity. Specifically, they believed that transparency aided their ability to conduct proper follow-up to seek clarification; They also noted that anonymity is not necessary as participants encourage open, transparent communication practices in a positive, supportive environment. This difference in opinion may be attributable to the fact that project managers are often responsible for identifying and understanding the details of risk information (something that would be difficult to obtain with anonymity).

This research revealed that a positive organizational environment is vital for nurturing transparency across organizations and that anonymity may be helpful if poor team dynamics and big egos are involved (as can be the case in bigger projects). To some degree, the research findings in this work align with the literature, as Pennock and Haimes (2002) note that anonymous reporting systems enable the transparent communication of valuable risk information, as well as allowing for the transfer of knowledge without fear or concern for political restrictions. Ultimately, the goal is to culturally build trust and encourage proactive participation of knowledge sharing (Pennock & Haimes, 2002). According to the participants, this level of trust and knowledge sharing was already culturally embedded within their environments (positive and supportive) to nurture transparency across their organizations. This may explain why no such reporting system was utilized by the participants at the time of this research.

6.1.9 Risk/Opportunity Analysis in Decision Making

Having addressed the key deliverables of risk management and the role that transparency plays in effective risk communications, further understanding was sought regarding the decision-making techniques employed by research participants when assessing the balance between risks and opportunities (i.e., how they decided whether a risk was worth pursuing if there were potential opportunities for a greater good).

As an investment (i.e., managing positive uncertainties), costs must not exceed the potential benefits of risk management (Schwalbe, 2006). To ensure that risks and opportunities are properly analyzed and balanced, the literature recommends qualitative estimations and quantitative evaluations (Chapman, 1997; Schwalbe, 2006). While qualitative estimations present many challenges (e.g., the complexity of determining accurate estimates without sufficient evidence), they help professionals quickly estimate project risks to determine the best course of action, a positive step required to identify top risks that must be further evaluated (Schwalbe, 2006). While quantitative evaluations offer objective, accurate measurement of risk information and probabilities, they can also be expensive and time-consuming (Boehm, 1991; McConnell, 1996). To balance limited resources and produce accurate information, professionals should concurrently and iteratively perform qualitative estimations and quantitative evaluations, according to Schwalbe (2006).

While all participants noted that all available data must be considered and utilized to make the best possible risk/opportunity decisions, they emphasized qualitative over quantitative decision-making. Participants noted that while quantitative techniques may be accurate and useful, and have their theoretical merits, they all require information that is simply not available in practice, given the lack of historical data to support the quantitative calculations of risk. As this area of risk research is still in its infancy in the eHealth literature, there simply is little or no data that practicing professionals can refer to when considering their quantitative decision-making processes. Further research may be required to compile and build a repository of all quantifiable, historical risk data that all eHealth projects can contribute to and then reference in a practical manner. A large set

of quantifiable evidence in similar, contextual settings would help the health care industry better anticipate and plan against risks.

Further to the issue of a lack of evidence, more than half of directors (67%) and no project managers (0%) who participated in the study noted that all risk/opportunity decisions must be made using evidence-based planning and proven practices (i.e., fully justified and referenced). Directors were required to provide evidence of risks and formulate proven strategies to present a case that a particular project could succeed within the projected value propositions. While the eHealth literature lacks quantitative evidence, limited qualitative evidence is available. However, the challenge with qualitative evidence-based decision making is that much of the available evidence around risks and benefits is context-sensitive; It depends on factors such as organizational culture, which varies widely from organization to organization.

Given this overall lack of useful evidence, it becomes necessary to make the best of limited information that is available and integrate expert opinions from a broad spectrum of stakeholders to consider the contextual differences between eHealth implementations. In other words, collective decision making becomes a critical component of risk/opportunity decision making; It offers a way to gather data when historical data is unavailable and to collect context-relevant information when the available evidence is inappropriate. This is done via two-way communication between those who are involved and those who are impacted by the project. Once a decision is collectively made by multiple stakeholders and experts, the participants further expressed the importance of achieving group consensus and securing executive commitment for proposed decisions before moving forward.

While all the participants noted the significance of collective decision making, only the directors said that evidence-based decision making was important. This difference may be attributed to the fact that directors are more involved and experienced in making decisions that impact organizations; They are also more accountable for the outcomes or financial implications of such decisions. To ensure that directors' decisions are robust,

viable, and sustainable, using proven evidence-backed strategies and securing the appropriate buy-in and commitment from all those involved and impacted may be critical components of their risk/opportunity decision-making process.

6.1.10 Level of Risk Tolerance

Many businesses and organizations succeed due to their willingness to take risks that present significant opportunities. As all projects possess uncertainties with both positive and negative outcomes, the main risk management concern is to decide which projects and decisions to pursue and how to manage project risks throughout the project life cycle (Schwalbe, 2006). However, managing risks in a large IT project is a major challenge, as it is complicated by inherently unpredictable interactions between the organizations and their people (Pennock & Haimes, 2002).

Throughout this examination of how risk/opportunity decisions are made in practice, differing levels of risk tolerance was regularly mentioned by the participants, as perfectly and practically balancing risks and opportunities can be challenging in collaborative settings (i.e., different stakeholders have different degrees of risk tolerance). This level of risk tolerance can be explained by the utility theory of risk – the amount of satisfaction derived from a potential payoff. According to this theory, risk-averse individuals possess a low level of risk tolerance, as they experience little or no satisfaction from high-risk stakes. Risk-seekers have a high tolerance for risks, as their satisfaction increases when greater payoffs are possible. Risk-neutral individuals strive to achieve a perfect balance between risks and payoffs (Schwalbe, 2006).

To further understand how decisions are made when balancing risks and opportunities in collaborative settings, this thesis research sought to understand the participating directors' and project managers' levels of risk tolerance. According to all directors (100%) and more than half of the project managers (67%), the health care culture is generally risk-averse, largely because failure to properly manage a project or implement a solution can potentially result in harm to patients. As the industry deals with people's

lives, certain projects also have high political visibility. Both of these factors tend to promote a risk-averse position.

While the majority of participants (89%) stated that eHealth projects naturally tend toward risk aversion, less than half of the directors (17%) and more than half of the project managers (67%) suggested that this level of risk tolerance can actually be risk-neutral, depending on the type and the phase of a particular project. This may have been because project managers must manage conflicting priorities against limited resources. The difference in opinions between the two stakeholder groups may also be attributed to the fact that project managers are more intimately involved in the management of risks, so they better understand risk evolution as projects progress.

Lastly, more than half of the directors (67%) and no project managers (0%) noted that the level of risk tolerance exhibited by individuals or organizations can be classified as risk-seeking depending on who you ask, what the scenario is, and how well or poorly a project is progressing. Specifically, directors were more willing to innovate and take risks when they believed long-term benefits might accrue, and were less willing to allow decision making to be paralyzed by risk-aversion. This difference of opinion between the two stakeholder groups may be at least partially attributed to the fact that, for directors, the very process of establishing an EHR itself entails inherent risk of patient harm, but they usually have the authority to innovate and establish a vision, strategy, and decision about which projects to implement. Project managers, on the other hand, are limited to simply managing the project they are given.

It is interesting to notice the evolution of risk aversion toward risk-neutrality for those responsible for managing risks and toward risk-seeking for those responsible for establishing the vision or the strategy. Understanding the level of risk tolerance held by stakeholders who are involved and impacted by projects and their risk tolerance interactions is important, as this collaborative attitude toward risk typically dictates the type of projects selected and/or shapes the type of projects they become (e.g., risk-averse

individuals may resist a particular system functionality, while risk-seekers may embrace it).

6.1.11 eHealth Risks and Risk Factors

As discussed, risk is defined by the participants as the categorization of all potential risk factors or scenarios having common risk attributes. Risks do not materialize from a single risk factor or event. They are often part of a chain of intertwined risk events, and this interdependent nature of risks ultimately leads to their materialization. This was validated by the participants; Their definitions and descriptions of the eHealth risk factors (that influence a project outcome) centred on how risk factors relate to one another.

During the interviews, the researcher uncovered a total of 37 risk factors from all nine participants. As discussing these on an individual basis can be taxing and inefficient, duplicates were eliminated based on their definitions and descriptions, and 20 unique risk factors were derived from their interview data. Table 20 lists these unique eHealth risk factors that were synthesized by the researcher from the participants' data; These risk factors were then grouped into four unique eHealth risks according to their common attributes and relationships (as per the definition of risk provided by participants).

EHEALTH RISKS	**UNIQUE EHEALTH RISK FACTORS**
Lack of End-User Engagement and Change Management	Lack of User Engagement and Commitment/Buy-In
	Lack of Change Management and Post-Implementation Strategies
	Lack of User Support and Education/Training
	Lack of Responsiveness to User Feedback
	Lack of User Adoption and System Usage
Lack of Executive Sponsorship and Resource Management	Lack of Executive Sponsorship and Buy-In
	Lack of Program Survivability and Shifting/Competing Priorities
	Lack of Resource Security and Responsibility/Accountability
	Lack of Strategic and Implementation Understanding
	Overaggressive Scope/Plans and Tight Timelines/Schedules
Lack of Organizational Trust and Partnerships	Lack of Trust between Departments: Politics and Culture
	Lack of Stakeholder Integration and Organizational Gaps
	Lack of Relationships between Internal System Owners
	Lack of External Partnerships and Vendor Management
Lack of eHealth	Lack of Client Requirements and Transition Management

Solution Alignment/Stability and Talented Professionals	Misalignment of ICT/Systems and Clinical Workflow/Business Process
	Misalignment of Security/Privacy Legislations and Technical Systems
	Lack of System Interoperability and Technical Stability
	Lack of Tested User Interface and Poor Functionality/Design
	Lack of Skilled Professionals and Talented Human Resources

Table 20: eHealth Risks and Risk Factors from the Research Findings

The next section presents a brief outline of these four unique eHealth risks and how they interact with one another to influence the outcome of eHealth projects.

Lack of End-User Engagement and Change Management: This eHealth risk describes a lack of strategic understanding of eHealth solutions by end-users (e.g., vision, objectives, and benefits). According to 67% of the participants (director = 3; project manager = 3), it is important to engage end-users to: 1) communicate the purpose and the benefits of eHealth solutions, 2) obtain user commitment and buy-in, 3) support and respond to user concerns, and 4) ensure system usage and adoption. Without proper user engagement and change management, organizations face the risk of eHealth solutions being utilized improperly or not at all, resulting in resistance and workarounds. As such, it is critical to provide end-user support via education and training from project initiation through to post-implementation. Being responsive to user feedbacks is also important to for addressing their concerns and fears. Through early engagement and continued support, organizations can facilitate end-user participation and long-term commitment. This not only ensures successful completion of eHealth projects, it also builds trust and increases the likelihood of effective system utilization by end-users.

Lack of Executive Sponsorship and Resource Management: This eHealth risk describes a lack of executive management and project accountability. According to 78% of the participants (director = 5; project manager = 2), obtaining and securing executive sponsorship and buy-in when making organizational changes is essential. First, as the national economy fluctuates (e.g., the economic crash of 2008) or as the government party changes (along with its direction), organizations are often required to reprioritize

their goals and objectives where existing projects are concerned or to reallocate project funding and resources according to new priorities. To ensure that eHealth funding and resources remain secure and that a project survives, teams need executives who believe in and will champion the project at the decision-making level, against shifting and competing priorities. Secondly, once executives secure funding and resources by championing a project as a top priority, it is then imperative to hold committed executives accountable and responsible for their respective human and financial resources objectives. Lastly, when the project is considered a top priority and proper funding and resource allocations have been secured, it may yet fail if executives overpromise with overaggressive or overestimated business plans that are simply unrealistic. Executives may lack the strategic vision to fully understand who and what particular solutions may impact and what may be required to develop and deliver those solutions so they can develop and deliver successful eHealth solutions. When this occurs, there is the perception of project failure owing to inadequate expectation management. Through proper sponsorship and commitment, organizations are able to ensure that: 1) projects remain top priorities, 2) all the required funding is budgeted and sufficient resources are allocated, and 3) no unrealistic commitments regarding the project's scope, cost, and schedule are promised to stakeholders and end-users.

Lack of Organizational Trust and Partnerships: This eHealth risk describes a lack of organizational trust between departments and stakeholder partnerships. According to 44% of the participants (director = 3; project manager = 1), one of the biggest risks that eHealth projects face is a lack of trust built into and around the organization owing to limited internal and external stakeholder integration. First, as provinces move toward ever more centralization and consolidation, a lack of trust between internal business owners and IT departments (the result of existing politics and culture) may occur. This risk is amplified when there is an organizational gap or lack of engagement resulting from geographic separation. Secondly, while provinces are beginning to develop and deliver provincial-level eHealth solutions, health authorities are currently only partially centralized and consolidated. As such, teams often rely on resources from vendors and external partnerships to drive, interface with, and support these provincial-level projects.

It was interesting to note participants' emphasis on the difficulty of driving centralized projects in decentralized environments. To address this concern, there is a need to manage vendors and external partnerships to ensure the survival of external resources throughout the project's life cycle as well as to hold the external partners accountable for completing and sustaining these solutions (i.e., performance). Suitable stakeholder integration and appropriate management of internal and external parties allows project management teams to close the organizational gap and build trust between businesses and IT departments. This is not only important for ensuring that existing politics and culture are tactfully addressed, but also to ensure that organizations have accountable, continued support to drive and interconnect provincial eHealth solutions in decentralized health care settings.

Lack of eHealth Solution Alignment/Stability and Talented Professionals: According to 89% of the participants (director = 6; project manager = 2), this eHealth risk describes the organizations' inability to align eHealth solutions to the businesses they serve and to implement stable, usable systems for the end-users. First, solutions must align with the project's organizational goals, business processes, and clinical workflows to ensure successful transitions by meeting and managing all mandatory client requirements. The cause of this misalignment can often be attributed to the aforementioned eHealth risks (i.e., lack of change/executive management and organizational partnerships), which further illustrates the interdependent nature of these risks. Secondly, solutions must align with other eHealth systems and the overall data/performance standards to ensure the efficient delivery of, and access to, accurate, complete health information. The highest technical standards and current best practices are required to implement eHealth solutions that are stable, usable, and interoperable. Failure to address this misalignment can result in the rejection of systems by end-users, returning them to old practices. Thirdly, solutions must meet and comply with (align) strict security and privacy legislation that has been established by governments to protect eHealth systems' sensitive, personal health information. Lastly (and most importantly), the most talented professionals available must be recruited to properly align the business, standard, and policy requirements listed above with eHealth solutions. While executives' responsibility for

securing required eHealth funding and resources has previously been discussed, this differs from the recruitment of talented professionals who offer the right fit for the task of ensuring such alignment. To summarize, then, eHealth projects must ensure that their solutions are properly aligned with client, business, policy, and legislation requirements, while meeting the highest technical/design standards and best practices established. This requires organizations to attract, recruit, and utilize talented professionals capable of successfully aligning eHealth solutions and requirements. It is interesting to note that the risk of eHealth misalignment is often the product of the aforementioned risks associated with a lack of user engagement, executive management, and organizational partnerships.

Table 21 illustrates the distributions and the frequencies of their appearance per participant group of these four eHealth risks:

EHEALTH RISKS FROM RESEARCH FINDINGS	**OVERALL**	**DIRECTORS**	**PROJECT MANAGERS**
Lack of Executive Sponsorship and Resource Management	32.43%	83%	67%
Lack of eHealth Solution Alignment/Stability and Talented Professionals	27.03%	100%	67%
Lack of End-User Engagement and Change Management	24.32%	50%	100%
Lack of Organizational Trust and Partnerships	16.22%	50%	33%

Table 21: Distributions of eHealth Risks per Participant Group

According to this table, all directors identified risk factors related to the risk of Lack of eHealth Solution Alignment/Stability and Talented Professionals, while all project managers identified risk factors associated with the risk of Lack of End-User Engagement and Change Management. This may be attributed to participants' desire to do their jobs well and to meet their individual requirements for accountability and responsibility. Specifically, while directors are often concerned with the overall, strategic vision and with securing the resources required (e.g., solution alignment and talent acquisition), project managers often focus on the project's ultimate success, which is often measured

by degrees of user adoption and system utilization (e.g., engaging users and managing changes).

6.1.12 eHealth Risks and Risk Factors: The Research Findings vs. The Literature

While Table 20 and the accompanying discussion outlined eHealth risk factors with common risk attributes (as perceived by the practicing participants), it is clear that many risks and risk factors remain heavily intertwined. This further illustrates and validates the claim that risks do not materialize as a result of a single factor or event. Risks are an intertwined chain of risk events, and this interdependent nature of eHealth risks ultimately leads to their materialization. The above exploration of eHealth risk relationships is unique to the literature, as it looks at how these risks/risk factors influence eHealth project outcomes as a whole. While the eHealth risk literature briefly discusses risk relationships and interactions via risk dimensions, it mainly focuses on risk decompositions (i.e., individual risk factors) when describing how these elements influence project outcomes (rather than their compounds). Although disaggregating a whole risk into its parts is theoretically useful, it carries its own risk – that of losing all relational and interactional meaning. Understanding this systemic, organic risk relationship and its impact on eHealth project outcomes offers applicable and practical insights for managing eHealth risks in real world settings.

The many available methods used to define and categorize the multi-dimensional risk characteristics/variables (influencing the nature of risk) account for the difficulty of comprehending the range and interactions of eHealth risks and risk factors identified by the participating directors and project managers. To facilitate our comprehension, Table 20 is compared with those outlined by the literature. In their 2006 research, Sicotte et al. (see Table 4), thoroughly reviewed the literature to locate all relevant risk factors supported by empirical work to produce a baseline risk framework. Their framework was considered robust and complete (i.e., valid) at the time, as no additional risk factors were found that could supplement their taxonomy. In 2008, Pare et al. incorporated materials from the Information Systems (IS) and the Health Informatics (HI) literatures to produce an updated baseline/initial risk framework. The eHealth risk factors comprising of Pare et

al.'s initial framework are now contrasted with those that were independently collected and analyzed for the current research project. Because this study's risk factors are derived completely from the participants' practical experience in this field and absent the influence of the relevant literature, this study is able to make an objective comparison to identify the true gap between the literature and the research findings with respect to eHealth risks (i.e., independent sets of eHealth risk factors).

RESEARCH FINDINGS	PARE ET AL. (2008) - INITIAL
Lack of User Engagement and Commitment/Buy-In	Lack of Cooperation/Commitment from Users
Lack of Change Management and Post Go-Live Strategies	Overall Resistance to Change
Lack of User Support and Education/Training	Lack of Computer Skills and Knowledge among Users
Lack of Responsiveness to User Feedback	---
Lack of User Adoption and System Usage	Poor Perceived System Ease of Use (Repeat)
	Poor Perceived System Usefulness (Repeat)
	Poor Software Performance (Repeat)
Lack of Executive Sponsorship and Buy-In	Lack of Project Leadership (Repeat)
	Lack of Project Champions
	Lack of Support from Upper Management
Lack of Program Survivability and Shifting/Competing Priorities	Organizational Instability
Lack of Resource Security and Responsibility/Accountability	Insufficient Resources
	Changes to Membership on the Project Team
Lack of Strategic and Implementation Understanding	Large and Complex Project
	Complex Software Solution (Repeat)
Overaggressive Scope/Plans and Tight Timeline/Schedules	Unrealistic Expectations
	Scope Creep
Lack of Trust between Departments: Politics and Culture	Political Games and Conflict
Lack of Stakeholder Integration and Organizational Gap	Misalignment of Partners' Objectives and Stakes
Lack of Relationships between Internal System Owners	---
Lack of External Partnerships and Vendor Management	Unreliable External Partners
Lack of Client Requirements and Transition Management	Changes to Requirements

Misalignment of ICT/System and Clinical Workflow/Business Process	Misalignment of CIS with Local Practices and Processes
Misalignment of Security/Privacy Legislation and Technical Systems	---
Lack of System Interoperability and Technical Stability	Complex Software Solution (Repeat)
	Poor Software Performance (Repeat)
Lack of Tested User Interface and Poor Functionality/Design	Poor Perceived System Ease of Use (Repeat)
	Poor Perceived System Usefulness (Repeat)
Lack of Skilled Professionals and Talented Human Resources	Lack of Project Leadership (Repeat)
	Lack of Required Knowledge or Skills
	Lack of Local Personnel Knowledgeable in IT
---	Lack of a Formal Project-Management Methodology
---	Complex/Incompatible Hardware
---	Complex/Unreliable Technical Infrastructure or Network
---	Prior Negative Experiences with CIS Projects
---	Lack of Clear Role Definitions
---	Introduction of a New Technology

Table 22: Comparison of eHealth Risk Factors found in the Research and the Literature

Note. Owing to overlapping descriptions, a Repeat label was added to those risk factors.

Table 22 illustrates that the two independently compiled lists of eHealth risk factors (i.e., from the literature and from the research participants) are relatively comparable – many similarities were found. That said, the few differences between the two sets of eHealth risk factors are outlined in Table 23:

NEW EHEALTH RISK FACTORS FROM RESEARCH FINDINGS	EHEALTH RISK FACTORS MISSING FROM RESEARCH FINDINGS
Lack of Responsiveness to User Feedback	Lack of a Formal Project Management Methodology
Misalignment of Security/Privacy Legislations and Systems	Complex/Incompatible Hardware
Lack of Relationships between Internal System Owners	Complex/Unreliable Technical Infrastructure or Network
---	Prior Negative Experiences with CIS Projects
---	Lack of Clear Role Definitions

---	Introduction of a New Technology

Table 23: Differences between the eHealth Risk Factors in the Research and the Literature

While an initial observation of the differences shows that six eHealth risk factors from the baseline/initial risk framework (derived from the literature) were not identified by the research participants, further examination indicates that Pare et al. (2008) also found three of those six factors to be irrelevant and excluded them from their final risk framework: 1) Prior Negative Experience with (CIS) Projects, 2) Lack of Clear Role Definitions, and 3) Lack of Formal Project Management Methodology. The first risk factor can be explained by the fact that eHealth is a relatively new development in Canadian health care settings. Due to the lack of eHealth system deployments, end-users may not have had any direct experience with such projects. While the most similar eHealth risk factor identified by the research is a Lack of Change Management (to address negative experience, preconceptions, and resistance), this is not completely comparable, as the participants did not use the term 'negative past experience' to describe this risk factor. The second and third risk factors found to be irrelevant by Pare et al.'s final risk framework and this research can be attributed to the fact that, with the rise of certification programs such as PMP, PRINCE2, ITIL, and COBIT5, these are now clearly defined and well-managed, and to the growing trend toward establishing project management offices (PMO) in large health organizations. Based on the definitions used by the participants, no comparable eHealth risk factors exist in this research that can be associated with these two risk factors.

The remaining three eHealth risk factors that were identified by Pare et al.'s final risk framework but do not appear in the current research may be explained either by the nature of the participant sample and/or the evolving landscape of the 21st century: 1) Complex/Incompatible Hardware, 2) Complex/ Unreliable Technical Infrastructure or Network, and 3) Introduction of a New Technology. As all of the current research's participants are project directors and managers, they are often more concerned with high-level technical risks such as a Lack of System Interoperability and Technical Stability and less with the technical details such as Incompatible Hardware and Unreliable

Technical Infrastructure/Network. While the participants may have classified hardware and network within the categories of system interoperability and technical stability, this is not fully comparable, as they did not use such language or terms to describe this risk factor. However, further observation of Pare et al.'s final risk framework shows that these three risk factors were ranked at the bottom of their final list of risk factors. This illustrates and validates Schmidt et al.'s (2001) claim that certain risks decline in importance or completely disappear (e.g., technical risks) as technological and business landscapes continue to evolve.

Continuing this discussion of the differences between the literature and research findings, this research identified three new and emerging eHealth risk factors from the baseline/initial risk framework (Table 22 and 23) that currently influence eHealth project outcomes: 1) Lack of Responsiveness to User Feedback, 2) Misalignment of Security/Privacy Legislations and Systems, and 3) Lack of Relationships between Internal System Owners. However, Pare et al.'s final risk framework also included two similar risk factors in their study findings, suggesting both that these risk factors may be emerging in the field of eHealth projects and that they are translatable to Anglo-Canadian health care settings: 1) Negative Attitude of Project Team Members and 2) Environmental Change (e.g., Legal and Ethical Constraints).

According to participants, Lack of Responsiveness to User Feedback refers to the end-users' belief that user concerns and fears are unlikely to be heard or addressed, even if they are expressed. It describes the end-users' willingness to participate and contribute, and the project teams' lack of attentiveness to such feedback. While this can be attributed to many factors (e.g., lack of resources/manpower, competing priorities, or inadequate communication mechanisms), it mainly illustrates the project teams' unwillingness to negotiate and integrate business and user needs. This finding may be comparable to the Negative Attitude of Project Team Members factor Pare et al. (2008) identified in their final risk framework. Pare et al. also describes Environmental Changes as the project teams' duty to consider legal and ethical constraints (including patient consent and clinical data sharing between organizations) because Canadian health care is publicly

funded. This may be comparable to the research findings on Misalignment of Security/Privacy Legislations and Technical Systems as participants described this risk factor as the ability to meet and comply with provincial standards regarding access, quality, and security of personal health information.

It is interesting to note that a key factor identified by the research, Lack of Relationship between Internal System Owners, was not present in either the risk literature (i.e. baseline/initial risk framework) or in Pare et al.'s final risk framework. While the closest risk factors Pare et al. (2008) identified are Political Games/Conflict and Misalignment of Partners' Objectives/Stakes, these are not completely comparable. The former suggests existing relationships (between owners and stakeholders) while the latter involves objectives rather than relationships. According to participants, a Lack of Relationship between Internal System Owners describes the lack of relationship caused by business separations (due to factors such as geographic distances) as organizations move toward centralization and consolidation. Increasing distance contributes to the lack of relationships and trust between internal system owners. This partly validates Pennock and Haimes's 2002 paper on the importance of understanding system boundaries (i.e., horizontal, vertical, external, and geographic) when developing a system of systems. Their 'geographic boundary' term refers to the physical distance between organizations and departments and the decreasing levels of communication that often accompany increased distances. As organizations continue to centralize and consolidate, this risk factor must be considered a contributing factor that influences eHealth project outcomes.

This segment illustrates that independently compiled lists of eHealth risk factors were relatively comparable. This finding was illuminating, given that this research had a small sample size (n = 9), while Pare et al.'s 2008 study included 21 experienced project managers working in Quebec, Canada. It also validates the fact that many of the risk factors found in Quebec, Canada, are translatable to Anglo-Canadian health care settings.

6.1.13 eHealth Risk Prioritization and Rankings

Discussions around eHealth risks and risk factors as identified by the current research and in the research literature are important for establishing a baseline to understand their influence on eHealth project outcomes. However, the immediately preceding discussions do not take their significance into account, as the purpose of the above framework or taxonomy was only to identify the relevant eHealth risks and risk factors in today's health care settings. Once this baseline is established, the significance of each eHealth risk and how they influence eHealth project outcomes must be addressed.

As discussed, participants described risk management as a shared responsibility owned by multiple stakeholders via collaboration and partnership. Additionally, collective risk/opportunity decisions are often made via two-way communication between those who are involved and those who are impacted by the projects. Once a risk decision is collectively made, participants noted the importance of achieving group consensus and securing commitment before moving forward. An important consideration in this process is how the concept of risk tolerance may impact the collaborative nature of eHealth projects. To further discuss how different stakeholders (i.e., directors and project managers) perceive risks, Table 24 ranks the relative significance of the identified eHealth risks (based on average mean rankings) that influence eHealth project outcomes in today's health care settings.

RISK RANKING	**OVERALL**	**DIRECTORS**	**PROJECT MANAGERS**
#1	Lack of eHealth Solution Alignment/Stability and Talented Professionals	*Lack of End-User Engagement and Change Management*	Lack of eHealth Solution Alignment/Stability and Talented Professionals
#2	Lack of Executive Sponsorship and Resource Management	Lack of eHealth Solution Alignment/Stability and Talented Professionals	Lack of Executive Sponsorship and Resource Management
#3	Lack of End-User Engagement and Change Management	Lack of Executive Sponsorship and Resource Management	Lack of Organizational Trust and Partnerships
#4	Lack of	Lack of Organizational	*Lack of End-User*

	Organizational Trust and Partnerships	Trust and Partnerships	*Engagement and Change Management*

Table 24: Summary of eHealth Risk Priorities per Participant Group

The ranked list of eHealth risks in Table 24 is now compared and contrasted with the final ranked list produced by Pare et al. in 2008 (outlined in Table 9). However, these two sets of final ranked lists are not completely comparable, as this research ranks risks while Pare et al.'s ranks risk factors. This research took the approach of ranking the significance of risks (i.e., the categorization of all potential risk factors/scenarios that have common risk attributes) to maintain the intertwined relationships and the interdependent nature of eHealth risks. While the literature often breaks risks down into risk factors to discuss how these elements influence project outcomes, this research discusses risks as a whole to highlight the interactions inherent to these organic, systemic risk relationships. This is important as the decomposition process eliminates the important interactions between the parts. To properly compare Pare et al.'s 2008 final ranked list with the list produced by the current research, the former has been reiterated (using the earlier comparison table [Table 22] as a mapping tool) to correspond with the form of eHealth risks discussed by the participants involved in the current research.

RISK RANKING	**PARE ET AL. (2008) TRANSFORMED INTO THE RESEARCH EHEALTH RISKS**
#1	Lack of Executive Sponsorship and Resource Management
#2	Lack of Organizational Trust and Partnerships
#3	Lack of eHealth Solution Alignment/Stability and Talented Professionals
#4	Lack of End-User Engagement and Change Management

Table 25: eHealth Risk Rankings Transformed from Pare et al. (2008)

Because Pare et al. (2008) produced their final ranked list from 21 experienced project managers in Quebec, Canada, the ranked list produced from the project managers' data generated by this research is examined first. (The data solicited from directors is treated separately below).

The relative rankings of eHealth risk significance between the project managers of this research and Pare et al.'s rankings are comparable with respect to which risks were

included (matching) and to their relative order, with the exception of *Lack of eHealth Solution Alignment/Stability and Talented Professionals*, which the project managers interviewed for this research perceived to be the most important eHealth risk. This may be attributed to the following challenges that the current research's participating project managers faced in their health care settings: 1) ensuring that eHealth solutions are aligned with client, business, policy, and legislative requirements, 2) meeting the established technical/design standards and best practices, and 3) attracting, recruiting, and utilizing talented professionals capable of aligning solutions with the project's requirements and standards.

Because Pare et al.'s 2008 final ranked list did not include input from directors (but only from a set of project managers), it is not completely comparable with the ranked list produced by the directors who participated in the current research. However, Table 24 (eHealth risk rankings) indicates that both the directors and the project managers who participated in this research perceived the relative significance of eHealth risks comparably (with but one exception). This may suggest that project managers from different organizations share a similar risk awareness (horizontal) and that project managers and directors from the same organization also share a similar awareness (vertical), but that project managers and directors from different organizations have different perspectives of eHealth risk significance/rankings (slope). Further research is required to test this hypothesis, as this research does not have sufficient data/evidence to validate this claim with any real confidence.

6.1.14 eHealth Risk Prioritization and Ranking Rationale

Within the eHealth risk ranking table produced from the directors and the project managers of this research (Table 24), the relative rankings of eHealth risk significance are comparable (i.e., matching and relative order) with the exception of *Lack of End-User Engagement and Change Management*. While directors perceived this risk to be the most significant, project managers rated it as the least important. This variance is worth considering, because the previous discussion about the distributions of eHealth risks (Table 21) showed that all project managers who participated in this research identified

related risk factors around this eHealth risk. The ranking rationale behind these risk prioritizations is discussed in order to understand why the participants ranked the significance of eHealth risks the way they did (including the Lack of End-User Engagement and Change Management anomaly).

According to Keil et al. (1998) and Schmidt et al. (2001), the Perceived Level of Risk Control is a fundamental element that influences the dynamic nature of evolving risks. Both studies describe the level of risk control in the following fashion: outside risks refer to those that cannot be controlled or monitored, inside risks refer to those that can be controlled or monitored, and shared risks refer to those over which there is only limited control or influence. Many organizations are challenged by, and thus rank highly, the shared risks that require cooperation and communications across organizational boundaries. However, only 33% of the participants expressed that they rated and ranked eHealth risks and risk factors based on their perceived level of risk control.

In contrast, 89% of the participants (83% directors; 100% project managers) stated that eHealth risks and risk factors are rated and ranked based on the nature of risk dependencies and relationships. Specifically, eHealth risks are considered relatively significant when they are perceived to be the root cause(s) of other risks, resulting in a massive ripple effect (including interactions impacting situations not directly related to the initial interactions). Risks are ranked relatively higher if they result in multiple risks occurring to the rest of the projects and/or if they significantly impact the overall project's success. Participants stated that this is where they are most vulnerable, as projects may fail or be cancelled if high-ranked risks (i.e., show-stoppers) are not resolved, but only the project quality may suffer if low-ranked risks are not addressed (i.e., if projects are cancelled because a highly ranked risk was not handled effectively, then low-ranked risks become moot.). These ranking rationales provided by participants may explain the existence of the identified exception, the Lack of End-User Engagement and Change Management.

6.1.15 The Root Cause(s) of eHealth Project Risks

According to this research, eHealth risks are ranked the highest when they are perceived to be the root cause(s) of other risks, impacting the overall project's successful completion. To further understand the root cause(s) of eHealth risks, this discussion concludes with an exploration of the following root causes (as perceived by the research participants): 1) Complexity of the Health Care Industry and 2) Political Pressure and Lack of Resources/Talents.

According to the majority of directors (83%) and no project managers (0%), eHealth risks stem from the complex mixture of heterogeneous personalities, cultures, organizations, environments, and risk tolerances that results in a lack of relationships, interactions, coordination, and integrations. The social and organizational complexity of the health care industry results in almost every decision being contingent and dependent on other projects, systems, and decisions. This complexity is further amplified when project teams are limited by organizational structure/size and politics/ego. When organizations are too large or too rigidly structured (e.g., as a result of provincial consolidation and centralization), project teams lack the agility or the nimbleness required to make timely, effective decisions. In other words, organizations may suffer decision paralysis and be unable to make substantive decisions when too many priorities or opinions/egos must be considered.

In contrast, no directors (0%) and all project managers (100%) noted that eHealth risks result from a scarcity of talents, lack of resources, and political pressure from governments. As inexperienced professionals often jump into projects without the necessary knowledge, resources, or time to complete them correctly, the majority of identified eHealth risks can be addressed simply enough by applying more talent and/or other resources. Further, project managers noted that funding cycles and distribution models have always been an issue, along with the political pressure that limits their ability to properly plan projects and deliver solutions.

Considering the comparability of eHealth risk rankings between directors and project managers and observing that the participants share similar ranking rationales, it is interesting to note the single exclusion to that overall compatibility. The majority of directors (83%) indicated that Complexity of the Health Care Industry was the root cause of many eHealth risks, but all project managers (100%) noted that Lack of Resources/Talents and Political Pressure was the primary root cause. This variance may be attributed to the fact that directors are often decision-driven when perceiving eHealth risks, while project managers are often delivery-driven. Specifically, directors are responsible for making important, long-term decisions, but with the rise of consolidation, their ability to do so is hindered by social and organizational complexities that result in decision paralysis. In contrast, project managers are responsible for delivering successful solutions, but their ability to do so is hindered by a scarcity of talented professionals and a lack of resources.

6.2 Research Contributions

The objective of this section is to discuss the contributions this research makes to the health informatics (HI) literature and to health informatics professionals.

Many experts are calling for a re-examination of project risks and their significance to reflect the changing technological and organizational landscapes of the 21st century (Schmidt, Lyytinen, Keil, & Cule, 2001). Since the 1970s, project management and IS implementation research has produced many studies pertaining to risk, but those studies published before the late-1990s are viewed as misleading by many researchers. In their research, Schmidt et al. (2001) compared and validated their ranked list of risks against those found in the literature (Boehm, 1991; Barki et al., 1993; Moynihan, 1997) and found that certain risks have either declined in significance or completely disappeared. Additionally, Schmidt et al. (2001) suggested that much of the then-current published risk research is limited by cultural perspectives, as they were often based on American data and/or restricted to American culture.

6.2.1 Anglo-Canadian and Director's Perspective of eHealth Risk Awareness

As the root cause of many eHealth risks can be traced to differences in the way professionals think about risk (i.e., risk awareness), understanding how project teams that practice in Canada perceive risks and their significance is important. While Sicotte et al. (2006) and Pare et al. (2008) did explore this issue from a Canadian perspective, their studies are limited to Franco-Canadian culture. Adhering to Pare et al.'s 2008 recommendation that additional research should be conducted among risk practitioners from other parts of the world, this research explores and expands this area of risk research by incorporating Anglo-Canadian culture. In addition, while many risk researchers gather their data from the perspective of project managers, clinicians, and health informaticians, few, if any, studies explicitly address senior executives' perspectives. However, Schmidt et al. (2001) recognized the value of further extending risk research to examine project risk awareness from the vantage point of senior executives and how they actually manage risks in the 21st century. This research, then, explores and expands this area of risk research as perceived by directors (senior executives) who practice in Anglo-Canadian cultural settings.

6.2.2 Practical Benefits of Risk Awareness and Management

While the practice of risk management makes an important contribution to the overall success rates of projects and helps prevent runaways (i.e., out-of-control projects), risk management is generally neglected (Schwalbe, 2006). However, successful applications of risk management processes can have a valuable, positive impact by enabling project teams to grasp the nature of a project, define its strengths and weaknesses, and integrate the project management knowledge areas (Schwalbe, 2006). This research found that understanding eHealth risks offers significant practical benefits (e.g., project foresight, effective management, and enhanced communication). First, understanding eHealth risks significantly enhances project foresight by requiring/facilitating preparedness and anticipation. As problems are an inevitable part of life (and of any project), it is best to proactively plan for, rather than react to, surprises. Secondly, understanding eHealth risks enhances the effective management of projects' finances, resources, changes, and strategies. In particular, effective management of risks ensures that eHealth projects are successfully delivered on time, within budget, and within the planned scope. Lastly,

enhanced communication ensures that proper risk strategies are communicated to the appropriate stakeholders.

6.2.3 Application of Risk Awareness Knowledge in Practice

Raising eHealth risk awareness ensures that expectations can be properly managed and dealt with in a timely manner and that appropriate risk decisions can be made consensually. To help realize and maximize the benefits of eHealth risk management, this research discusses the current gap between established risk awareness/knowledge and its applications to today's health care settings. By understanding this gap, HI professionals are able to identify the areas for improvement in their risk management practices to maximize benefits and improve project success rates. Moreover, this research looks at how directors and project managers perceive eHealth risk awareness differently (i.e., identification, analysis, and prioritization). By understanding the gap between these stakeholders' divergent perspectives, HI professionals are better able to anticipate and manage partnerships and expectations to align potentially conflicting goals, objectives, and resources toward successful project outcomes. In essence, this research serves as a basis for the collaboration needed to identify, define, analyze, and rank the eHealth risks that are most significant to eHealth project outcomes for directors and project managers. By understanding the relative significance of risks and integrating the risk awareness of stakeholders, HI professionals are better able to allocate resources, focus efforts, and strategize against risks with the most dependencies (most likely to cause significant problems) in order to leverage and maximize the scope of their risk strategies. This research offers HI professionals the required insights, concepts, tools, frameworks, and taxonomies of current eHealth risks they need to proactively protect the vision, goals, strategies, plans, and assets of their organizations and eHealth projects.

6.2.4 Establishment of Baseline for Theory Development

While this research makes no claim to having developed or established a theory, it offers theoretical insights through the following hypotheses and probable assumptions:

- Risks do not emerge from a single risk factor or event. It is often a chain of intertwined risk factors/events or the interdependent nature of eHealth risks that lead to their materialization.

- Project managers from different organizations reported very similar perspectives of risk awareness (horizontal). Project managers and directors from the same organization also shared similar risk awareness perspectives (vertical). The perspectives of eHealth risk significance differed, however, between project managers and directors from different organizations (slope).
- Directors perceive the Complexity of the Health Care Industry to be the root cause of many eHealth project risks, probably because they are decision driven. Project managers perceive the Lack of Resources/Talents and Political Pressure to be the root cause of many eHealth project risks, potentially because they are driven to deliver results.

Research in risk awareness is relatively neglected in health informatics as compared to other areas such as business and information systems (Richard & Morse, 2007). Given the dearth of project risk theories in the literature, this research offers a foundation for theory development by presenting a baseline for its progression. As exploratory/ descriptive research, this study begins to address the gaps identified in the literature by defining and surveying eHealth risk awareness to build new knowledge.

6.3 Research Limitations

6.3.1 Small Sample Size of the Research

To properly compare and contrast the perspectives of eHealth risk awareness held by directors and project managers, the researcher distributed invitations using a snowball sampling approach (Goodman, 1961) to recruit four directors and two project managers. After multiple requests for recommendations, the total sample size of six was determined to be too small, thus the strategy was modified to further recruit participants using two email distribution lists (the School of Health Information Science and its alumni). With these initial points of contact, the snowball sampling approach was again used to recruit two more directors and one more project manager, reaching a total of nine participants.

By the ninth participant interview, the data saturation point had apparently been reached. The methodological research indicated that data collection should end when significant

improvement is no longer observed in the data being gathered (i.e., when saturation is reached), and it was expected that this would occur before the end of the third month after data collection began. As data saturation was beginning to appear and as the three-month mark had passed, the decision to terminate the data collection process was made. While data saturation was beginning to appear, the small sample size (i.e., six directors and three project managers) was concerning. However, the literature does note that there are no statistical requirements that mandate a specific number of subjects for data saturation (Brink & Wood, 1998; Richard & Morse, 2007). While there is an unequal number of directors and project managers, the literature also notes that an identical number is not required, as research analysis is not influenced by sample size, but by data saturation (Schmidt, 1997; Schmidt, Lyytinen, Keil, & Cule, 2001). While the researcher wished to validate data saturation with further participants, this was not possible due to lack of response from the populations of interest. Instead, collected data were validated against the literature, which showed that many concepts of risk awareness reported in this research were comparable with that of the literature.

6.3.2 Inability to Apply a Multi-Research Design Method

While it is considered good practice to reiterate data collection and analysis over two to three rounds of a multi-research design approach (allowing participants to verify and/or revise their individual rankings in light of group rankings), time and resource constraints prevented this researcher from carrying out this step. Additionally, the researcher calculated simple approximations of mean ranks (i.e., central tendencies) to produce the ranked lists of eHealth risks as perceived by participants. However, there is some danger that the mean ranks varied a little, as each participant independently ranked an arbitrary number of significant eHealth risks (Schmidt, 1997). This limitation stems from the fact that this research did not separate the establishment of baseline from the establishment of rankings (via reiteration of data collection and analysis). While establishing and then refining the baseline and the rankings prevents participants from independently assigning and ranking arbitrary number of risks (Schmidt, 1997), this separation fell beyond the scope of this research project owing to financial and time constraints. While this limitation was discussed and accepted in Chapter 4, results indicated that the final ranked

lists of eHealth risks were comparable between directors and project managers, as well as between these research results and the published literature.

6.3.3 Multiple Methods for Defining and Categorizing Risks

Understanding eHealth risks and risk factors is complex because so many methods can be used to define and categorize the multi-dimensional characteristics of risks. While this research defined eHealth risks and risk factors as per definitions provided by participants (i.e., the categorization of all potential risk factors/scenarios that have common risk attributes), these definitions can be also defined and categorized in multiple ways (e.g., risk dimensions). However, this researcher followed the lead of the study's participants and presented the organic, systematic relationships of eHealth risks to offer applicable, practical insights for managing eHealth risks in today's health care settings.

6.4 Future Research

Research in risk awareness is relatively neglected in the health informatics literature compared to areas such as business and information systems (Richards & Morse, 2007). Moreover, the literature states that successful, proven practices in other industries do not always adapt well to health care settings (Anderson & Stafford, 2002). As such, the health informatics literature requires a specialized view and considerations by researchers to understand eHealth risk awareness. As the current literature lacks project risk theories and hypotheses, this research provides a foundation for theory development by presenting a baseline for its progression. It offers explorations and descriptions of eHealth risk awareness to build new knowledge that can be used as a starting point for future research. The objective of this section is to discuss potentially fruitful research questions that will further advance the current state of eHealth risk literature.

6.4.1 Quantitative Verification of Hypotheses and Probable Assumptions

Further studies should address the identified limitations of this research. Specifically, a robust research design such as a ranking-type Delphi method (Schmidt, 1997) is needed to scientifically and incrementally reach a consensus regarding prioritized risks and risk factors that are significant to eHealth project outcomes. A scientific theory can only be established if a scientific hypothesis survives experimental testing. While this research

makes no claim to having developed or established a theory, it offers theoretical insights through the hypotheses and probable assumptions (see 6.2.4 Establishment of Baseline for Theory Development) that require future quantitative verification via experimental testing.

6.4.2 Exploration and Description of Risk Control and Management

This research consolidates the established risk management frameworks into the following to compile a comprehensive overview of the current state of eHealth risk awareness knowledge:

- Risk Awareness and Assessment
    - Risk Initiation and Planning
    - Risk Identification
    - Risk Analysis and Assessment
    - Risk Prioritization and Filtration
- Risk Control and Management
    - Risk Response Planning
    - Risk Resolution and Implementation
    - Risk Monitoring and Management

This research explores and describes perspectives of eHealth risk awareness using the first part of the framework (i.e., Risk Awareness and Assessment), but the perspectives of directors and project managers could usefully be explored and described using the second half (i.e., Risk Control and Management).

6.4.3 Perspectives of Risk Awareness from Other Stakeholders and Countries

In addition to examining the eHealth risk awareness of senior executives (e.g., directors) and project managers, this emerging field of research would also benefit from the extension and inclusion of other stakeholder groups such as external partners (e.g., vendors) and the system end-users. Including the perspectives of stakeholders and end-users in countries other than Canada and the United States would constitute another valuable addition to the research literature. According to this research, eHealth risks occur due to the complex mixture of personalities, cultures, organizations, environments,

and risk tolerances that result in a lack of relationship, interaction, coordination, and integration. By understanding and integrating the potentially conflicting perspectives of all major stakeholder groups, directors and project managers are better positioned to anticipate expectations and manage relationships/partnerships to more effectively align eHealth projects' vision, goals, strategies, decisions, systems, resources, and assets.

6.4.4 Historical and Quantifiable eHealth Risk Data Repository

This research found that while the quantitative techniques of risk/opportunity decision making may be accurate and useful, the required risk information is simply not available in practice (i.e., there is a lack of historical data to support such quantitative calculations of risk). As this area of eHealth risk research is still in its infancy, little or no data that practicing professionals can refer to (when considering whether to use quantitative decision-making processes) is available. Further research is required to compile and build a repository of all quantifiable, historical risk data that eHealth project teams can contribute to and then reference in a practical manner. A large set of quantifiable evidence in similar contextual settings could help the industry better anticipate and plan against eHealth risks.

6.4.5 Reorganization toward Risk Dependencies and Relationships

The interdependent/intertwined nature of risk relationships was one of this study's most significant findings. While breaking a whole down into its parts is useful (in this case, into individual risk factors), there is a danger in doing so; Some or all of the meaning of organic, systemic relationships/interactions between the parts may be lost. Having said that, defining and characterizing individual components (i.e., risk factors) remains an important part of the eHealth risk literature progression. However, there is a need to start exploring and defining the simple rule(s) that govern eHealth risk relationships/ interdependencies and their impacts upon the overall system of eHealth risks. Much like a biological classification system (i.e., taxonomic ranks), eHealth risks and risk factors need to be reorganized in a family-tree-like fashion to delineate risk components and their relationships with one another. Moreover, future research that defines and characterizes the simple rule(s) that govern the evolution of eHealth risks (much like Darwin's evolutionary taxonomy) would be exceedingly helpful. Advancing this area of

risk relationship and evolution research (in addition to risk component/factor research) would benefit the current state of the eHealth risk literature.

6.5 Conclusion and Recommendations

The objective of this research was to explore and compare the unique perspectives held by stakeholders (i.e., directors and project managers) regarding risk awareness in eHealth development projects. To do so, an answer was sought to the following question: Do directors and project managers who are or have been involved in (i.e., who oversee or manage) eHealth development projects (1) identify, (2) analyze, and (3) prioritize risks and/or risk factors differently? By understanding the distinction that this research revealed, professionals will be better able to properly align expectations and partnerships to facilitate more successful eHealth project outcomes. In addition, this research addressed the gap that exists between established knowledge and its applications in current eHealth project settings. By understanding what they should do versus what they actually do, professionals will be able to improve and enhance their risk management practices to proactively protect their eHealth projects. This research concludes by discussing the gaps that exist between the literature and the research as well as new research findings to accelerate the practice of risk awareness and management in today's eHealth project settings.

First, there is a fundamental gap in the way today's directors and project managers view and perceive risks. Specifically, risks and risk management are often associated with negative uncertainties (e.g., failure and harm). However, the literature notes that professionals must also examine positive uncertainties as a form of investment to create and expand opportunities (Schwalbe, 2006). This multi-dimensional view should be promoted so professionals can increase the scope of their definitions and considerations.

Secondly, risk management practices currently operate at a very basic, skeletal level. Specifically, the risk register was found to be the only tool that both directors and project managers used to identify and communicate eHealth risks. However, the literature recommends other valuable tools/deliverables such as the risk management plan, which

allows risk management to be planned with the same weight of importance as project management at the level of operations (Chapman, 1997). Another similarly neglected recommendation from the literature is the utility of a contingency reserve. The research indicated that only one director and one project manager reported ever having one in place (putting aside 10–12.5% of the total budget). As the established body of risk knowledge continues to evolve, professionals should be trained to use these and other recommended practices to expand the set of tools required to deliver projects successfully.

Thirdly, only limited accountability for the proactive management of eHealth risks was reported by participants. Due to budgetary constraints, today's eHealth projects do not employ risk officers to play the role of devil's advocate and be accountable for proactive risk management, a practice McConnell recommended as long ago as 1996. Instead, it is a shared responsibility owned by multiple stakeholders. While 67% of the project managers noted that risk officers are not necessary, 67% of the directors affirmed their importance. According to McConnell (1996), project managers and risk officers should be separate individuals (as is the case with peer reviews). To ensure accountability, appropriate personnel should be hired to advocate for risk management to be given the proper weighting against competing eHealth project priorities and resources.

Collective decision making is the fourth critical practice that must be embraced in eHealth project settings. While both directors and project managers noted that all qualitative and quantitative data must be considered, they reported relying mainly upon qualitative methods owing to a pronounced lack of reliable, related quantitative data, and 67% of the directors further noted that decisions are often driven by evidence-based planning. However, the contextual sensitivity of qualitative, evidence-based decision making is problematic, and it requires decision makers to integrate expert opinions to weigh those contextual differences. The health care industry should acquire and/or train risk specialists who are well-versed in evidence-based consultations and who have the required knowledge of the kind of contextual differences that apply to eHealth projects.

This research also highlighted a fundamental difference between directors' and project managers' levels of risk tolerance. While the health care culture is naturally risk-averse (as direct harm to patients is at stake), 67% of the project managers interviewed suggested that it can be risk-neutral, and 67% of the directors observed that it could even be classified as risk-seeking. This difference can be attributed to the project manager's accountability/responsibility to manage conflicting project priorities against limited resources, whereas directors are usually in a position to innovate and take risks that may generate long-term benefits, particularly in a project's early stages. While the field of health care is inherently risk-averse, decision making cannot be paralyzed by risk-aversion, and the very nature of eHealth projects themselves inevitably introduces some risk-seeking decisions. This mismatch of risk tolerances can generate conflict and impact how eHealth solutions are collectively handled. Given that the risk literature offers many examples of organizations succeeding because of their willingness to take risks that also present great opportunities, health care organizations and eHealth projects should more effectively negotiate and manage appropriate risk-tolerance expectations. Understanding risk tolerance and its interactions is important in collaborative settings, as this can dictate the type of projects selected and/or shape the type of projects they become.

The sixth recommendation arising from this research identifies a relatively new eHealth risk factor, the Lack of Relationships between Internal System Owners. Both project/system centralization and organizational consolidation result in growing geographic distances between businesses that contribute to a lack of (as opposed to conflicting) communication, relationship, and trust between internal system owners. Professionals involved in project/system centralization and organizational consolidation should consider and rank this risk and its potential impact on eHealth project outcomes amongst other eHealth risks.

The fact that directors and project managers perceived the relative significance of eHealth risks comparably with the exception of the Lack of End-User Engagement and Change Management risk highlights a seventh suggestion resulting from this study. While directors perceived this risk as the most significant, project managers ranked it last. This

difference can be explained on the basis of their ranking rationale (i.e., eHealth risks with the most risk dependencies/relationships and/or limited level of risk control). Examining this distinct divergence in relative risk significance perception places directors and project managers in a better position to investigate and evaluate that difference to negotiate and ensure the proper alignment of project priorities, resources, and efforts.

Finally, while the Complexity of the Health Care Industry was identified as the root cause of many eHealth risks by directors, project managers thought the Lack of Talents/Resources and Political Pressure was responsible for more risks. This can be attributed to differing perceptions of eHealth risks; Directors are decision-driven, while project managers are delivery-driven. Directors are responsible for making critical decisions, but their ability to do so is hindered by social, organizational complexities (often resulting in decision paralysis). Project managers are responsible for delivering successful solutions, but their ability to do so is hindered by a scarcity of talented professionals and a lack of resources. Understanding directors' and project managers' divergent viewpoints regarding the root causes of these risks allows eHealth projects to better leverage resources and focus efforts on risks having the most significant impact.

The practice of risk management must be embraced by health informatics professionals, as it encourages professionals to be forward thinking (i.e., stay one step ahead of risks) in order to prevent avoidable risks and seize opportunities. It is clear that risks do not materialize from a single risk factor or event and that a chain of intertwined risk factors/events and/or the interdependent nature of risk itself that often lead to their materialization. Understanding these organic, systemic risk relationships and their impacts on eHealth project outcomes offers applicable, practical insights for effectively identifying, analyzing, and prioritizing risks in today's eHealth project settings.

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Appendix A: Semi-Structured Interview Questions

Part A (10-15 minutes)

1. What does risk, risk factor, and risk management mean to you?
2. What are some benefits of practicing risk management?
3. Does your team have a designated risk officer?
4. Do you take a multi-stakeholder approach when managing risks?
    a. Who is involved in your risk management practices?
    b. Whose perspectives are represented (e.g. public, users, staff, project, executives)?
5. Does your team consider risks for project management or strategic management practices?
6. What type of tools and techniques do you use to document, measure, and manage risks? What are the key deliverables for your risk management practices?
    a. Example: risk management plan, risk register, risk probability and impact, risk milestone chart, or top priority risk tracking.
7. Does your project have a direct, anonymous reporting system to allow the appropriate risk owner to access a set of unfiltered risk information?
8. What is your project team's level of risk tolerance (neutral, aversion, seeking)? How do you balance risks and opportunities when it comes to eHealth applications in healthcare settings?

Part B (30-35 minutes)

1. Which risk factors do you consider to be the most significant to your project outcome? Can you list them in the order of their relative importance from high to low?
    a. Can you briefly explain your rationale for this ranking order?
2. For each risk factor, starting from the top:
    a. Can you briefly describe this risk factor and how it impacts the project outcome?
    b. Which risk dimension does this risk factor belong to (e.g. technical, political, cultural)?
    c. Which SDLC phase is this factor most significant in? Can you describe your rationale?
    d. Which stakeholder is accountable for this risk factor? Who owns it?
    e. What is the source of this risk? Why does this risk exist?
    f. What is the response strategy against this risk factor? Specifically, do you 1) Avoid, 2) Accept, 3) Transfer, or 4) Mitigate this risk factor? Does your team have any other response strategy against it? What is a possible risk for this risk response (i.e., secondary risk)?
3. How important is it to encourage multi-stakeholder engagement and collaboration to fully understand risks from all perspectives?
    a. Why don't some organizations engage their stakeholders to encourage collaboration? How can we close this gap?

   b. How does your team engage stakeholders and encourage collaboration?
   c. On the scale of 1-10 (10 being the highest), how do you rate your team's multi-stakeholder engagement and collaboration practices?
4. How important is it to facilitate risk communication between the stakeholders?
   a. Why don't some organizations facilitate risk communication between stakeholders? How can we close this gap?
   b. How does your team communicate risks between stakeholders?
   c. On the scale of 1-10 (10 being the highest), how do you rate your team's risk communication practices?
5. Do you have anyone you can refer me to for the purpose of continuing this research?
   a. Name, Organization, Position, E-Mail, Phone Number

Appendix B: Demographic and Project Questionnaires

DEMOGRAPHIC CHARACTERISTICS		
Gender	Male	☐
	Female	☐
Age	18-29	☐
	30-39	☐
	40-49	☐
	50-59	☐
	60+	☐
Highest Education Degree	High School	☐
	Bachelors or Equivalent	☐
	Post-Graduate Diploma	☐
	Masters or Equivalent	☐
	Ph.D or Equivalent	☐
Professional Background	Project Manager or Equivalent	☐
	Director or Equivalent	☐
Years of Experience in the Health Care Industry		
Number of Major eHealth Projects Overseen/Managed		

PROJECT CHARACTERISTICS	**EXAMPLES**
System Solution	EHR, EMR, CIS, or Data Warehouse
Solution Provider	In-House or Vendor
Purpose and Outcome	Objectives and Goals
Type of Solution	Standalone, Sub-Component, or Integrated
Solution Network	Regional, Provincial, or National
Network Size	Number of Involved Organizations
Targeted Organizations	Clinics or Hospitals
Number of Users	Number of System Users
Targeted Users	General Practitioners or Specialists
Project Length	Number of Months
Total Budget	Canadian Dollars
Contingency Reserve Fund	Yes or No; Canadian Dollars
Source of Resource	Government Funding or Grants

Appendix C: Recruitment Email

My name is Rand B. Park and I have been referred to you by [Insert Name] from [Insert Organization].

I am inviting you to participate in a study entitled "Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers." This research is being conducted as part of the requirements for a degree in Master of Science (School of Health Information Science, University of Victoria).

The objective of this research is to explore and compare the unique perspectives held by stakeholders (i.e., directors and project managers) on issues regarding risks associated with eHealth development projects. Specifically, this research aims to answer the following question: Do directors and project managers who are involved in eHealth projects identify, categorize, and prioritize risk factors differently? For further information regarding this research, please review the consent form attached for your reference.

As your participation is completely voluntary, you have the option to withdraw at anytime without any consequence or explanation. However, if you decide to participate until the end of this research, you will be provided with the research summary (e.g. the final list of ranked risk factors). The hope is to benefit you, the participant, by raising risk awareness to further advance your project risk communication and collaboration practices.

To participate in this research, I require the following conditions from participants:

- Be able to read, write, and speak English;
- Have access to a phone and the Internet;
- Be over the age of 18 to be able to consent;
- Able to give written or verbal informed consent;
- Hold or have recently held the position of director, project manager, or equivalent within the Canadian healthcare setting;
- Responsible for the development or management of eHealth applications;
- Have basic knowledge of the Software Development Lifecycle(SDLC) and project management; and
- Have the time to commit (30-45 minutes for an interview).

If you are interested in this research and meet the above requirements, I would like to schedule a 30-45 minute interview with you. Please advise your preferred time and date with a phone number I can reach you at.

[Attach Consent Form]
Best Regards,

Rand B. Park, B.Sc. (M.Sc. candidate)

Appendix D: Recruitment Email – Modified (1)

My name is Rand B. Park and I have been referred to you by [Insert Name] from [Insert Organization].

I am inviting you to participate in a study entitled "Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers." This research is being conducted as part of the requirements for a degree in Master of Science (School of Health Information Science, University of Victoria).

The objective of this research is to explore and compare the unique perspectives held by stakeholders (i.e., directors and project managers) on issues regarding risks associated with eHealth development projects. Specifically, this research aims to answer the following question: Do directors and project managers who are involved in eHealth projects or those who have recent experience fulfilling these roles and responsibilities identify, categorize, and prioritize risk factors differently? For further information regarding this research, please review the consent form attached for your reference.

As your participation is completely voluntary, you have the option to withdraw at anytime without any consequence or explanation. However, if you decide to participate until the end of this research, you will be provided with the research summary (e.g. the final list of ranked risk factors). The hope is to benefit you, the participant, by raising risk awareness to further advance your project risk communication and collaboration practices.

To participate in this research, I require the following conditions from participants:

- Be able to read, write, and speak English;
- Have access to a phone and the Internet;
- Be over the age of 18 to be able to consent;
- Able to give written or verbal informed consent;
- Hold or have recently held the position of director, project manager, or equivalent within the Canadian healthcare setting;
- Responsible for the development or management of eHealth applications;
- Have basic knowledge of the Software Development Lifecycle(SDLC) and project management; and
- Have the time to commit (30-45 minutes for an interview).

If you are interested in this research and meet the above requirements, I would like to schedule a 30-45 minute interview with you. Please advise your preferred time and date with a phone number I can reach you at.

[Attach Consent Form]
Best Regards,

Rand B. Park, B.Sc. (M.Sc. candidate)

Appendix E: Recruitment Email – Modified (2)

My name is Rand B. Park and I have been referred to you by [Insert Name] from [Insert Organization].

I am inviting you to participate in a study entitled "Understanding Perspectives of Risk Awareness." This research is being conducted as part of the requirements for a degree in Master of Science (School of Health Information Science, University of Victoria).

The objective of this research is to explore and compare the unique perspectives held by stakeholders (e.g. directors and project managers) on issues regarding risks associated with eHealth-related projects. Specifically, this research aims to answer the following question: How do those who *oversee* eHealth-related projects (e.g. directors/executives – concerned with 'what') and those who *manage* eHealth-related projects (e.g. project managers – concerned with 'how') or those who have recent experience fulfilling these roles and responsibilities perceive and prioritize risks differently? For further information regarding this research, please review the consent form attached for your reference.

As your participation is completely voluntary, you have the option to withdraw at anytime without any consequence or explanation. However, if you decide to participate until the end of this research, you will be provided with the research summary (e.g. the final list of ranked risk factors). The hope is to benefit you, the participant, by raising risk awareness to further advance your project risk communication and collaboration practices.

To participate in this research, I require the following conditions from participants:

- Be able to read, write, and speak English;
- Have access to a phone and the Internet;
- Be over the age of 18 to be able to consent;
- Able to give written or verbal informed consent;
- Is/was responsible for *overseeing* or *managing* eHealth-related projects within the Canadian healthcare setting;
- Responsible for the development or management of eHealth-related applications;
- Have basic knowledge of the Software Development Lifecycle(SDLC) and project management; and
- Have the time to commit (45-60 minutes for an interview).

If you are interested in this research and meet the above requirements, I would like to schedule a 45 minute interview with you. Please advise your preferred time and date with a phone number I can reach you at.

[Attach Consent Form)]
Best Regards,

Rand B. Park, B.Sc. (M.Sc. candidate)

Appendix F: Follow-Up Email

Thank you very much for your interest in my research. In preparation for the interview, please review the attached documents: 1) Demographic and Project Questionnaires, 2) Semi-Structured Interview Questions, and 3) Risk Factors found in the Literature.

Although my plan is to ask you #1 and #2 during our interview session, I am including these for your reference. My intent is for you to reflect on these questions to ensure a smooth flow of conversation during our interview. Additionally, #3 is provided to help you recall risk factors and to guide our conversation. It is also used as a baseline to ensure that all participants are working from a common set of risk factors. However, it is upto you whether you want to use #3 or not. The objective of this research is to identify and understand risk factors that are important according to you, not the literature.

I look forward to speaking with you at [time] on [date/day] – [phone number]

[Attach Demographic and Project Questionnaires (#1)]
[Attach Semi-Structured Interview Questions (#2)]
[Attach Risk Factors from the Literature (#3)]

Best Regards,

Rand B. Park, B.Sc. (M.Sc. candidate)

Appendix G: Consent Form

Health Information Science
University of Victoria

Participant Consent Form

Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers

You are invited to participate in a study entitled "Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers" that is being conducted by Rand B. Park.

Rand B. Park is a graduate student in the School of Health Information Science at the University of Victoria and you may contact him if you have further questions by phone (250-658-3568) or email (randbpark@gmail.com).

As a graduate student, I am required to conduct research as part of the requirements for a degree in Master of Science. It is being conducted under the supervision of Elizabeth Borycki. You may contact my supervisor at (250) 472-5432

Purpose and Objectives
The purpose of this research project is to explore and compare the unique perspectives held by different stakeholders (i.e., directors and project managers) on issues regarding risk awareness of eHealth development projects. Specifically, this research aims to answer the following question: Do directors and project managers who are involved in eHealth projects identify, categorize, and prioritize risk factors differently?

Importance of this Research
While the importance of risk perception has been well-documented in the literature, this area of research is still in its infancy in health informatics. Yet, understanding how stakeholders perceive risks differently has great implications for the outcome of eHealth projects. For instance, if a director regards 'policy' as her #1 risk factor while a project manager regards 'education' as his first risk factor, such disagreement can result in the inappropriate allocation of resources causing schedule delays and cost overruns. This research aims to understand the size of this gap by comparing risk perspectives held by directors and project managers who are involved in eHealth development projects. The result of this research can then be used to improve risk communication and stakeholder management for eHealth development projects.

Participants Selection
You are being asked to participate in this study as you have been recommended by your peers (i.e., snowball sampling approach) and hold the position of director, project manager, or equivalent. Directors and project managers are selected in this research as they represent two of the most involved stakeholders in the development of eHealth

applications. As a result, they possess valuable insight regarding risks associated with eHealth development.

What is involved

If you agree to voluntarily participate in this research, your participation will include the following:

- **Procedure:**
    a. An invitation to participate will be sent to you via email. If your interest is expressed, a follow-up email will be sent to confirm the interview.
    b. The researcher will read and explain the consent form to you at the beginning of the interview. Once consent is obtained in person or over the phone, the researcher will then obtain your demographic and project information prior to beginning the semi-structured interview.
    c. Semi-structured interviews will be conducted via in-person or phone interviews depending on your location. Here, an audio recording device will be used to record the interview. The recording will then be transcribed for the purpose of data analysis.
- **Duration:** Approximately 30-45 minutes of your time is required.
- **Location:** In the case of in-person interview, participation will take place at your workplace. In the case of phone interview, the researcher will call from UVic classroom or his private residence to your workplace.

Inconvenience

Participation in this study may cause some inconvenience to you, including time devoted to the research (i.e., 30-45 minutes of your time for the interview).

Risks

There are some potential risks to you by participating in this research. Specifically, you may experience some emotional discomfort when recalling risk factors that significantly influenced the outcome of your previous project(s). To prevent or to deal with this issue, you are reminded that you do not have to answer any questions you feel uncomfortable answering.

Benefits

The potential benefits of your participation in this research include the following:

- **To Participants:** This research serves as a ground for collaboration to discuss the importance of each risk factor that can significantly influence the outcome of eHealth development projects. Thus, by participating in this research, you will understand which risk factors are important to your peers and other stakeholders. By understanding where your risk perception lies in comparison with the other members and groups, you will be more informed to make better decisions.
- **To Society:** As this research encourages the collaboration of risk management efforts between directors and project managers, it has the potential to increase the success rate of eHealth development projects. This means less tax dollars being wasted on failed eHealth projects and more health management applications being available and accessible for the public to use.

- **To the State of Knowledge:** As far as the researcher is aware of, there is no research that studies different perspectives of risk awareness held by directors and project managers in the health informatics literature. Thus, this research aims to fill this literature gap in the area of risk management and stakeholder management.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study, your data will not be used in the analysis and will be destroyed.

Anonymity
There are limits on how your anonymity can be protected due to the nature of Snowball Sampling approach. Specifically, those who recommended you will know who you are. However, your identity will be completely masked from other participants and the public by using pseudonyms and changing other identifying information and features during transcription of the interview.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected by using pseudonyms and changing other identifying information and features during transcription of the interview. Additionally, all the collected data will be coded, aggregated, and summarized into a single list that represents the group perspective rather than individual perspectives. While the researcher will need to associate responses and other data to you, no one else will be able to make this association (i.e., who said what). All files (e.g. audio recordings, transcripts, and coded data) will be encrypted and password protected using software called TrueCrypt. All files will also be stored on a password-protected computer. All paper printouts will be stored in a locked cabinet.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways:

- Thesis/Dissertation/Class presentation;
- Presentations at scholarly meetings;
- Internet or websites;
- Published article, chapter or book;
- Media; and
- Directly to participants and/or groups involved:
    - A summary of this research (e.g. the final list of ranked risk factors) will be sent to all participants so that they can compare their own perspectives with that of their peers and other stakeholders. This will benefit the participants by raising risk awareness and enhancing risk communication and collaboration practices.

Disposal of Data

The encrypted data from this study will be disposed of 5 years after the study has been completed. After 5 years, the method for destroying data is to delete the encrypted data as they are and to shred all paper forms and documents.

Contacts

Individuals that may be contacted regarding this study include the following:

- **Researcher:**
  - Rand B. Park ,Graduate Student, School of Health Information Science, University of Victoria, (250) 658-3568, randbpark@gmail.com
- **Supervisor:**
  - Elizabeth Borycki, School of Health Information Science, University of Victoria, (250) 472-5432, emb@uvic.ca
- **Thesis Committee Member:**
  - Andre Kushniruk, School of Health Information Science, University of Victoria, (250) 472-5132, andrek@uvic.ca

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

Name of Participant	*Signature*	*Date*

If a verbal consent is obtained from the participant:

Name of Participant	*Signature of Witness of Verbal Consent*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix H: Consent Form – Modified (1)

Health Information Science
University of Victoria

Participant Consent Form

Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers

You are invited to participate in a study entitled "Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers" that is being conducted by Rand B. Park.

Rand B. Park is a graduate student in the School of Health Information Science at the University of Victoria and you may contact him if you have further questions by phone (250-658-3568) or email (randbpark@gmail.com).

As a graduate student, I am required to conduct research as part of the requirements for a degree in Master of Science. It is being conducted under the supervision of Elizabeth Borycki. You may contact my supervisor at (250) 472-5432

Purpose and Objectives
The purpose of this research project is to explore and compare the unique perspectives held by different stakeholders (i.e., directors and project managers) on issues regarding risk awareness of eHealth development projects. Specifically, this research aims to answer the following question: Do directors and project managers who are involved in eHealth projects or those who have recent experience fulfilling these roles and responsibilities identify, categorize, and prioritize risk factors differently?

Importance of this Research
While the importance of risk perception has been well-documented in the literature, this area of research is still in its infancy in health informatics. Yet, understanding how stakeholders perceive risks differently has great implications for the outcome of eHealth projects. For instance, if a director regards 'policy' as her #1 risk factor while a project manager regards 'education' as his first risk factor, such disagreement can result in the inappropriate allocation of resources causing schedule delays and cost overruns. This research aims to understand the size of this gap by comparing risk perspectives held by directors and project managers who are involved in eHealth development projects or those who have recent experience fulfilling these roles and responsibilities. The result of this research can then be used to improve risk communication and stakeholder management for eHealth development projects.

Participants Selection
You are being asked to participate in this study as you have been recommended by your peers (i.e., snowball sampling approach) and hold or have recently held the position of director, project manager, or equivalent. Directors and project managers are selected in this research as they represent two of the most involved stakeholders in the development

of eHealth applications. As a result, they possess valuable insight regarding risks associated with eHealth development.

What is involved

If you agree to voluntarily participate in this research, your participation will include the following:

- **Procedure:**
    d. An invitation to participate will be sent to you via email. If your interest is expressed, a follow-up email will be sent to confirm the interview.
    e. The researcher will read and explain the consent form to you at the beginning of the interview. Once consent is obtained in person or over the phone, the researcher will then obtain your demographic and project information prior to beginning the semi-structured interview.
    f. Semi-structured interviews will be conducted via in-person or phone interviews depending on your location. Here, an audio recording device will be used to record the interview. The recording will then be transcribed for the purpose of data analysis.
- **Duration:** Approximately 30-45 minutes of your time is required.
- **Location:** In the case of in-person interview, participation will take place at your workplace. In the case of phone interview, the researcher will call from UVic classroom or his private residence to your workplace.

Inconvenience

Participation in this study may cause some inconvenience to you, including time devoted to the research (i.e., 30-45 minutes of your time for the interview).

Risks

There are some potential risks to you by participating in this research. Specifically, you may experience some emotional discomfort when recalling risk factors that significantly influenced the outcome of your previous project(s). To prevent or to deal with this issue, you are reminded that you do not have to answer any questions you feel uncomfortable answering.

Benefits

The potential benefits of your participation in this research include the following:

- **To Participants:** This research serves as a ground for collaboration to discuss the importance of each risk factor that can significantly influence the outcome of eHealth development projects. Thus, by participating in this research, you will understand which risk factors are important to your peers and other stakeholders. By understanding where your risk perception lies in comparison with the other members and groups, you will be more informed to make better decisions.
- **To Society:** As this research encourages the collaboration of risk management efforts between directors and project managers, it has the potential to increase the success rate of eHealth development projects. This means less tax dollars being wasted on failed eHealth projects and more health management applications being available and accessible for the public to use.

- **To the State of Knowledge:** As far as the researcher is aware of, there is no research that studies different perspectives of risk awareness held by directors and project managers in the health informatics literature. Thus, this research aims to fill this literature gap in the area of risk management and stakeholder management.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study, your data will not be used in the analysis and will be destroyed.

Anonymity
There are limits on how your anonymity can be protected due to the nature of Snowball Sampling approach. Specifically, those who recommended you will know who you are. However, your identity will be completely masked from other participants and the public by using pseudonyms and changing other identifying information and features during transcription of the interview.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected by using pseudonyms and changing other identifying information and features during transcription of the interview. Additionally, all the collected data will be coded, aggregated, and summarized into a single list that represents the group perspective rather than individual perspectives. While the researcher will need to associate responses and other data to you, no one else will be able to make this association (i.e., who said what). All files (e.g. audio recordings, transcripts, and coded data) will be encrypted and password protected using software called TrueCrypt. All files will also be stored on a password-protected computer. All paper printouts will be stored in a locked cabinet.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways:

- Thesis/Dissertation/Class presentation;
- Presentations at scholarly meetings;
- Internet or websites;
- Published article, chapter or book;
- Media; and
- Directly to participants and/or groups involved:
    - A summary of this research (e.g. the final list of ranked risk factors) will be sent to all participants so that they can compare their own perspectives with that of their peers and other stakeholders. This will benefit the participants by raising risk awareness and enhancing risk communication and collaboration practices.

Disposal of Data

The encrypted data from this study will be disposed of 5 years after the study has been completed. After 5 years, the method for destroying data is to delete the encrypted data as they are and to shred all paper forms and documents.

Contacts

Individuals that may be contacted regarding this study include the following:

- **Researcher:**
  - Rand B. Park ,Graduate Student, School of Health Information Science, University of Victoria, (250) 658-3568, randbpark@gmail.com
- **Supervisor:**
  - Elizabeth Borycki, School of Health Information Science, University of Victoria, (250) 472-5432, emb@uvic.ca
- **Thesis Committee Member:**
  - Andre Kushniruk, School of Health Information Science, University of Victoria, (250) 472-5132, andrek@uvic.ca

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

_____	_____	_____
Name of Participant	*Signature*	*Date*

If a verbal consent is obtained from the participant:

_____	_____	_____
Name of Participant	*Signature of Witness of Verbal Consent*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix I: Consent Form – Modified (2)

Health Information Science
University of Victoria

Participant Consent Form

Understanding Perspectives of Risk Awareness

You are invited to participate in a research study entitled "Understanding Perspectives of Risk Awareness" that is being conducted by Rand B. Park.

Rand B. Park is a graduate student in the School of Health Information Science at the University of Victoria and you may contact him if you have further questions by phone (250-658-3568) or email (randbpark@gmail.com).

As a graduate student, I am required to conduct research as part of the requirements for a degree in Master of Science. It is being conducted under the supervision of Elizabeth Borycki. You may contact my supervisor at (250) 472-5432

Purpose and Objectives
The purpose of this research project is to explore and compare the unique perspectives held by different stakeholders (e.g. directors and project managers) on issues regarding risk awareness of eHealth-related projects. Specifically, this research aims to answer the following question: How do those who *oversee* eHealth-related projects (e.g. directors/executives – concerned with the question 'what') and those who *manage* eHealth-related projects (e.g. project managers – concerned with the question 'how') or those who have recent experience fulfilling these roles and responsibilities perceive and prioritize risks differently? This research also aims to explore and understand the role of risk communication and multi-stakeholder engagement and collaboration on improving risk management practices and vice versa.

Importance of this Research
While the importance of risk perception has been well-documented in the literature, this area of research is still in its infancy in health informatics. Yet, understanding how stakeholders perceive risks differently has great implications for the outcome of eHealth-related projects. For instance, if a director regards 'policy' as her #1 risk factor while a project manager regards 'education' as his first risk factor, such disagreement can result in inappropriate allocation of resources causing schedule delays and cost overruns. This research aims to understand the size of this gap by exploring and comparing the risk perspectives held by those who *oversee* and *manage* eHealth-related projects or those who have recent experience fulfilling these roles and responsibilities. The result of this research can then be used to improve risk communication and stakeholder management for eHealth-related projects and vice versa.

Participants Selection

You are asked to participate in this study as you (1) have been recommended by your peers (i.e., snowball sampling approach), (2) are part of the alumni or graduate student listserv, or (3) have your contact information listed in the public domain, and are/were responsible for *overseeing* or *managing* eHealth-related projects in Canada. Executives, directors, project managers, consultants, and analysts are among many who are being selected and recruited in this research as they possess valuable insight regarding risks associated with eHealth-related projects.

What is Involved

If you agree to voluntarily participate in this research, your participation will include the following:

- **Procedure:**
    g. An invitation to participate will be sent to you via email. If your interest is expressed, a follow-up email will be sent to confirm the interview.
    h. The researcher will read and explain the consent form to you at the beginning of the interview. Once consent is obtained in person or over the phone, the researcher will then obtain your demographic and project information prior to beginning the semi-structured interview.
    i. Semi-structured interviews will be conducted via in-person or phone interviews depending on your location. Here, an audio recording device will be used to record the interview. The recording will then be transcribed for the purpose of data analysis.
- **Duration:** Approximately 45-60 minutes of your time is required.
- **Location:** In the case of in-person interview, participation will take place at your workplace. In the case of phone interview, the researcher will call from UVic classroom or his private residence to your workplace.

Inconvenience

Participation in this study may cause some inconvenience to you, including time devoted to the research (i.e., 45-60 minutes of your time for the interview).

Risks

There are some potential risks to you by participating in this research. Specifically, you may experience some emotional discomfort when recalling risk factors that significantly influenced the outcome of your previous project(s). To prevent or to deal with this issue, you are reminded that you do not have to answer any questions you feel uncomfortable answering.

Benefits

The potential benefits of your participation in this research include the following:

- **To Participants:** This research serves as a ground for collaboration to discuss the importance of each risk factor that can significantly influence the outcome of eHealth-related projects in Canada. Thus, by participating in this research, you will understand which risk factors are important to your peers and other stakeholders. By understanding where your risk perception lies in comparison

with the other members and groups, you will be more informed to make better decisions.

- **To Society:** As this research encourages the collaboration of risk management efforts between those who *oversee* and *manage* eHealth-related projects, it has the potential to increase the success rate of eHealth-related projects in Canada. This means less tax dollars being wasted on failed eHealth-related projects and more health management applications being available and accessible for the public to use.
- **To the State of Knowledge:** As far as the researcher is aware of, there is no research that studies different perspectives of risk awareness held by those who *oversee* and *manage* (past and present) eHealth-related projects in the health informatics literature. Thus, this research aims to fill this literature gap in the area of risk management and stakeholder management.

Voluntary Participation

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study, your data will not be used in the analysis and will be destroyed.

Anonymity

There are limits on how your anonymity can be protected due to the nature of Snowball Sampling approach. Specifically, those who recommended you will know who you are. However, your identity will be completely masked from other participants and the public by using pseudonyms and changing other identifying information and features during transcription of the interview.

Confidentiality

Your confidentiality and the confidentiality of the data will be protected by using pseudonyms and changing other identifying information and features during transcription of the interview. Additionally, all the collected data will be coded, aggregated, and summarized into a single list that represents the group perspective rather than individual perspectives. While the researcher will need to associate responses and other data to you, no one else will be able to make this association (i.e., who said what). All files (e.g. audio recordings, transcripts, and coded data) will be encrypted and password protected using software such as TrueCrypt. All files will also be stored on a password-protected computer. All paper printouts will be stored in a locked cabinet.

Dissemination of Results

It is anticipated that the results of this study will be shared with others in the following ways:

- Thesis/Dissertation/Class presentation;
- Presentations at scholarly meetings;
- Internet or websites;
- Published article, chapter or book;
- Media; and

- Directly to participants and/or groups involved:
    - A summary of this research (e.g. the final list of ranked risk factors) will be sent to all participants so that they can compare their own perspectives with that of their peers and other stakeholders. This will benefit the participants by raising risk awareness and enhancing risk communication and collaboration practices.

Disposal of Data

The encrypted data from this study will be disposed of 5 years after the study has been completed. After 5 years, the method for destroying data is to delete the encrypted data as they are and to shred all paper forms and documents.

Contacts

Individuals that may be contacted regarding this study include the following:

- **Researcher:**
    - Rand B. Park ,Graduate Student, School of Health Information Science, University of Victoria, (250) 658-3568, randbpark@gmail.com
- **Supervisor:**
    - Elizabeth Borycki, School of Health Information Science, University of Victoria, (250) 472-5432, emb@uvic.ca
- **Thesis Committee Member:**
    - Andre Kushniruk, School of Health Information Science, University of Victoria, (250) 472-5132, andrek@uvic.ca

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

_____	_____	_____
Name of Participant	*Signature*	*Date*

If a verbal consent is obtained from the participant:

_____	_____	_____
Name of Participant	*Signature of Witness of Verbal Consent*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix J: Verbal Consent Script

1. A Consent Form was provided to you in my previous email. Have you had a chance to read and understand it?
    a. If yes, move to step 2.
    b. If no, read the consent form to him or her prior to collecting any data. Move to step 2.
2. Do you have any questions regarding the consent form or my research?
    a. If yes, answer any questions he or she may have. Move to step 3.
    b. If no, move to step 3.
3. May I obtain your verbal consent for your participation in my research? May I have your approval to sign the consent form on your behalf?
    a. If yes, sign it on his or her behalf and start data collection.
    b. If no, explain that this research cannot proceed without his or her verbal consent. If still no, then terminate the session.

Appendix K: Certificate of Approval (Ethics)

University of Victoria

Human Research Ethics Board

Certificate of Approval

PRINCIPAL INVESTIGATOR:	**Byunguk (Randon) Park**	**ETHICS PROTOCOL NUMBER:**	**11-312**
UVic STATUS:	**Master's Student**	ORIGINAL APPROVAL DATE:	08-Aug-11
UVic DEPARTMENT:	**HEIS**	APPROVED ON:	08-Aug-11
SUPERVISOR:	**Elizabeth Borycki**	APPROVAL EXPIRY DATE:	07-Aug-12

PROJECT TITLE: **Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers**

RESEARCH TEAM MEMBERS: Andre Kushniruk, Thesis Committee Member (UVic)

DECLARED PROJECT FUNDING: **None**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations involving Human Participants.

[redacted]

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 08-Aug-11

11-312 Park, Byunguk (Randon)

Appendix L: Approval of Request for Modification (1)

University of Victoria

Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria British Columbia V8W 2Y2 Canada
Tel 250-472-4545, Fax 250-721-8960
Email ethics@uvic.ca Web www.research.uvic.ca

Modification of an Approved Protocol

PRINCIPAL INVESTIGATOR:	Byunguk (Randon) Park	ETHICS PROTOCOL NUMBER:	11-312
UVic STATUS:	Master's Student	ORIGINAL APPROVAL DATE:	08-Aug-11
UVic DEPARTMENT:	HEIS	MODIFIED ON:	23-Sep-11
SUPERVISOR:	Elizabeth Borycki	APPROVAL EXPIRY DATE:	07-Aug-12

PROJECT TITLE: **Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers**

RESEARCH TEAM MEMBERS: Andre Kushniruk, Thesis Committee Member (UVic)

DECLARED PROJECT FUNDING: **None**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

[redacted]

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 23-Sep-11

11-312 Park, Byunguk (Randon)

Appendix M: Approval of Request for Modification (2)

University of Victoria

Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria British Columbia V8W 2Y2 Canada
Tel 250-472-4545, Fax 250-472-4089
Email ethics@uvic.ca Web www.research.uvic.ca

Modification of an Approved Protocol

PRINCIPAL INVESTIGATOR	Byunguk (Randon) Park	ETHICS PROTOCOL NUMBER	11-312
UVic STATUS:	Master's Student	ORIGINAL APPROVAL DATE:	08-Aug-11
UVic DEPARTMENT:	HEIS	MODIFIED ON:	01-Dec-11
SUPERVISOR:	Elizabeth Borycki	APPROVAL EXPIRY DATE:	07-Aug-12

PROJECT TITLE: **Understanding Perspectives of Risk Awareness**

RESEARCH TEAM MEMBERS: Andre Kushniruk, Thesis Committee Member (UVic)

DECLARED PROJECT FUNDING: **None**

ADDITIONAL COMMENTS: Previous Title: 'Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers'

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

[redacted]

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 01-Dec-11

11-312 Park, Byunguk (Randon)

Appendix N: Certificate of Renewed Approval (1)

University of Victoria

Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria, British Columbia, V8W 2Y2, Canada
Tel 250-472-4545, Fax 250-721-8960
Email ethics@uvic.ca Web www.research.uvic.ca

Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR:	Byunguk Randon Park	ETHICS PROTOCOL NUMBER	11-312
UVic STATUS:	Master's Student	ORIGINAL APPROVAL DATE:	08-Aug-11
UVic DEPARTMENT:	HEIS	RENEWED ON:	08-Aug-12
SUPERVISOR:	Elizabeth Borycki	APPROVAL EXPIRY DATE:	07-Aug-13

PROJECT TITLE: **Understanding Perspectives of Risk Awareness**

RESEARCH TEAM MEMBERS: Andre Kushniruk, Thesis Committee Member (UVic)

DECLARED PROJECT FUNDING: **None**

ADDITIONAL COMMENTS: Previous Title: 'Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers'

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

[redacted]

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 08-Aug-12

11-312 Park, Byunguk Randon

Appendix O: Certificate of Renewed Approval (2)

University of Victoria

Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria British Columbia V8W 2Y2 Canada
Tel 250-472-4545, Fax 250-721-8960
Email ethics@uvic.ca Web www.research.uvic.ca

Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR:	Byunguk Randon Park	ETHICS PROTOCOL NUMBER Minimal Risk - Delegated	11-312
UVic STATUS:	Master's Student	ORIGINAL APPROVAL DATE:	08-Aug-11
UVic DEPARTMENT:	HEIS	RENEWED ON:	05-Jul-13
SUPERVISOR:	Elizabeth Borycki	APPROVAL EXPIRY DATE:	07-Aug-14

PROJECT TITLE: **Understanding Perspectives of Risk Awareness**

RESEARCH TEAM MEMBERS: Andre Kushniruk, Thesis Committee Member (UVic)

DECLARED PROJECT FUNDING: **None**

ADDITIONAL COMMENTS: Previous Title: 'Comparing the Perspectives of Risk Awareness: Directors vs. Project Managers'

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

[redacted]

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 05-Jul-13

11-312 Park, Byunguk Randon