MULTI-LEVEL FACTORS INFLUENCE THE IMPLEMENTATION AND USE OF COMPLEX INNOVATIONS IN CANCER CARE: A MULTIPLE CASE STUDY OF SYNOPTIC REPORTING IN NOVA SCOTIA

by

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ABSTRACT

Background: Moving knowledge into healthcare practice and the implementation of innovations in healthcare organizations remain significant challenges. The objective of this study was to examine the key interpersonal-, organizational-, and system-level factors that influenced the implementation and use of an innovation – synoptic reporting tools – in three specific cases of cancer care.

Methods: Using case study methodology, this study examined three cases in Nova Scotia, Canada, wherein synoptic reporting tools were implemented within clinical departments/programs. Three theoretical perspectives guided the design, analysis, and interpretation of the study. Data were collected through semi-structured interviews with key informants across four units of analysis (individual user, implementation team, organization, and larger system), document analysis, nonparticipant observation, and examination/use of the synoptic reporting tools. Analysis involved production of case histories, an in-depth analysis of each case, and a cross-case analysis.

Results: Numerous factors – which existed at multiple levels of the system and which were often related – were important to the implementation and use of synoptic reporting tools. The cross case analysis revealed five common factors that were particularly influential to implementation and use across the three cases studied: stakeholder involvement, managing the change process, administrative and managerial support, the presence of clinical champions, and attributes of the tools themselves. Key factors distinct to one or two of the cases were: implementation approach, project management, resources, culture, leadership, monitoring and feedback mechanisms, and components of the healthcare system (e.g., care delivery structures, system infrastructure, and socio-historical context). The analyses suggested that several contextual factors, including the timing of implementation and technical requirements of the tool, contributed to the differences across cases.

Discussion: This study contributes to our knowledge base on the multi-level factors, and the relationships amongst factors in specific contexts, that influence implementation and use of innovations such as synoptic reporting tools in health care. Importantly, the findings add to our understanding of several important issues that are under-developed in the existing literature in this area: organizational management; healthcare system components; interpersonal aspects of implementation, including stakeholder involvement; and the complex nature of implementation processes.

LIST OF ABBREVIATIONS AND SYMBOLS USED

BI-RADS	Breast Imaging Reporting and Data System
CAG	Canadian Association of Gastroenterologists
CAR	Canadian Association of Radiologists
CBCF	Canadian Breast Cancer Foundation
CBCSD	Canadian Breast Cancer Screening Database
CCNS	Cancer Care Nova Scotia
CCPP	Colon Cancer Prevention Program
CHI	Canada Health Infoway
CIHR	Canadian Institutes of Health Research
CME	Continuing medical education
CORI	Clinical Outcomes Research Initiative
CPAC	Canadian Partnership Against Cancer
CRC	Colorectal cancer
CSA	Cancer Surgery Alberta
CSM	Case study methodology
CSWG	Cancer Surgery Working Group
DHA	District Health Authority
DoHW	Department of Health and Wellness
DRS	Diagnostic Reporting System
EMR	Electronic medical record
FIT	Fecal immunochemical test
FOIPOP	Freedom of Information and Protection of Privacy Act

GRS	Global Rating Scale
HI	Halifax Infirmary
HITS-NS	Health Information Technology Services Program of Nova Scotia
IP&Ps	Implementation policies and practices
IT	Information technology
IWK	IWK Health Centre
KT	Knowledge translation
KTE	Knowledge translation and exchange
MIS	Mammography Information System
NCCSN	National Colorectal Cancer Screening Network
NSAR	Nova Scotia Association of Radiologists
NSBSP	Nova Scotia Breast Screening Program
PARiHS	Promoting Action on Research Implementation in Health Services framework
PHAC	Public Health Agency of Canada
PIPEDA	Personal Information Protection and Electronic Documents Act
QEII HSC	Queen Elizabeth II Health Sciences Centre
RCT	Randomized controlled trial
SRT	Synoptic reporting tool
SRTP	Synoptic Reporting Tools Project [*national pilot project*]
SSRTP	Surgical Synoptic Reporting Tools Project [*provincial pilot project*]
VG	Victoria General
WebSMR	Web-based Surgical Medical Record

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time Mommy spent in school, I sincerely hope this experience has taught her similar values. Finally, I must thank the newest addition to our family, Victoria, who came along approximately one week after finishing this dissertation. Not only am I incredibly grateful for her relaxed temperament as I prepared for the oral defense, but also the fresh perspective and enjoyable diversion she provided down the 'home stretch.'

CHAPTER 1: INTRODUCTION

The first chapter of this dissertation is the Introduction Chapter and is comprised of two sub-chapters.

Chapter 1.1 frames the issue of moving knowledge into practice, introduces the reader to the current study, and provides the reader with context in terms of the researcher's decisions related to study design and the researcher's relationship to the cases studied.

Chapter 1.2 is a manuscript, accepted for publication in *The Journal of Continuing Education in the Health Professions*, which discusses two of the theoretical perspectives used to inform this study and demonstrates how each may be applied to understand and study innovation implementation in cancer care.

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Chapter 1.1. Background and Introduction to Study

BACKGROUND

Moving Knowledge into Healthcare Practice

Much empirical work has demonstrated a gap between what is identified as 'best practice' (as determined by scientific evidence, largely acquired via randomized controlled trials) and what actually happens in clinical care [1-3]. This *knowledge-practice gap* has led an increasing number of researchers to study how knowledge is applied in practice and whether there are particular conditions, approaches, or strategies that can optimize the use of knowledge or evidence in healthcare practice (from clinical 'frontline' care to policy-making). In Canada, this emerging scientific field is commonly referred to as knowledge translation, though many terms exist, across disciplines and jurisdictions, to describe the process of putting knowledge into practice [4]. Despite this growing area of research, however, moving knowledge into practice continues to be a slow, complex, and poorly understood process [5-7].

The integration of knowledge into practice involves multiple components, including its synthesis, dissemination/transfer, adoption, application, implementation, and sustained use. Most strategies aimed at increasing the adoption and use of knowledge in clinical practice, and thus modifying the behaviour of health professionals, fall within the realm of individual-level interventions [8-11]. These strategies tend to involve single interventions or variable combinations of single interventions, such as the dissemination of printed materials, educational sessions, educational outreach, opinion leaders, audit and feedback, patient-mediated triggers, and reminder systems. The target of these interventions is typically the "autonomous" individual clinician [6]; that is, the targeted

individuals are presumed to be generally independent in their capacity to assemble knowledge and subsequently apply that knowledge to modify their practices [12]. The dominant viewpoint, presented in many models meant to explain the processes of transferring and applying knowledge in practice, is generally that experts develop knowledge, change agents receive the knowledge and adapt to the situation, and individual users are influenced by these leaders to use the new knowledge in their practices [4, 13-16].

As several researchers have recently emphasized [17, 18], this is a simplistic view of the knowledge to practice process. In reality, the process of moving knowledge into practice is dynamic, non-linear, and highly contingent on contextual factors [19-27]. For example, the *setting* in which an innovation is implemented (e.g., the department, hospital, and/or healthcare system), the *timing* and duration of implementation and the cultural, economic, and socio-political climate during that particular period of time, and the *actors* (or individuals) involved may all affect whether, and the extent to which, new ideas and tools are implemented in clinical practice. Indeed, the same strategy or intervention often results in varying degrees of effectiveness when applied in different settings and situations [28-32]. Systematic reviews [9, 10, 33-36] on the movement of scientific evidence into clinical practice have underscored this variability, being unable to demonstrate which strategies work best (or even consistently) across clinical settings. These findings highlight at least two salient issues: one, we need an improved understanding of the contexts in which these interventions are implemented and of how important contextual factors influence the intervention and outcome(s); and two, it may be unrealistic to simply measure whether particular strategies are effective at moving

knowledge into practice, but rather, effective *at what* and *under which conditions* may be the more appropriate measurement questions [37].

While individual-level interventions are important to increasing efficiency and quality in the delivery of care, these interventions alone cannot achieve these objectives [18, 29, 38-42]. Many organizational, socio-political, and economic factors can affect whether individuals in clinical settings actually make changes in their practice [6, 18, 22, 39]. For example, much research has demonstrated the importance of organizational factors – a learning- and values-oriented culture, effective leadership, senior management support, appropriate monitoring and feedback mechanisms, and the presence of champions – to the movement of knowledge into healthcare practice [6, 23, 43-55]. Healthcare systems are comprised of several defining features, including the range and diversity of stakeholders, professional autonomy of many of its staff, and complex governance, resourcing, and regulatory arrangements, that impact organizational and clinical activities [56, 57]. Empirical study at the individual and broader (e.g., organization, system) levels is complementary and necessary to narrow the knowledge-practice gap and successfully change clinical practice [8, 11, 39, 40].

As the delivery of care becomes increasingly multidisciplinary and technologically advanced, the introduction of new knowledge and practices are increasingly becoming *collective* endeavors. That is, many new tools and practices introduced in healthcare organizations are complex and require coordinated use by many individuals and professional groups to achieve benefits [50]. Moreover, healthcare settings are characterized by high levels of interdependency and interconnectedness amongst individuals in the system [18, 56]. Thus, for many practices, individuals working

in healthcare organizations (e.g., clinicians, administrators) seldom have enough autonomy on their own to apply new knowledge and make use of new tools and technologies in their practices [18, 58, 59]. These professionals are situated in organizational relationships whereby knowledge use will ultimately be influenced by processes such as coalition building [18, 60] and rhetoric and persuasion (e.g., framing of problems, use of language/discourse to influence others) [61, 62]. The success of any knowledge to practice effort is likely dependant on the quality of the implementation and the degree of support from the organization as well as the relational aspects of the implementation process.

Recently, literature and dialogue pertaining to the multi-level influences on moving knowledge into healthcare practice have embraced ideas and concepts from social sciences (including theories of innovation, learning organizations, and complexity) and 'systems thinking' [17, 56, 63]. One advantage of these perspectives is that they move thinking from a linear, rational view of knowledge transfer and application [64] to one that is much more contextual, relational, and complex in nature. The essence of such systems thinking, for example, lies in seeing interrelationships rather than linear cause-and-effect sequences and in seeing processes of change rather than single snapshots [65]. Acknowledging the complexity of healthcare organizations means that researchers ought to consider a range of factors, at multiple levels of the system, and how they relate to one another. Researchers have begun to use systems theories to improve their understanding of the application and integration of new tools and practices across various clinical settings [26, 29, 66, 67].

This thesis research is concerned with the implementation and use of a specific innovation, as defined as a new idea, tool, or practice that an organization is using for the first time [68], in cancer care. The innovation is a tool, known as a synoptic reporting tool (SRT), for reporting findings from investigations and procedures related to cancer detection and treatment. The dominant method of reporting procedures and findings, based on traditional medical teaching, is known as narrative reporting. Although there is a spectrum of what is considered a SRT [69], contemporary SRTs generally differ from narrative reporting in at least two ways. First, today's SRTs normally require that the physician enter information about the patient, procedure, and suspected or confirmed findings using a computer rather than dictate (or narrate) information into a voice recorder or telephone system. Second, the end synoptic report presents data items in a structured manner and contains only the information necessary for patient care rather than providing a free-text descriptive account of the procedure and findings. More than two decades of research has demonstrated that SRTs consistently improve the quality of pathology [69-83] and surgery [84-87] reporting for a variety of cancers, as well as of various diagnostic investigations and procedures [88, 89], compared to narrative reporting. Like many new practices introduced in clinical care settings, the implementation and use of SRTs require changes in individuals' behaviours (i.e., physicians, organizational members who use patient reports) and in organizational structures, policies, and processes. These changes undoubtedly necessitate coordination and cooperation amongst individuals and groups working within the system.

Focusing on Implementation

The current study focuses on the implementation processes related to moving knowledge on SRTs into healthcare practice. Understanding the diffusion dynamics of innovations in organizations has a long history in management and organizational sciences. Lawrence [90] published one of the earliest studies on behavioural and attitudinal resistance to change in organizations more than 50 years ago. In an influential model of innovation diffusion, Rogers [16] has conceptualized the innovation-decision process as unfolding in distinct stages whereby an organization moves from initial awareness/knowledge of an innovation to eventually successfully integrating the innovation into ongoing processes (or, alternatively, rejecting the innovation). Despite the linear progression of his model, and the problematic nature of this linearity in real-world settings [17, 21], his description of implementation is nonetheless useful, highlighting that the implementation of new ideas and knowledge represents a potential challenge to the innovation process:

> Until the implementation stage, the innovation decision-process has been a strictly mental exercise of thinking and deciding. But implementation involves overt behavior change as the new idea is actually put into practice. It is one thing for an individual to decide to adopt a new idea, quite a different thing to put the innovation to use, as problems in exactly how to use the innovation crop up at the implementation stage (pg. 179) [16].

Thus, implementation processes are characterized by *action* and represent "the transition period during which targeted organizational members ideally become increasingly skilled, consistent, and committed in their use of an innovation" (pg. 1057) [68].

The prevailing thinking on implementation is that it represents one stage of many that innovations move through as they make their way from conception to institutionalization: i.e., new ideas are thought to progress through a series of stages such as invention/creation, testing, dissemination, adoption, implementation, and confirmation or institutionalization [16, 38, 91]. However, integrating new knowledge and ideas in real-world settings (and sustaining them there) is a complicated, long-term endeavour wherein these 'stages' often occur simultaneously and many difficulties are encountered throughout the process. Empirical research on innovation processes indicate that the linear approaches commonly presented in the literature rarely reflect what actually happens in real life: innovation processes are often messy and complex, with implementation of a new idea characterized by non-linear cycles of divergent and convergent activities, many actors engaging and disengaging over time in a variety of roles, and ongoing re-invention and re-implementation [21].

Research in the organizational sciences and management fields has demonstrated that the poor uptake of innovations is commonly a failure of the implementation process rather than of the innovation [92, 93]. As Klein and Sorra [68] observed following their extensive study of innovation implementation in manufacturing settings,

> [w]hen organizations adopt innovations, they do so with high expectations, anticipating improvements in organization productivity and performance. However, the adoption of an innovation does not ensure its implementation; adopted policies may never be put into action, and adopted technologies may sit in unopened crates on the factory floor (p. 1077).

Similarly, in health care, the important issues related to health and health system improvement may relate less to the dissemination of knowledge and decisions around its adoption, and more to its implementation [94, 95]. Indeed, the ongoing tensions between the business of healthcare and the practice of healthcare [96], the increasing specialization of practice and concurrent increase in new professional groups with their own languages, values, and objectives [97], and the multitude of resourcing and regulatory arrangements [56] mean that implementation processes in healthcare settings (or actually putting a new idea into practice) are likely much more complicated than dissemination and adoption processes. Moreover, for many innovations, i) those making the decision that it should be adopted or utilized are not directly involved in its implementation, ii) the implementation requires behaviour change by many employees, and iii) the end goal is a single outcome resulting from the interactions of multiple individuals in the system [98, 99]. Thus, the implementation of many new tools and practices in healthcare organizations will require collaboration with those expected to use the new tool or practice directly as well as many support departments (e.g., engineering services, information technology [IT], and health records), some of which may lie outside of the organization, in order to achieve the desired benefits. Navigating and managing such issues are imperative to ensuring that an innovation is actually put into routine practice.

The importance of implementation processes and their hindering and enabling influences on innovation use highlights the need to enhance and expand our study of implementation processes and how they unfold. A recent review, undertaken by the Institutes of Medicine in the United States, observed that little research has examined

innovation implementation in healthcare compared to innovation adoption [100]. Uncovering the important contextual factors should help optimize implementation in real-world settings. That the level of implementation (as measured by aspects such as fidelity [the extent to which the implemented innovation/intervention corresponds to the originally intended innovation/intervention], dosage [how much of the original innovation/intervention has been delivered], and reach [the rate of involvement or participation]) affects the outcomes achieved [101, 102] further underscores the importance of identifying and understanding the factors that affect implementation processes. In a review of the impact of implementation on outcomes in the prevention and health promotion literature, Durlak and Dupre [101] noted marked variability in the implementation of interventions and programs; 20 to 40% differences in the level of implementation achieved across providers and settings were commonly observed within the same study. Utilizing research designs and methods to more effectively study implementation will help researchers determine how strategies or interventions were executed, how outcomes should be interpreted, and the extent to which the findings are generalizable to other settings. Understanding the variability in implementation, for example, will help address important issues of implementation fidelity and adaptability [101, 103, 104], or the extent to which innovations and interventions should be implemented as originally designed or modified to meet the needs of clinicians and organizations. Given that settings often differ in important ways from those wherein an intervention was originally developed and tested, an improved understanding of such issues is vital to optimizing implementation and realizing the intended health and/or health system benefits of newly introduced tools and practices in healthcare settings.

CURRENT STUDY

This study used case study methodology to examine three specific cases of SRT implementation and use in Nova Scotia, Canada:

1. Synoptic reporting in the Nova Scotia Breast Screening Program (NSBSP);
2. Synoptic reporting in the Colon Cancer Prevention Program (CCPP); and
3. Synoptic reporting in the Surgical Synoptic Reporting Tools Project (SSRTP).

The overall aims of the research were to identify the key interpersonal, organizational, and system level factors that influenced the implementation and use of these tools in each case, and to explore the extent of and plausible explanations for commonalities and differences across cases. Appendices A-D provide a historical/contextual description of the health system in Nova Scotia and histories of each case.

Case study methodology was utilized as it permits the rigourous study of a contemporary phenomenon within its real-life context [105]. It provided a coherent and valid approach to studying the individual synoptic reporting cases in-depth, and exploring which factors were barriers or facilitators of implementation and the reasons these factors were influential (i.e., the *how* and *why* of implementation). As such, use of case study methodology allowed the researcher to "both learn about a specific social situation and also to learn from it" (pg. 6) [106]. By examining each of the cases individually and comparing similarities and differences across cases, this study contributes to our understanding of how people and organizations involved in the delivery of care introduce new knowledge and tools in practice, and whether there are specific factors we can influence (e.g., target, modify, intervene upon) to implement these changes more effectively.

Theoretical Perspectives Guiding Study

The use of theory, considered broadly as a relationship to the literature or some other substantive source [105], is particularly important in case study research. According to Yin [105], the benefit of theory development during the design phase is a stronger research design and a heightened capacity to interpret the resulting data. Simply put, the use of theory provides structure to the inquiry and analysis, and it is through theoretical ideas and concepts that the findings from the case study can be connected to the broader body of literature related to the phenomenon of interest – in this study, implementation and use of a tool in cancer care – and contribute knowledge beyond the specific case(s) studied.

Three theoretical perspectives, arising from different disciplines and situated within different bodies of knowledge, guided the design, analysis, and interpretation of this study. Two [22, 50, 51] are identified as conceptual frameworks and thus they represent organizing *mental devices* that identify variables and possible relationships that should be examined in order to understand and explain implementation [22]. Such frameworks are embedded (implicitly or explicitly) in theoretical positions, yet they do not necessarily specify the direction of relationships or identify hypotheses as theories normally do. The other theoretical perspective [17] is comprised of a series of propositions on the nature of moving new knowledge and ideas into practice, arising from a critique of social sciences, management of innovations, and systems theories literature. These theoretical perspectives (described below) were selected since, taken together, they present a broad range of interpersonal, organizational, and system level influences on practice change. Given that one theory is unlikely to fit all settings and that theory related

to moving knowledge into practice is located in many disciplines, use of multiple theoretical perspectives may be more powerful than an overarching theory for guiding the study of moving knowledge into practice [107]. In other words, it is valuable to understand and use different theoretical perspectives to navigate and improve our understanding of knowledge to practice processes in healthcare settings.

1. Promoting Action on Research Implementation in Health Services

The Promoting Action on Research Implementation in Health Services (PARiHS) framework [22, 51] arises from the nursing literature and proposes that successful implementation of research into practice is a function of the interaction between three core elements: 1) the level and nature of the evidence; 2) the context into which the research is implemented; and 3) the method by which the process is facilitated. Through concept analyses of evidence [108], context [109], and facilitation [110], the authors have provided further conceptual clarity around these three elements. In essence, the authors posit that successful implementation is more likely to occur when the following elements are present: evidence from multiple sources (research, clinical experience, patient experience, and local context); a context (setting) that exhibits a learning and values-oriented culture, effective teamwork, and receptivity to change; leadership that is transformational and employs an enabling/empowering approach to teaching, learning, and managing; performance feedback that provides multiple sources of feedback on multiple levels of performance; and a dedicated facilitator who helps organizational members understand what they have to change and how to change it.

While the constructs of the PARiHS framework are generally supported by literature in quality improvement, change management, and organizational effectiveness, as well as case study analyses in health settings [23, 51] and survey data from the Alberta Registered Nurse study [46], there is a need to test this framework prospectively. Authors of a recent synthesis of peer-reviewed PARiHS literature [111] found that no studies have used PARiHS to prospectively design implementation studies and, in the 18 studies that used PARiHS as an organizing framework for empirical analyses, there was (generally) a lack of detail about how variables were measured and then mapped to specific PARiHS elements.

2. Organizational Framework of Innovation Implementation

Helfrich and colleagues [50] adapted an organizational model on the implementation of complex innovations from the manufacturing sector [68, 112] after studying the implementation of cancer prevention and control research programs in cancer clinical research networks. Their adapted framework posits that management support is key to enacting high quality implementation policies and practices, with financial resource availability partially mediating this relationship. Implementation policies and practices refer to organizational strategies (policies) and actions (practices) to support an innovation's implementation; they may be operationalized as the number and nature of an organization's efforts to support targeted members' use of the innovation. In turn, high quality implementation policies and practices increase the probability of developing a favorable implementation climate (targeted organizational members' shared perceptions that innovation implementation and use is an organizational priority, which is supported

and rewarded) and subsequently achieving implementation effectiveness (the consistency and quality of innovation use). The implementation climate is also influenced by both innovation champions and innovation-values fit (the alignment between the users' values and the innovation). Moreover, data suggest a reinforcing feedback loop from implementation effectiveness to implementation climate: that is, indicators of implementation effectiveness, particularly early on, 'feed back' to organizational members and help create a more positive implementation climate.

3. "Systems" Thinking / Change

In a recent theoretical paper, Kitson [17] critiqued the social sciences, action sciences, diffusion of innovations, practice development, management of innovations, learning organizations, and systems theories literature to explore the underlying assumptions and theories used to describe healthcare systems and how knowledge is translated into practice. She argued that the viewpoint that health systems operate as machines and the assumption that knowledge translation is a linear, rational phenomenon have hindered our ability to advance our understanding of the complex processes that influence how new knowledge gets applied and used in practice. Using literature from social sciences and systems theories, Kitson puts forward five propositions regarding knowledge translation: 1) knowledge translation is a necessary, but insufficient, mechanism to transform healthcare systems; 2) the system-as-machine metaphor is profoundly unhelpful to our understanding of knowledge translation and to enabling new knowledge to be translated into practice; 3) the healthcare system is best viewed as a complex, interactive entity; 4) successful innovation into any system is a function of the local autonomy experienced by individuals, teams, and the unit involved in the change process; and 5) innovation is most

effective when it involves key stakeholders. Regarding the latter, stakeholders involvement is germane to four central elements: education and personal development; control of immediate physical resources; control of the immediate context; and control of the external environment. These propositions align with the thinking that innovation journeys are characterized by non-linear cycles of divergent and convergent activities [21, 65] rather than progression through a series of discrete stages [16, 38, 91].

Changes in Theoretical Perspectives

The reader should note that the theoretical perspectives changed over the course of the research. Specifically, the three theoretical perspectives discussed above informed the design, conduct, and analyses of the *final study*. Two of these perspectives – PARiHS [22, 51] and the organizational framework of innovation implementation [50] – remained consistent throughout the study. However, early in the research process, the framework for change in health service organizations [48] was also used to inform the study design. Following the pilot study, the researcher determined that this latter framework did not contribute guidance beyond the other two perspectives. Moreover, the pilot data demonstrated the importance of certain factors, which were not part of the perspectives initially drawn upon, to the implementation of surgical synoptic reporting (e.g., stakeholder engagement, flexibility with implementation). Subsequently, a "systems" thinking perspective [17] was incorporated into the study design due to its focus on the relational aspects of innovation implementation as well as the complexity of implementation processes.

As a result of these changes, there are differences in the theoretical perspectives cited in the various chapters of this dissertation. Specifically,

- In Chapter 1.2, PARiHS and the organizational framework of innovation implementation are discussed as examples to demonstrate how theoretical perspectives may be used to inform our understanding of innovation implementation.
- In Chapter 3.1, PARiHS, the organizational framework of innovation implementation, and the framework for change in health service organizations are discussed since this chapter presents the pilot study and its findings, which were informed by these three theoretical perspectives.
- All other chapters, when citing or presenting theoretical perspectives, discuss the three theoretical perspectives used to inform the final study: PARiHS, the organizational framework of innovation implementation, and "systems" thinking / change.

RESEARCHER RELATIONSHIP TO CASES

Before reading this dissertation, the researcher deems it important that the reader be aware of and understand the relationships the researcher had to the cases studied. In all cases, the researcher had an existing relationship with the case, either with some of the implementation team members within the case or with the organization within which the case was positioned.

1. NSBSP: the researcher had a limited relationship with this case having previously worked with two members of the NSBSP implementation team to acquire NSBSP data for another research study.
2. CCPP: the researcher has been a Research Associate in the Cancer Research Outcomes Program, Cancer Care Nova Scotia, since 2006. The CCPP is also a program of Cancer Care Nova Scotia, and thus the researcher worked within the

same organization. However, in the context of this study, the researcher had no prior working relationship with either member of the CCPP implementation team (in fact, the researcher had not met three of the implementation team key informants prior to contacting them for participation in this study). However, key informants were aware of the researcher's position at Cancer Care Nova Scotia.

3. For the SSRTP, the researcher has an ongoing working relationship with the project lead (e.g., co-investigators on studies, co-authors on manuscripts). She also had an existing working relationship with the project coordinator. Moreover, the researcher has been involved at the national level in surgical synoptic reporting, by working with the Canadian Partnership Against Cancer on its national evaluation and its development of surgical quality indicators.

The researcher did not have a prior relationship with most other key informants (including no relationship with any of the clinician SRT users), though she had met several informants previously through work-related meetings.

The researcher perceived that the existence of relationships with members of the implementation teams, as well as her prior knowledge of the cases and contexts, held several key benefits for this research. These included:

1. For one of the cases (and perhaps two), existing relationships likely enhanced accessibility to the case, including access to interviews with implementation team members and documents. Indeed, the leads of two cases were initially hesitant regarding participation. However, after meeting these individuals and explaining the purpose of the study, accessibility was not an issue, with the existence of a prior relationship most likely a contributing factor.

2. Existing relationships and prior knowledge of the cases likely aided in recruitment. Indeed, in two of the cases studied, only one potential participant failed to respond to the invitation (CCPP) and only one explicitly declined participation (SSRTP).
3. Familiarity with the cases, and the organizations involved in the cases, meant that the researcher could pick up on potential issues during key informant interviews, through both verbal and non-verbal cues, that might otherwise have gone unnoticed. This allowed the researcher to probe further, knowing that some issue required more questioning. Familiarity with the cases, organizations, and socio-political context also allowed the researcher to be sensitive to phrasing and dialogue around particular issues (e.g., prior or existing tension amongst individuals and/or organizations with the healthcare system).
4. Familiarity with the cases and a shared understanding of SRTs (including associated technical and clinical language) also helped the researcher build a rapport with key informants and allowed them to relay their experiences in the language that was comfortable with them, without stopping to explain key concepts and activities. In fact, the majority of key informant interviews were characterized by a personal approach, resulting in encounters that were more like conversations than structured interviews with a series of questions. The researcher's experience during data collection, and again while reviewing the audiotapes and interviews, was that most informants were at ease during the interview and comfortable with sharing their true experiences.

Despite these benefits, there were also potential disadvantages regarding the researcher's relationship to the cases. These included the risk of seeking to find data that

aligned with pre-existing ideas and perceptions and the risk of being so 'close' to the data that it became difficult to see the data in their entirety (i.e., to 'see the whole picture'). Certainly, the researcher had beliefs about the cases prior to initiating this study, with some of these beliefs corroborated in the data while others were found inaccurate. Recognizing these potential disadvantages from the beginning, the researcher was very conscious of her prior beliefs and cognizant of the need to check and question her interpretations. This meant that she continually went back and forth between her reflective notes and emerging analysis and the line-by-line data to ensure that her interpretations were grounded in the data (in addition, for each case, a document was created that linked each finding to every pertinent data source in the dataset). Additional methodological procedures that allowed the researcher to check her interpretations and enhance rigour included audiotaping interviews and using verbatim transcripts, member checking, and discussing the analytic procedures and interpretations with committee members throughout the research process.

Prior relationships with members of the implementation teams also led to the researcher feeling challenged at times during the writing of this dissertation. There was a level of discomfort and uneasiness in writing about individuals and groups with whom one works and has a relationship. Certainly, the purpose of this research was not to discover viewpoints and perceptions that might reflect poorly upon individuals or organizations involved in the cases, nor does the researcher believe this occurred. Nonetheless, key informants were extremely frank and honest about both their positive and negative experiences. This meant that writing the dissertation was challenging since the researcher did not want the way she articulated the findings to result in undue

defensive or wary reactions and thus to negatively impact on her relationships with participants of this study, or relationships between participants. To mitigate this concern, the researcher discussed the best ways to articulate several parts of the dissertation, which might be considered sensitive issues by key informants, with committee members on numerous occasions, and continually revisited the data to ensure all interpretations were clearly linked to data sources (e.g., key informants, documents) so that the credibility of the study's findings could be demonstrated if necessary.

ORGANIZATION OF DISSERTATION

This dissertation is organized into four distinct chapters plus appendices. Chapter 1 is the Introduction Chapter and is comprised of two sub-chapters. Chapter 1.1 frames the issue of moving knowledge into practice, introduces the reader to the current study, and provides the reader with context in terms of the researcher's decisions related to study's design (i.e., theoretical perspectives) and the researcher's relationship to the cases studied. Chapter 1.2 is a manuscript that discusses two of the theoretical perspectives used to inform this study (PARiHS [22, 51] and the organizational framework of innovation implementation [50]) and demonstrates how each may be applied to understand and study innovation implementation in cancer care. Two theoretical perspectives are presented to demonstrate how *different* perspectives may be used to inform our understanding. Given the aims of the manuscript, presenting and discussing a third theoretical perspective was deemed unnecessary and redundant. This manuscript is accepted for publication in the Journal of Continuing Education in the Health Professions.

Chapter 2 is the Methods Chapter and is comprised of two sub-chapters. Chapter 2.1 is a manuscript, yet to be submitted, which describes the methodology used in this study. Specifically, it provides an overview of CSM and discusses its value for research on moving knowledge into practice. Chapter 2.2 is also a manuscript, published in Implementation Science, which presents the study protocol for this study. As such, it is largely focused on the methods used in this research.

Chapter 3 is the Results Chapter and is comprised of two sub-chapters. Chapter 3.1 is a manuscript, published in Current Oncology, which presents the pilot study conducted for this research. The main aims of the pilot study were to develop, trial, and refine (where needed) components of the study design and its data collection instruments (e.g., recruitment process, interview guides, coding framework). Chapter 3.2 provides a description of the final analysis and presents the study findings.

Chapter 4 is the Discussion Chapter. It includes an in-depth discussion of the study findings and presents sub-sections related to study strengths and limitations, implications of findings, methodological considerations, knowledge translation, future research, and conclusions. Finally, numerous appendices are included to provide the reader with background information as well as methods documentation. All appendices are referred to in the relevant chapters or chapter introductions.

Due to the combined manuscript/traditional format of this dissertation, there is some repetition across chapters, particularly in terms of background information and literature. The author has attempted to minimize this for the reader, but unfortunately some repetition is required to ensure that the manuscripts are ‘standalone’ and can be

understood in their entirety. Given the dissertation format, the reader may find it helpful to keep the following 'roadmap' nearby as he/she reads it:

- Chapter 1.1: Background and Introduction to Study
- Chapter 1.2: Theoretical Perspectives (manuscript)
- Chapter 2.1: Study Methodology (manuscript, to be submitted)
- Chapter 2.2: Study Protocol (manuscript)
- Chapter 3.1: Pilot Study (manuscript)
- Chapter 3.2: Study Findings
- Chapter 4: Discussion of Study Findings

The manuscripts included in this dissertation vary with respect to status of publication from published articles to unsubmitted manuscripts. For all manuscripts, the student conceived the idea for the paper, led the intellectual development, wrote the manuscript, and revised the manuscript based on co-author input. For those manuscripts involving research studies, the student designed and conducted the study (i.e., participant recruitment, data collection, data analysis). The student also completed all manuscript revisions requested by the journal reviewers and editorial team.

As stated above, many terms exist, across disciplines and jurisdictions, to describe the process of putting knowledge into practice. For example, knowledge translation has been defined as the "iterative, timely and effective process of integrating best evidence into the routine practices of patients, practitioners, health care teams and systems" (Canadian Institutes of Health Research, as cited in Davis [113], pg. 8) while implementation research has been defined as

> the scientific study of methods to promote the systematic uptake of proven clinical treatments, practices, organisational, and management interventions into routine practice, and hence to improve health. … it includes the study of influences on patient, healthcare professional, and organisational behaviour in either healthcare or population settings. (pg. 2) [114]

Clearly, these definitions describe similar concepts. Nonetheless, is important to highlight the inconsistency in terminology given that this dissertation presents and applies literature from a broad range of disciplines and jurisdictions. Throughout the dissertation, the author has framed much of the literature and the current study in the general terms of 'moving knowledge into practice.' Still, there are specific references to knowledge translation, knowledge translation and exchange, and implementation science; unless otherwise specified, these terms are used interchangeably and all to refer to the movement of knowledge into practice. Finally, there are many acronyms, specific to the innovation and/or Nova Scotia, throughout this dissertation. To ease readability, the reader may use the List of Abbreviations and Symbols Used, provided in the opening pages, while reading the dissertation.

Chapter 1.2. Theoretical Perspectives (manuscript)

INTRODUCTION

Moving knowledge into practice and implementing innovations in health care remain significant challenges. Research in these areas has largely focused on potentially useful strategies (e.g., opinion leadership, academic detailing) for improving the uptake of evidence into practice, with the target of such strategies normally the individual clinician [6, 22]. While systematic reviews have demonstrated that many of these strategies can have small effects on measures of professional behaviour [9, 33, 115], there is wide variation in effect sizes that is not well-understood or explained. This has led many researchers to call for an increased emphasis on the conceptual and theoretical underpinnings of clinical and organizational behaviour change and a more systematic approach to the use of theory in knowledge-to-practice research [8, 9, 116]. The use of an explicit and appropriate theoretical approach may help researchers and practitioners better understand and subsequently target the factors that influence behaviour change in healthcare settings.

Much of the conceptual and theoretical work to date on moving knowledge into clinical practice has focused on adoption and uptake by individual practitioners [50], with many researchers using motivation, action, and stage theories to explain how individuals decide to change behaviour and how they move from intention to actual behaviour change [8, 12]. However, much of health care delivery occurs within complex organizational structures, with many innovations (i.e., new tools and practices) requiring coordinated use by many individuals and professional groups to achieve benefits [50]. Organizational theories propose that institutional factors, such as organizational culture

or senior management, and relationships amongst those factors influence the implementation and coordinated use of new approaches and practices by targeted organizational members. The aims of this paper are to: 1) present two conceptual frameworks for understanding the organizational factors important to the successful implementation of innovations in healthcare settings; 2) discuss each in relation to the literature; and 3) briefly demonstrate how each may be applied to three initiatives involving the implementation of synoptic reporting tools (SRTs).

SELECTING POTENTIALLY USEFUL FRAMEWORKS TO ADVANCE OUR UNDERSTANDING

A range of models and theoretical perspectives exist in the knowledge-to-practice field, with the terms 'framework,' 'theory,' and 'model' often used interchangeably [107]. However, distinctions exist amongst these terms. A framework identifies a set of factors and relationships among those factors that should be examined to understand and explain a phenomenon [22]. Thus, frameworks provide a list of variables that may be used, diagnostically or prescriptively, to analyze particular settings and their ability to absorb and adopt innovations [117]. A theory presents a denser, logically coherent set of constructs and relationships that has predictive capability and therefore may be translated into testable hypotheses to predict or explain a certain phenonemon [22, 99]. Oftentimes, a framework's constructs draw upon multiple theories. Models, however, normally depict specific situations and thus are narrower in scope than frameworks or theories [117]; examples include models of research implementation that guide individuals through the processes of transferring and applying research in practice [4, 118].

We conducted a narrative review of the literature to identify articles that discuss organizational approaches to understanding innovation implementation in healthcare. Specifically, we searched the PubMed/Medline and PsychINFO databases (using combinations of terms and phrases such as 'clinical practice guidelines', 'physician behavi*r', 'organizational theor*', 'organizational change', 'organizational culture', 'leadership', and 'quality improvement') as well as reference lists of influential papers [39, 48, 116]. The goal was to identify potentially useful frameworks to help researchers and practitioners better understand practice/organizational settings and their influence on innovation implementation.

The literature review identified numerous frameworks and models related to the organizational influences on moving knowledge into practice. Two frameworks were selected to review and consider with respect to the implementation of a specific innovation. These frameworks identify different theoretical concepts as being important to implementation. The two frameworks were: 1) Promoting Action on Research Implementation in Health Services (PARiHS) framework [22, 51] and 2) organizational framework of innovation implementation [50]. These frameworks originate in the nursing and management fields, respectively, and were selected for several reasons, including: a) they contain a limited number of constructs (compared to, for example, Greenhalgh and colleagues' model [116]) that researchers and practitioners can assess and subsequently target; b) the constructs are generalizable across a range of innovations and organizations; c) both are framed around the implementation of new tools and practices versus transforming health systems (compared to, for example, Ferlie and Shortell's framework for change [48]); and d) based on our prior understanding of the SRT implementation

initiatives, they included constructs we considered more directly relevant to these initiatives and on which there was some degree of variability across initiatives. Both frameworks are also relevant to many fields trying to optimize the transfer and use of knowledge into practice. Continuing professional development (CPD), for example, involves the acquisition of new knowledge and skills to facilitate competent practice. While encompassing self-directed learning and personal development methods, CPD also considers the organizational and system factors that influence the processes by which knowledge is applied in health professionals' practice [119, 120].

REVIEWING AND APPLYING FRAMEWORKS TO ADVANCE OUR UNDERSTANDING

We reviewed and applied two frameworks to demonstrate how different frameworks might add to one's examination and understanding of the same issue. Use of multiple theoretical perspectives can provide a depth of understanding that is greater than one single theory or framework and thus prove more valuable for guiding knowledge-to-practice processes [107]. First, we reviewed each framework, examining its constructs to gain a greater understanding of how they were conceptualized and operationalized. We then explored the connections between those constructs and the broader knowledge-to-practice, health services, and quality improvement literature. Next, we applied the frameworks' constructs to three initiatives in Nova Scotia, Canada, involving implementation of SRTs for mammography, colonoscopy, and surgery reporting in cancer care (see Table 1). They represent diverse contexts, including differences in

professional groups, mode of change, implementation support, resource characteristics, and history/timing.

SRTs capture information from tests, investigations, surgeries, and pathology examinations in a standardized manner and collect only the information necessary for patient care. These tools differ from the dominant method of reporting findings, based on traditional medical teaching, which is a physician-dictated, descriptive account of the procedure and suspected or confirmed findings. Dictated, narrative reports are poor at providing the information needed to make informed patient care decisions [70, 121, 122]. Synoptic reports, or structured abstracts using key words and phrases (not free-text sentences) to present clinically relevant elements, have been shown to greatly improve the quality of pathology reporting for colorectal [69-76], breast [69, 71, 77-79], lung [69, 80], prostate [69], pancreatic [81], melanoma [82], and hematolymphoid cancers [83], and the quality of surgical reporting for colorectal [84], breast [85], thyroid [86], and pancreatic cancers [87], as well as non-malignant operative procedures [88, 89]. Given this evidence, a growing number of international jurisdictions are moving to this method of reporting [123-127]. However, the implementation and use of SRTs require changes in physician behaviour and practice [128] and in organizational policies, structures, and processes. For example, all of the initiatives in Table 1 use electronic SRTs, meaning that physicians have to enter patient and procedural data on a computer screen (versus providing the information through a telephone dictation system). This means that processes and infrastructure must be adapted to meet the requirements of this tool, such as changing computer locations to accommodate reporting, ensuring the end report is

appropriately transferred to the patient's electronic medical record, and providing ongoing technical support processes for physicians using the systems.

Overview of Frameworks

1. Promoting Action on Research Implementation in Health Services

The first framework we examined was PARiHS [22, 51] which was initially based on the developers' collective experiences helping clinicians introduce new ideas in practice (including practice guidelines), tested using four case studies, and further developed through concept analyses of its key elements [108-110, 129]. Through the framework, the authors sought to depict some of the complexities of moving knowledge into clinical practice. The framework proposes that successful implementation of knowledge into practice is a function of the interaction between three elements: 1) the level and nature of evidence; 2) the context into which evidence is implemented; and 3) the method by which the process is facilitated. These elements are conceptualized as existing on a continuum, with high evidence, context, and facilitation driving successful implementation. For example, the likelihood of successful implementation is much less in task-driven environments wherein people feel they are not valued, roles are uncertain, leadership is poor, and there are few mechanisms to review performance (low context) than in learning- and people-centered environments where the opposite conditions exist (high context). Recently, the researchers proposed that PARiHS may also be used prospectively to develop interventions; that is, the framework may be used to assess the elements of evidence and context and then to determine the most appropriate facilitation (or intervention) method [22].

Evidence. The PARiHS framework regards *evidence* as knowledge attained from a variety of sources: 1) research evidence; 2) clinical experience (e.g., tacit knowledge); 3) knowledge from patients, clients, and carers (e.g., preferences for care, knowledge acquired through participation in planning and service delivery); and 4) local context (e.g., audit and performance data) [108]. While physicians undoubtedly use these four sources of knowledge in practice, how these sources are integrated during individual episodes of care and the degree of importance attributed to each one are largely unstudied. Indeed, research evidence is more highly valued than other sources of knowledge in the health sector [108] and the availability and acceptance of credible research evidence can be critical to gaining physicians' commitment to change their current practice [44]. Despite the value given to research evidence, however, 'credible' research evidence has no clear or agreed-upon definition. For example, physicians have questioned the significance of randomized controlled trials to practice, due to their limited applicability to everyday practice [130] and methodological concerns (e.g., too few subjects) [131]. Moreover, physicians often view clinical experience as more important than research knowledge [131].

Context. PARiHS proposes that three features of context, or the setting wherein the evidence or innovation is introduced, will influence the likelihood of successful implementation: culture, leadership, and evaluation. Culture – the deeply-embedded set of shared values and assumptions that govern how employees function and behave within organizations [132] – is increasingly recognized as an important influence on knowledge application and use in clinical settings [6, 48, 116]. In healthcare organizations, numerous

subcultures exist, across both managerial and clinical groups as well as within groups [48], and these cultures must be understood if change is to be achieved and sustained [109]. Flexible, participative cultures that support and enable learning may be key to the successful implementation of new knowledge and practices [48, 129, 133, 134].

Explicitly or implicitly, leaders reinforce the prevailing culture. Therefore, leaders must value the use of evidence in practice through their "talk" and actions [55]. Effective leaders can stimulate both improved team functioning and organizational structures [51, 129]. Many researchers have studied the nature of leadership in healthcare organizations, with general agreement that the implementation of change requires leaders to communicate the need for change, establish a vision for improvement, provide clarity about the change process, and follow through with the necessary resources and operational details [135, 136]. Not surprisingly, leaders who align an implementation project's goals with higher-level organizational goals can increase their access to financial, administrative, and evaluation resources, information technology, and training support [137].

The use of multiple methods and sources of feedback or evaluation may be key to enabling successful implementation efforts [129]. Senge [65] considers performance feedback to be central to the development of a learning organization. Wilson and Kurz [138] propose that any new tool or practice must continually demonstrate value if it is to "stick" following implementation. Their data suggest that the institutionalization of new tools and practices does not occur without continual monitoring and evaluation, regardless of the degree of support during adoption and implementation. Such evaluation

initiatives are likely to be more effective when clinicians perceive the data to be valid, reflective of current practice, and benchmarked against suitable comparison groups [44].

Facilitation. In essence, facilitation describes the process of providing support to individuals or groups to achieve an intended change [139]. Models of facilitation vary from providing practical/technical support to achieve a specific goal (task-based) to enabling individuals and teams to reflect upon and change their own attitudes, behaviours, and ways of working (holistic) [110]. The early use of facilitators to improve clinical practice primarily involved task-based approaches to improve disease prevention [140] or implement clinical audit processes [141]. Despite subsequent developments in experiential learning and critical reflection [110], task-oriented facilitators arguably dominate the knowledge-to-practice field [139, 142, 143]. Though the facilitator role is sometimes similar to other change agent roles, facilitators are normally formally appointed and often attempt to address organizational processes and structures (unlikely to be a focus of opinion leaders or academic detailers) [110].

2. Organizational Framework of Innovation Implementation

The second framework we examined was developed by Helfrich and colleagues [50], who used an organizational model of the implementation of complex innovations from the manufacturing sector [68, 112] to study the implementation of cancer prevention/control research programs in cancer clinical research networks. The original model [68] was developed to better understand and explain the determinants of innovation implementation since organizational analyses were increasingly identifying

implementation failure, not innovation failure, as the reason why many organizations were not realizing the intended benefits of the innovations they adopted. The model was empirically tested and refined using a sample of 1219 survey respondents from 39 manufacturing plants [112], and subsequently tested by others in various organizational settings [144-146]. Using their findings, Helfrich et al. [50] revised this model for healthcare organizations. Their adapted framework comprises six elements and highlights relationships amongst elements. The elements are management support, implementation policies and practices (IP&Ps), financial resource availability, implementation climate, innovation champions, and the 'fit' between users' values and the innovation. This framework posits that these elements play important roles in achieving implementation effectiveness (i.e., consistent, committed, and skilled innovation use [112]).

Management support. Managers can be operationalized as individuals who have positional authority in regards to the implementation process [50]. Committed managers are more likely to invest in and monitor the quality of IP&Ps (e.g., user training, incentives), and their statements and actions are strongly associated with staff perceptions that implementation is an organizational priority [112]. Management support has proven important to successfully implementing and sustaining changes in clinical practice [45, 50, 54]. Bradley and colleagues [44, 45] studied interventions to increase beta-blocker use after acute myocardial infarction and observed that support from senior managers was a critical factor in the success of the intervention. The roles and activities of senior management identified as important included personal engagement with the intervention,

regular and respectful contact with clinical staff, promotion of a quality culture, and attainment of resources to sustain improvements in care.

Financial resource availability. Hospitals implementing new tools or practices will almost always require dedicated funding. Financial resource availability was shown to be related to the quality of IP&Ps during implementation of new technologies in the manufacturing sector [112]. To our knowledge, few researchers have studied the relationship between financial resource availability and innovation implementation in healthcare. A recent study on factors that affected implementation of electronic medical records in Alberta, Canada, demonstrated that availability of resources facilitated the adoption and implementation of this technology [147]. Perhaps more importantly, research has shown that effective leaders/managers are able to attain the funding necessary to implement and monitor use of new knowledge and tools in practice, even with significant budget constraints [45, 50]. However, lack of dedicated finances may hinder the institutionalization of new tools/practices, particularly when it precludes ongoing evaluation [138].

Implementation policies and practices. The implementation of an innovation into practice will require organizational strategies (policies) and actions (practices) to support its use. IP&Ps may be operationalized as the number and nature of an organization's efforts to support use of the innovation [112]. Such IP&Ps may involve user training/support, provision of time to experiment with the innovation, rewards for use, and communication strategies [137]. While the successful implementation of evidence

into practice will often require some degree of training and skills development [6], Bradley et al. [44] observed similar IP&Ps across high- and low-performing hospitals in regards to beta-blocker use post-acute myocardial infarction. This finding is consistent with the broader knowledge-to-practice literature, which shows wide variation in the effectiveness of most implementation strategies [9].

Implementation climate. The climate for implementation refers to employees' "shared experiences and observations of, and their information and discussions about, their organization's implementation policies and practices" (pg. 1060) [68]. This is conceptually distinct from organizational culture; rather than addressing the deeper values and assumptions shared amongst employees (i.e., culture), climate refers to employees' perceptions of the extent to which an organization supports a specific innovation. This construct encompasses an organization's IP&Ps in their entirety: the question is not whether one IP&P is effective or not, but rather whether the cumulative IP&Ps work together to: i) increase employee skill; ii) provide incentives; and iii) remove barriers [68]. Thus, similar implementation climates may result from very different IP&Ps. Nevertheless, a strong implementation climate does not ensure committed or sustained innovation use [68]. If users do not believe in or value the innovation, they will be unlikely to use it even in a supportive environment.

Innovation-values fit. This construct describes the degree to which users perceive that innovation use will advance or impede the fulfillment of their individual values [112] as well as those of their professional group [50]. When the innovation "fits" with existing

values and previously introduced ideas, employees may be more likely to accept its use [50, 99]. During the implementation of cancer prevention/control research within existing clinical research networks [50], groups who perceived prevention/control research to be congruent with professional competencies and experiences were more likely to exhibit positive implementation climates. On a broader level, aligning an innovation with overall organizational values may increase the probability of successful implementation [68, 137], particularly as a way of acquiring support from executive leadership.

Champions. Researchers have described champions as: skilled communicators who can effectively advocate to their peer groups; personable and well-respected individuals who are capable of building strong relationships throughout the organization; knowledgeable about the organization and its prevailing culture; and deeply committed to the initiative [53]. The overarching goal of a champion is to convince others to accept the new idea or practice [53]. Many researchers have demonstrated that the existence of a champion (or champions) is essential to the success or failure of evidence-based practice initiatives [44, 47, 53, 116]. While physician champions are often perceived as critical to success [44, 139], the co-existence of managerial, executive, and clinical champions, working across professional and departmental boundaries, has been cited as particularly influential in changing practice in acute care settings [47, 53].

Applicability of the Frameworks

After examining the two frameworks in the context of the knowledge-to-practice, health services, and quality improvement literature, we applied them to the SRT initiatives to explore how each may be used to improve our understanding of SRT implementation and use. Table 2 presents the definition of each construct and then provides a series of relevant questions that may be asked to assess each in the context of SRT implementation. For instance, the extent to which SRTs are supported by evidence will likely influence whether clinicians (and other professionals) choose to endorse their use in practice. In the discourse and execution of professional practice, however, 'evidence' is not solely scientific in nature. Clinical experience, local audits/evaluations, and information/reports from other organizations/jurisdictions all provide important data to corroborate or counter implementation and uptake. Additionally, the presence of clinical/administrative champions to advocate for SRTs and managers to provide moral and material support can be vital to establishing the innovation's credibility and subsequent implementation.

The use of these frameworks can help both researchers and practitioners evaluate settings, explore causal mechanisms underlying implementation processes, and design and deliver more appropriate interventions [5]. A conceptual framework explains "the main things to be studied - the key factors, concepts, or variables - and the presumed relationships among them" (pg. 18) [148] and thus can direct researchers to specific areas/issues that should be examined within the scope of a study [105]. In experimental research, empirically informed conceptual frameworks may be among the best available tools for designing and delivering interventions in health settings [18]: such frameworks

can act as “field guides” to make sense of the context, and identify the processes (or constructs) that are important in particular settings and thus should be the focus of an intervention. Interventions may then be designed to target the constructs identified as having a bearing on practice and attempt to enhance the processes that facilitate changes in them [8].

Similarly, by understanding the theory-based factors that underlie implementation processes, practitioners should be better equipped to develop ways to more effectively integrate new tools and practices into routine clinical care. A useful framework sheds light on particular phenomena and relationships that might otherwise be unseen or misunderstood [149]; thus, it can act as a source of guidance and provide a basis for individuals and teams to reflect on their experiential knowledge as well as existing research and theory to plan and monitor knowledge-to-practice initiatives accordingly.

To assess the utility of any conceptual framework, however, one needs to critically and thoughtfully examine its theoretical concepts to ensure they ‘fit’ with the context being evaluated [107]. Certainly, a researcher or practitioner must consider the framework in light of pilot and exploratory studies and their own experiential knowledge and thought experiments [149]. Ultimately, a useful framework is one that provides new insight into and broadens one’s understanding of a particular phenomenon (e.g., the organizational influences on moving research into practice) [149]. Based on our knowledge of the initiatives, neither framework fully depicts the implementation of SRTs in Nova Scotia, yet both offer important insight into the organizational factors that are important to their implementation. For example, a pilot study on one initiative [150] demonstrated that the presence of champions, innovation-values fit, and strengthening the

implementation climate [50] have played important facilitating roles in the implementation and use of this innovation in practice. Effective leadership [22, 51] was also closely linked to many of the factors that enabled successful implementation. Moreover, given the nature of the innovations themselves, neither SRT could possibly be implemented outside of an organized initiative and without the provision of task-based facilitation [110]. That specific constructs from both frameworks appear influential in these initiatives suggests that researchers and practitioners may find value in using several conceptual frameworks to broader their understanding of the various organizational factors that can influence innovation implementation and to help them analyze and 'navigate' their particular settings.

FURTHER CONSIDERATIONS

This article examined organizational factors influencing the implementation of innovations in healthcare settings and demonstrated how these factors may be applied to the implementation of a new tool in cancer care. Though individual-level factors such as attitudes, beliefs, motivation, and intention clearly contribute to a clinician's decision to adopt a new practice, we did not examine psychological and behavioural factors since current knowledge-to-practice literature provides conceptual guidance in this area [8, 12]. Rather, we focused on two frameworks that can help researchers and practitioners understand change-related experiences that occur within complex organizational structures. The appraisal of numerous frameworks is advantageous since using a conceptual framework that aligns with a particular setting may prove important to developing, implementing, and testing more effective interventions [107].

The frameworks we selected encompass a manageable number of constructs that can be assessed (e.g., surveys, qualitative methods) and subsequently targeted through appropriate interventions. However, assessment of these constructs is not necessarily straightforward and requires the identification of appropriate data sources and respondents at one or more levels of the organization [151]. In a recent review of the literature on the PARiHS framework, Helfrich et al. found a lack of well-developed instruments and other evaluation methods to diagnostically assess the framework's constructs or to evaluate "successful" implementation [111]. This same research team recently published a guide, with a set of reference tools, to help researchers use PARiHS in implementation trials and evaluations [152].

Given the sizeable body of implementation literature and its discipline-spanning nature, this article was not intended to present an extensive review. Rather, it discussed and applied two frameworks that may help researchers strengthen their study designs, and researchers and practitioners assess settings prior to developing and implementing interventions. By focusing on the organization, this article does not account for the broader social, cultural, economic, and regulatory contexts in which organizations operate, despite their influence on how innovations are implemented [99]. For example, the existence of national-level initiatives can have significant impact on local implementation projects by providing external pressures that support leaders' efforts and by allowing leaders to more quickly shift from educating on the need for change to providing training on how to implement the change [137]. The SRT initiatives we examined are closely tied to national and provincial organizations/programs. Thus, one weakness of the frameworks presented here are that they do not address the influence of

extra-organizational factors on implementation processes. Such factors undoubtedly impact innovation implementation in healthcare organizations [18]. Moreover, implementation processes are often messy and complex, with many convergent and divergent activities occurring over time [21]; these frameworks do not capture this complexity or the relational aspects of implementing new practices and tools in healthcare. Nonetheless, they do provide useful tools to help individuals and teams 'organize' their thinking, assess their contexts, and intervene accordingly.

The implementation of knowledge into practice continues to be a slow, complex, and poorly understood process. By advancing our understanding of existing frameworks, we enhance our capacity to select frameworks that are relevant to specific settings and subsequently our ability to more effectively study and target implementation processes. Finding congruence between a particular setting and conceptual framework may be an important step toward developing and testing more effective knowledge-to-practice interventions [107].

Table 1. Details of the three synoptic reporting tool (SRT) implementation initiatives in cancer care in Nova Scotia, Canada.

	TIMING	MODE OF CHANGE	MAIN IMPLEMENTATION POLICIES AND PRACTICES
A	Late 2000s	Combined bottom-up/top-down Began as pilot project in 3 hospitals Largely nationally-funded Physician lead	• Formal education (continuing medical education [CME], rounds) • Formal communication strategy targeting stakeholder groups • Involvement of stakeholder groups in planning/implementation • User training (one-on-one, small group); user manual, "cheat sheet" • CME credits for SRT use • Formal education for report recipients (e.g., health records) • Contact for ongoing technical support
B	Late 1980s	Bottom-up Began in 1 hospital, expanded across province (2+ decades) Largely provincially-funded Physician lead	• Informal communication strategy • User training (one-on-one, small group) • Contact for ongoing technical support
C	Late 2000s	Top-down Began in 3 health regions, expanded across province (~ 2 years) Provincially-funded Physician, managerial leads	• Stakeholders invited to partake in SRT procurement process • Formal communication strategy targeting stakeholder groups • Involvement of stakeholder groups in planning/implementation • User training (one-on-one, small-group); user manual, quick reference guide • Use is mandatory to partake in specific provincial program • Contact for ongoing technical support

Table 2. Construct definitions and their application to the implementation of synoptic reporting tools (SRT).

CONSTRUCT	DEFINITION	APPLICATION TO SRT IMPLEMENTATION
Promoting Action on Research Implementation in Health Services (PARiHS)		
Evidence	"[K]nowledge derived from a variety of sources that has been subjected to testing and has found to be credible" (pg. 83) [108]. Four sources of evidence are research, clinical experience, patient experience, and local information.	Is the use of SRTs supported in the research literature? What are the experiences of clinicians in terms of quality of reporting and use of reporting tools? Do clinicians believe SRTs will improve their reporting practices? How will the use of SRTs affect patient care? Are local data available regarding the quality of reporting? If so, what do the data indicate?
Context	The "environment or setting in which people receive health care services, or…the environment or setting in which the proposed change is to be implemented" (pg. 96) [109]. Context consists of:	Is the context receptive to change? Are policies and infrastructure in place to support change? Does the SRT project align with key practice issues in the organization?
	• *Culture* manifests itself through the values, beliefs, and assumptions embedded in organizations and is reflected in "the way things are done around here" (pg. 97) [109].	What is the organizational culture with respect to learning (e.g., creating, acquiring, managing, and transferring knowledge)? What are the relevant sub-cultures with respect to learning?

Table 2 continued.

CONSTRUCT	DEFINITION	APPLICATION TO SRT IMPLEMENTATION
	• *Leadership* "summarizes the nature of human relationships such that effective leadership gives rise to clear roles, effective teamwork, and effective organizational structures" (pg. 98) [109].	Do leaders provide role clarity regarding the project? Do they support the development of effective teams and inclusive decision-making processes? Do they engage and communicate with those affected by the change? Do they display transformational leadership characteristics?
	• *Evaluation* includes performance monitoring and feedback at the individual, team, and system levels.	Were users provided data (through clinical audit) on the quality of their reporting using the existing reporting method? Are users provided regular feedback on individual and aggregate SRT use?
Facilitation	A "technique by which one person makes things easier for others" (pg. 152)[51]. Facilitation models range from *doing for others* to *enabling others*.	Was the implementation facilitated by a dedicated individual (or group)? If so, who played this role and what specifically did this person do? Was he/she external or internal to the organization?

Table 2 continued.

CONSTRUCT	DEFINITION	APPLICATION TO SRT IMPLEMENTATION
Organizational framework of innovation implementation		
Management support	Managers' commitment to the implementation process, including investments in quality implementation policies and practices.	Do managers at different levels (team, unit, organization) explicitly or implicitly demonstrate moral or material support for implementation? Do managers consider SRT implementation a priority (and if so, how do they demonstrate this?)
Financial resource availability	The actual or potential resources that allow an organization or team adapt to, implement, and sustain change.	How have managers/leads acquired the resources required to implement the SRT (e.g., new personnel, IT infrastructure)? Do managers/leads perceive a lack of funding affected SRT implementation and/or expansion?
Implementation policies and practices	"[T]he formal strategies (i.e., the policies) the organization uses to put the innovation into use and the actions that follow from those strategies (i.e., the practices)" (pg. 284) [50].	What specific strategies and actions were put into place to support SRT use (e.g., training/support, time to experiment with SRT, rewards/incentives, communication, accessibility of SRT)?

Table 2 continued.

CONSTRUCT	DEFINITION	APPLICATION TO SRT IMPLEMENTATION
Implementation Climate	"Employees' shared perceptions of the importance of innovation implementation within the organization" (pg. 813) [112]. The extent to which employees view innovation use is "rewarded, supported, and expected within their organization" (pg. 1060) [68].	Did users view SRT use as being implicitly or explicitly supported, rewarded, and/or expected by their organization? Did the implementation team/organization: a) increase user skill level for SRT use, b) provide incentives for use, and c) remove obstacles to use?
Innovation-values fit	"[T]he perceived fit between the innovation and professional or organizational values, competencies and mission" (pg. 282) [50].	Does synoptic reporting fit with the values, interests, and perceived responsibilities of SRT users as well as their professional groups and organizations/hospitals?
Champions	"Charismatic individuals with significant personal authority who identify with the innovation and throw their weight behind its adoption and implementation" (pg. 295) [50].	Did a charismatic organizational member (clinical and/or managerial) advocate for the adoption and implementation of SRTs? Did champions have protected time to advocate the initiative?

CHAPTER 2: METHODS

The second chapter of this dissertation is the Methods Chapter and is comprised of two sub-chapters.

Chapter 2.1 is a manuscript, yet to be submitted, which describes the methodology used in this study. Specifically, it provides an overview of CSM and discusses its value for research on moving knowledge into practice. The current citation for this manuscript is:

Urquhart R, Grunfeld E, Jackson L, Porter GA, Sargeant J. Use of case study methods in knowledge translation and exchange research. To be submitted.

Chapter 2.2 is a manuscript, published in Implementation Science, which presents the study protocol. As such, it is largely focused on the methods used for this research. Related to this chapter, Appendix E contains examples of the data collection instruments used in this study.

Urquhart R, Porter GA, Grunfeld E, Sargeant J. Exploring the interpersonal-, organization-, and system-level factors that influence the implementation and use of an innovation - synoptic reporting - in cancer care. Implement Sci. 2012 Mar 1;7(1):12.

Chapter 2.1. Study Methodology (manuscript, to be submitted)

BACKGROUND

Health services researchers have consistently identified a gap between the best available scientific evidence and clinical practice [1-3]. This knowledge-practice gap has led to an emerging field of knowledge translation and exchange (KTE) research, wherein investigators are studying the process of putting knowledge into practice with the aim of optimizing the use of knowledge (largely scientific evidence) in health decision-making. Despite the considerable literature amassed in this field over the past decade, no single KTE method or strategy has been shown to consistently increase the use of scientific evidence in practice [98]. In fact, many systematic reviews have demonstrated small effects of most KT strategies on measures of professional behaviour [10, 33, 115], with wide variation in effect sizes that is not well understood or explained.

Much of the research in this area has been experimental in nature, demonstrated by the hundreds of randomized controlled trials (RCTs) that have been undertaken to investigate the efficacy of particular KTE strategies (e.g., academic detailing, opinion leadership, reminder systems) on the uptake of clinical practice guidelines [115]. While RCTs are important in demonstrating the efficacy of many clinical and health service interventions, there is an increasing awareness that, by attempting to control contextual influences, RCTs alone may be inadequate for studying interventions that are context-dependent, such as KTE strategies [18]. For example, there are situations when a researcher either cannot control for all the various factors influencing a particular outcome, or it simply does not make sense to do so since the context itself influences the outcome. Therefore, when studying the exchange, implementation, and use of knowledge

in practice, it would make sense to study the context as well as the intervention. This makes quantitative measurement of the implementation and its effects appreciably complex [42, 118, 153]. Attempts to control contextual factors have been plagued by methodological challenges [17, 18].

Narrowing the knowledge-practice-gap will require attention to how KTE processes actually work in the real world, rather than some ideal (context-removed) world [17, 98]. Historically, the use of mainly positivist approaches to studying the movement of knowledge into practice has limited our learning about the context in which the intervention occurs, the influence of contextual factors on outcomes, and the relationships amongst the intervention, context, and individuals involved. This is because experimental designs, such as RCTs, attempt to separate phenomena from their context and often assume that individual behaviours can be controlled. Adopting modes of inquiry from social sciences may complement the knowledge acquired from experimental research and expand our capacity to explore complex questions of KTE and practice change [17, 154]. There are various research approaches and designs (e.g., qualitative inquiry, mixed methods [155], realist evaluation [156], and case study methodology [CSM] [105]) that are potentially valuable in KTE research as they can provide an in-depth understanding of how and why new knowledge, tools, and practices are adopted, implemented, and sustained (or not) in healthcare settings. A better understanding of the "how" and "why" is necessary to understand the factors that inhibit and enable the processes that influence the knowledge-practice gap and to intervene appropriately.

This paper discusses one mode of inquiry – CSM – that has received limited use in KTE research, despite its focus on studying phenomena within their real-life context

[105] and on understanding the complex relationships amongst individuals, their actions, and their environments [157]. The objectives of this paper are to provide a brief overview of CSM and to discuss its value for KTE research. By doing so, this paper clarifies the ambiguity that often accompanies CSM and demonstrates how this approach can complement dominant research methods to advance our understanding of moving knowledge into healthcare practice.

DISCUSSION

Case Study Methodology: An Overview

Although its use in health research has been limited, case study research has a long tradition in social science disciplines such as sociology, anthropology, political science, law, psychology, management, and education [105, 158]. Robert Yin, a well-known case study methodologist, describes a case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 18) [105]. That is to say, CSM is particularly useful when an in-depth understanding of a phenomenon requires a comparable understanding of the important contextual conditions since these conditions are highly germane (or closely connected) to the phenomenon. Accordingly, the paradigmatic difference between CSM and experimental research is that case studies do not rely on controlled environments wherein a few variables are isolated and manipulated but rather study existing situations in all their complexity [159]; indeed, the same is true for other modes of inquiry arising from the social sciences. The focus on *contemporary* phenomena is common to many researchers' descriptions of CSM [105,

148, 160-162]. While research examining historical events may use many of the same techniques as case studies, the latter deal with a range of evidence sources (e.g., interviews, observation) beyond what is typically available in a historical study [105].

Case study inquiry typically deals with situations wherein there are more factors of interest than data points. In other words, since the context is included as a major part of the study, case study researchers examine settings and circumstances with a large number of factors that cannot be controlled nor even perceived and recognized in all their dimensions [105]. As a result, case studies: 1) rely on multiple sources of evidence to substantiate findings, and 2) benefit from knowledge of the literature and the prior development of theoretical propositions to guide data collection and analysis [105]. An overriding principle of case study research is the collection of data from multiple sources to corroborate the events and observations (known as data triangulation [162]). In fact, CSM is often referred to as a triangulated research strategy [163], distinguishing it from many modes of inquiry that do not necessitate the use of multiple evidence sources (though multiple sources may be used). Yin [105] argues that any case study finding or conclusion is likely more convincing and truthful if it is based on several different sources of information. The use of theory in CSM is broad, denoting a relationship to the literature, policy issues, or some other substantive source, such as pilot studies [164]. A theoretical basis will help identify criteria for screening and selecting cases to study, direct attention to specific areas/issues that should be examined within the scope of the study (i.e., suggest relevant factors of interest), and connect the study's findings to the broader body of literature [105]. Without a prior theoretical understanding, researchers

risk spending considerable time and effort gathering basic information and providing description without any deeper meaning [165].

Merriam [160] elucidates three special features of well-conducted case studies: particularistic, descriptive, and heuristic. The particularistic feature describes a case study's focus on a particular event, situation, program, or phenomenon (i.e., the *case*); the descriptive feature requires that the end product of a case study provide a rich description of the phenomenon under study and include many variables and analyses of their interaction over time; and the heuristic feature means that the case study enhances the reader's understanding of the phenomenon under study.

Research Design

The case (or unit of analysis) of a case study may be an individual, a decision, a program, a group, an institution or organization, an event, or even a concept [105, 158]. Yin [105, 164] describes three general types of case studies: exploratory, descriptive, and explanatory. In exploratory case studies, the researcher typically conducts fieldwork and collects data to develop research questions and propositions for a subsequent study. Oftentimes, the existing knowledge base is poor and there is no conceptual framework, and thus little prior knowledge to develop good theoretical statements upon which to base the study. Descriptive case studies simply present a complete description of the case(s) within their context, though often use a descriptive theory to guide the research (i.e., a theory that describes or classifies specific dimensions or characteristics of a phenomenon but does not identify or predict causal relationships between dimensions or characteristics [166]). Explanatory case studies present data to explain how and why events happened,

with the researcher interpreting phenomena on a theoretical level. They attempt to explain aspects and causal arguments identified by the descriptive research.

Many researchers use multiple-case [105] (or collective case [161]) research designs, meaning they investigate two or more cases in the same study. Most explanatory case studies also use embedded designs wherein various sub-units (or sub-cases) are attended to within each case. For example, if a researcher planned to study the implementation of a clinical practice guideline at tertiary cancer centres, s/he might be interested in multiple units of analysis and how factors at the different analytic levels impact guideline implementation. While the cancer centre might represent the main "case" or unit of analysis, the multiple sub-units in which the researcher is interested might include the guideline itself (i.e., its development/attributes), individual oncologists, and the organization within which the cancer centre is located (see Figure 1 for an illustration of this example).

In CSM, selecting cases to study normally involves theoretical (or purposive) sampling, whereby the researcher purposefully selects cases that are likely to replicate or extend an emergent theory or to provide examples of divergent theoretical categories [167]. This is fundamentally different than statistical sampling in quantitative research, where the gold standard is random selection. In multiple-case studies, cases are often selected so that they replicate each other, either predicting similar results (literal replication) or contrasting results for predictable reasons (theoretical replication) [164]. For Yin [105], the logic of sampling in multiple-case studies is in replication, analogous to the replication of findings in experimental research. Additional criteria important to selecting cases include: 1) relevance to the phenomenon of interest; 2) provision of

diversity across contexts (e.g., differences in settings, individuals involved); and 3) and provision of good opportunities to learn about complexities and contexts (e.g., cases with willing participants to maximize what can be learned in the time available) [161].

Case studies normally make extensive use of qualitative approaches and data, consisting of detailed observations, interviews, and excerpts from documents and records, which provide rich, detailed information about the phenomenon [105, 158]. Table 3 describes some common sources of evidence in case study research. The use of multiple sources is vital to CSM as it permits the substantiation and corroboration of findings and resultant interpretations [105]. Multiple sources may also identify areas of inconsistency and contradiction; additional evidence should be collected to resolve or explain contradictions when they occur. Where contradictions persist, these must be considered and displayed in the final analyses and interpretations along with converging findings [105]. The use of multiple sources means a researcher must be skilled in both qualitative and quantitative approaches and varied data collection procedures. Though qualitative data tend to be central to the case study, questionnaires are often used to capture perceptions, attitudes, and verbal reports about events and behaviour. In addition, other sources of quantitative data can provide "objective" evidence of outcomes (e.g., patient charts or administrative data to provide evidence of health service utilization or patient outcomes). Oftentimes, different data collection methods are used at each unit (or sub-unit) of analysis.

Although a discussion on analysis is outside the scope of this paper, there are a number of important analytic strategies that enhance the rigour of a case study: relying on theoretical propositions, developing in-depth case descriptions, using multiple sources of

evidence, and examining rival explanations [105]. Yin provides in-depth guidance on five useful analytic techniques [105]. High quality analyses require that researchers attend to *all* the evidence collected, display and present the evidence and interpretation(s) separately, and consider alternative interpretations. The result is both descriptive and theoretical in that the focus is on how and why the situation occurred as it did, and which factors may be important to consider and explore in similar situations [168].

Techniques to Maximize Rigour

There are numerous techniques emphasized in CSM to enhance the rigour of the study. Many similar techniques are used to establish the quality or rigour of any social science research. They occur throughout the research process, including the research design, data collection, and data analysis phases.

During the research design phase, the focus on theory and the use of replication logic [105] to select cases both serve to strengthen the transferability of findings (i.e., how well the findings relate outside the particular study and thus how they might be applied in another context [169]). During data collection, several techniques are used to strengthen the confirmability (i.e., ensuring the findings reflect the views and experiences of the participants rather than those of the researcher [169, 170]) and dependability (i.e., explicating the research process in a way that allows another researcher to clearly follow the data collection, analyses, and interpretation decisions [169]) of the research. These include: using multiple sources of evidence, developing and maintaining a case study database, and establishing a chain of evidence. A case study database consists of a complete set of all the data collected (e.g., relevant literature, documents, interview

guides, audiotapes, transcripts), along with the treatment of the data during the research process (e.g., coding system, handling of codes and categories, condensed versions of findings, criteria for analysis and interpretation) [105, 159]. A chain of evidence refers to maintaining explicit links among the study questions, the data collected, and the conclusions drawn [105], allowing an external reader to follow the source of any evidence from initial study questions to final conclusions. Finally, use of specific CSM analytic techniques (e.g., pattern matching, explanation building) and considering rival explanations during data analysis increase the credibility of the study (i.e., the degree to which the findings make sense or are congruent with reality [160, 169]). Yin provides explicit guidance on all of these techniques, underlining their importance in case study research [105].

Common Criticisms

Perhaps the most frequently cited criticism of CSM is related to the knowledge it produces [171]. That is, many researchers have disputed whether knowledge produced from a single case (or a small number of cases) is valuable, particularly as there is no method, statistical or otherwise, to assess the case's "representativeness" or generalizability to other unstudied cases [105, 159, 172]. Certainly, questions related to generalizability are not unique to CSM and exist for qualitative, mixed methods, and quantitative approaches more broadly. However, when doing a case study, the goal is to expand and generalize on a theoretical level (analytical generalization) not to make inferences about a population (statistical generalization) [105]. Hartley (1995, p. 225) maintains:

> The detailed knowledge of the organization and especially the knowledge about the *processes* underlying the behaviour and its *context* can help to specify the conditions under which behaviour can be expected to occur. In other words, the generalisation is about theoretical propositions not about populations (as cited in Meyer [165], pg. 347).

As such, the in-depth study of a single case or several cases can reveal detail, complexity, and nuances in social processes and experiences that are often omitted in statistical methods and generalizations [172]. A detailed, rich description of a case and its context will help others understand the uniqueness of the case as well as the "fittingness" of the findings to other cases [169, 173]. Transferability is increased when two or more cases are shown to support a theory [158].

Another common critique of CSM, and of qualitative inquiry in general, is that the research is subject to researcher bias, specifically toward confirmation of preconceived ideas (also known as theory verification) [174, 175]. That is, researchers can selectively describe and explain the studied events "to support a favoured theory by underplaying evidence inconsistent with the theory or supporting an alternative" (p. 164) [175]. Clearly, an *a priori* understanding of the literature requires that researchers balance their knowledge of the literature with the data emerging from the case, and consider alternative interpretations. Flyvbjerg provides extensive evidence that case study researchers are unlikely to underplay or disregard evidence inconsistent with their prior theoretical stance(s): "researchers who have conducted intensive, in-depth case studies typically report that their preconceived views, assumptions, concepts and hypotheses

were wrong and that the case material has compelled them to revise their hypotheses on essential points" (p. 235) [174].

There are also several criticisms that are specific to CSM. First, the term "case study" is frequently used as a catch-all category in research methods [160]. Case studies have been described as research designs, data collection procedures, research approaches, qualitative research methodologies, and research products [162, 165]. This ambiguity leads to a variety of assumptions regarding its robustness and may contribute to a poor perception of the methodology [176]. In the health field, the broad use of patient "cases" (i.e., case reports that focus on some notable aspect of a patient's condition or illness) as a teaching method has led to confusion between this teaching strategy and CSM as a research methodology [177], with this confusion compounded by the criticism it draws from its low position on the hierarchy of research evidence [178]. Due to its limited application in health research, many health researchers, clinicians, and decision-makers may have limited or no education/training in CSM; thus, a lack of knowledge and understanding likely impedes its use in this field. However, several case study methodologists [105, 161, 172] have outlined approaches to CSM that are rigourous and transparent, and that facilitate informed analyses and interpretations. These approaches are applicable to any field of study; it is the research question not the discipline that should drive the choice of methodology.

Case studies have also been criticized for being superficial and/or having an inappropriate theoretical foundation for generalization [159]. Some of this may be related to a lack of transparency surrounding data collection and analyses procedures. Researchers using CSM should strive to improve both the quality of documentation and

post-study reporting. Corcoran et al. [168] argue that CSM has not reached its potential to transform practice in higher education due to researchers failing to publish information on either their theoretical approach to the methodology or on their data collection procedures. Improved documentation will increase the dependability of the study (akin to reliability in the quantitative paradigm) [105, 179] and the legitimacy of this research methodology in the health field.

Potential Contributions to KTE Research

Narrowing the knowledge-practice gap in health care will require that we better understand how new knowledge, approaches, and practices are actually applied and integrated in clinical care and health programs/policy. To date, KTE research has largely focused on potentially useful strategies (e.g., opinion leadership, academic detailing) for improving the uptake of knowledge (e.g., clinical practice guidelines) into practice, with the target of such strategies normally the individual, presumably autonomous, clinician [6, 22]. However, health care delivery often occurs within complex organizational structures, and many new tools and practices require coordinated use by many individuals and professional groups to achieve benefits [50]. Research from a variety of disciplines (e.g., management, organizational science, political science) demonstrates that collective knowledge use is deeply embedded in organizational and policy contexts [18]. This "embeddedness" suggests that KTE researchers need to employ research methods that are better equipped to study the multi-level factors that prevent or enable the movement of knowledge into practice – nature of the knowledge or practice; mode of knowledge delivery; setting or context of care; organizational and socio-political constraints and

enablers [180] – and how these factors relate to specific contexts. The ensuing evidence will be better suited to explain how or why specific KTE interventions work (or do not work) and to provide guidance on how to adapt successful interventions to other settings. CSM provides a useful framework to investigate these multiple issues. Indeed, the distinctive need for case studies arises from the desire to understand complex social phenomena [105], such as KTE processes.

Numerous researchers have employed CSM to explore various dimensions of evidence-based practice as well as the implementation of complex innovations in health settings. For more than a decade, Ferlie and colleagues [130, 131, 181-184] have used case studies to examine evidence-based clinical practice, largely from an organizational perspective. Their work has highlighted many important influences on evidence-based practice, including the nature of evidence and the enabling and hindering functions of managerial and executive leadership. More recently, researchers have used CSM to examine the adoption and implementation of patient care delivery models (e.g., in diabetes management [185] and palliative care [186, 187]) and complex technologies (e.g., patient registries [188], intensity-modulated radiation therapy [189], surgical synoptic reporting [150]), and to identify the salient organizational- and system-level factors that enable or impede implementation processes. These studies have illustrated the value of CSM in explicating the important factors, and the relationship amongst factors, that influence the implementation and use of knowledge in practice when certain conditions and contexts are present. Importantly, people and relationships *matter* when exchanging and implementing new knowledge and practices in health care settings [17], and research that can investigate the complex interactions between individuals, their

actions, and their environments is important to understand these interpersonal influences. Thus, CSM may be particularly germane to understanding the interpersonal-, organizational-, and system-level factors that influence implementation and use processes in health care. Taplin and colleagues [190] recently argued that if we are to achieve high quality healthcare delivery in cancer, we must better understand and subsequently influence the multiple levels of the system wherein care is delivered. However, interpersonal, organizational, and system levels of analyses pose considerable methodological challenges for dominant KTE research methods (e.g., RCTs) [17, 18, 191, 192]. Moreover, since knowledge use is so contextually-dependent [18], the transferability of any specific KTE intervention will be difficult to assess without an in-depth understanding of the contextual factors and their relationships to the intervention and outcomes.

The increased use of CSM in KTE research can help establish a theoretical basis for KTE interventions and improve our capacity to design, select, and adapt interventions to optimize the use of evidence in health care decision-making (from clinical care to policy decisions). Currently, there is a limited theoretical basis for many KTE interventions [8]. Without a better understanding of the theoretical underpinnings of clinical and organizational behaviour change, researchers have no *a priori* basis to expect an intervention to change behaviour or to replicate a change if it is achieved [8]. Thus, generalizing findings from intervention studies to real-world clinical settings is a challenging task for researchers and practitioners alike. In case study analysis, the process of reconciling evidence across sources, levels of analyses, and cases, and between cases and the literature, increases the likelihood of generating novel theory or reframing (and

strengthening) existing theory [167]. The resulting theory is intimately connected to actual data (and reality) and thus likely to be empirically valid [167]. Moreover, the theory is likely to include constructs that are measurable, and generate hypotheses that are testable, given that the constructs have already been measured during the theory-building process. The development of relevant, valid, and testable theories is imperative given the lack of a robust and generalizable evidence base in the KTE field. This may be especially pertinent for team- and organizational-level interventions wherein the evidence base is much less developed relative to individual-level interventions [18].

Clearly, experimental and quasi-experimental quantitative research continues to be critical to improving our understanding of KTE interventions and their impact. However, complementary designs and data are needed to deepen our understanding of the context in which an intervention occurs and how the context influences both the intervention and the outcome(s). The development and advancement of KTE research will necessitate a both/and, versus an either/or, perspective concerning quantitative and qualitative methods. In short, it will require that researchers employ methods that best answer the research questions at hand; in many cases, this may involve a combination of quantitative and qualitative methods (i.e., mixed methods approaches). Many KTE interventions, for example, are complex interventions that involve changes in policy and/or health service components. Trials that evaluate these types of interventions will often fail to provide useful information unless they also illuminate contextual influences and clarify the mechanisms underlying the intervention and its implementation [193]. Without such information, it will be difficult to make sense of negative results (e.g., was the intervention ineffective, was it inadequately or inappropriately applied, or did it use

unsuitable measurement tools, comparison groups, or outcomes?) and to assess the applicability of positive results to different settings.

As part of a mixed methods approach, CSM may be employed *in conjunction with* intervention trials to help elucidate the processes and mechanisms underlying the intervention and build a theoretical foundation for intervention research. For example, this methodology can strengthen our understanding of the fidelity of KTE interventions, or the extent to which a particular intervention follows the original intervention design or plan. Fidelity is affected by factors such as the intervention's complexity, quality of delivery, context (e.g., organizational structures and culture, historical events), and participant recruitment and responsiveness [194, 195]. A recent study [196] that used CSM to prospectively examine the implementation fidelity of a multi-faceted intervention to improve health service and patient outcomes for community-dwelling frail elderly [197] found that the level of fidelity was generally high, but that certain factors, including participant recruitment, participant and staff responsiveness to the intervention, and financial resources for staffing, affected whether some components were delivered, modified, or added to the original intervention. Such mixed methods investigation is important to understanding how and why interventions produce the observed outcomes. Indeed, without knowledge about an intervention's fidelity, investigators risk evaluating the effects of an intervention that has not been fully implemented [198]. By facilitating study of the fidelity of KTE interventions and the contextual factors that moderate fidelity [196], CSM can help researchers define the core theoretical components of an intervention and reveal which components actually provide the active ingredients that influence the outcomes.

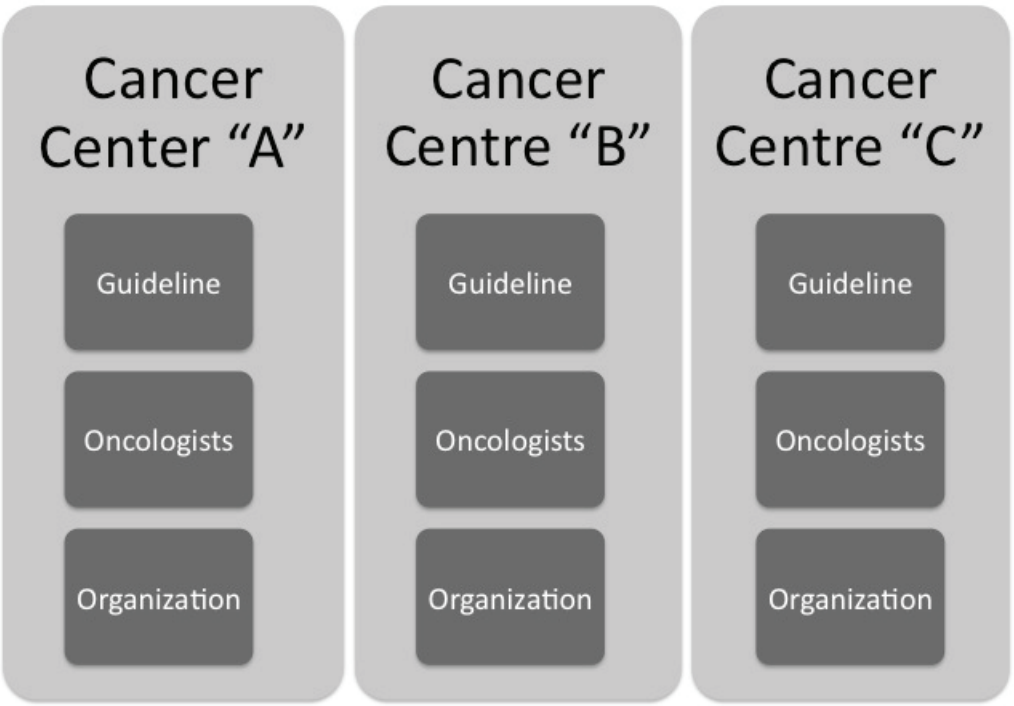
SUMMARY

At its core, case study research is *a study of practice* and CSM a methodology that illuminates the multiple factors influencing how and why the practice occurs as it does. Given the contextually-dependent nature of KTE processes, CSM provides a rigourous methodology to study the implementation, use, and sustainability of new knowledge and practices in healthcare, in an in-depth way through both description and contextual analysis [105, 168]. However, good case studies are difficult, and require the researcher(s) to be well-versed in multiple data collection methods, to spend substantial time immersed in a large amount of data, and to undertake a markedly iterative analytic process that requires the researcher to continuously negotiate between new ways of understanding the data (divergence) and seeking a single, unified theoretical explanation/interpretation (convergence). Well-conducted case studies can make significant contributions to the knowledge base of a particular area [158] and have the potential to transform practice, either within the case(s) being studied or across similar situations where individuals can learn from the findings [168]. The use of this methodology in KTE research can provide valuable insights into how people and organizations involved in the delivery of health care introduce changes in practice, and whether there are specific factors we can influence (e.g., target, modify, intervene upon) to implement these changes more effectively and efficiently.

Table 3. Sources of evidence commonly used in case study research.

Evidence source	Description
Documentation	Examples include personal documents (letters, emails, diaries), administrative documents (agendas, meeting minutes, proposals, progress reports, other internal records), formal evaluations conducted by others, and media articles.
Archival records	Examples include Census and other statistical data, service records, organization records (e.g., budget or personnel records, policies), maps and charts, and previously collected survey data.
Interviews	One-on-one interviews are normally conducted with a variety of key informants at multiple levels of the case.
Focus groups	Focus groups are often conducted with a group of people involved in the case to gather their perceptions of particular experiences or issues.
Observation	*Direct observation* may range from formal to casual data collection activities, but the researcher does not participate in the activities observed (passive observation). *Participant observation* occurs when the observer assumes a role within the case study situation and participates to some extent in the activity being studied.
Physical artifacts	A technological device, a tool, or some other physical evidence. Researchers may familiarize themselves with and use artifacts under study.

Figure 1. Example of using an embedded design to study the implementation of a clinical practice guideline at tertiary cancer centres.



Chapter 2.2. Study Protocol (manuscript)

BACKGROUND

Cancer treatment and management have become increasingly complex over the past two decades, with therapeutic decisions often based on input from a multidisciplinary team that consists of radiologists, surgeons, pathologists, and oncologists [69]. For patients with suspected or confirmed cancer, clear and thorough recording of diagnostic and surgical procedures and findings support accurate diagnosis and staging. Such recording also facilitates more accurate prognosis estimates, post-operative management, and adjuvant treatment planning. The dominant method of reporting findings from diagnostic tests/procedures, surgery, and pathology examinations is the narrative report, which is a free text, descriptive account of the procedure, suspected or confirmed findings, and proposed treatment. Physicians dictate this report, often through automated telephone systems, and professional transcriptionists transcribe the oral description into a written document that is eventually placed into a patient's medical record. Research has demonstrated that narrative reports inconsistently provide the information required to understand the disease and make informed patient care decisions [70, 84, 121, 122, 199, 200].

Another method of reporting, the synoptic report, captures data items in a structured manner and contains only items critical for understanding the disease and subsequent impacts on patient care. There is a spectrum of what is generally considered a synoptic report [69], from synoptic-like structured templates without scientifically validated elements to sophisticated electronic systems with drop-down menus, discrete data fields, standardized language, automated coding processes, and strong evidentiary

basis. A landmark study in the early 1990s, which audited pathology practice patterns at 532 institutions in three countries, found that the one practice associated with completeness of pathology reporting for colorectal cancer specimens was use of a standardized report or checklist [75]. Since that time, researchers have consistently demonstrated that synoptic reports (even paper-based 'checklist' formats) vastly improve the quality of pathology reporting in colorectal [69-74, 76], breast [69, 71, 77-79], lung [69, 80], prostate [69], pancreatic [81], melanoma [82], and hematolymphoid cancers [83]. More recently, synoptic reporting has been shown to improve the quality of surgical reporting for a variety of malignancies, including colorectal [84], breast [85], thyroid [86], and pancreatic cancers [87], as well as non-malignant operative procedures [88, 89].

Electronic synoptic reporting tools also lead to health system efficiencies compared to the dominant, dictated method of reporting [89, 201, 202]. Laflamme *et al.* [89] showed that use of synoptic templates accelerated the mean time for a verified surgical report to reach the patient's medical record by 800-fold compared to narrative reporting (28 minutes versus >14 days, respectively). Moreover, the mean time from the end of the surgery to initiating the report was substantially less when using synoptic templates (0.43 hours) versus dictation (9.7 hours). Similar efficiencies were demonstrated in subsequent studies [201, 202]. In a Canadian study, for example, 97% of synoptic reports were finalized, placed in the patient's medical record, and sent to all health professionals involved in the patient's care within 24 hours of surgery compared to a mean of 90 days for narrative reports [201]. Researchers have also estimated considerable cost-savings through the elimination of transcription services [89, 201].

Beyond improving completeness of reporting and availability/immediacy of reports, synoptic reporting tools have the potential to improve quality of care by integrating practice guidelines/best evidence into report templates [85, 201] and providing an efficient, real-time mechanism to generate data from the diagnostic and peri-operative periods [85, 201, 203, 204]. These data may be used to provide real-time performance feedback to physicians and surgeons as well as enable improved process and outcomes measurement. International jurisdictions are increasingly endorsing synoptic reporting, including actively supporting/funding the implementation of synoptic templates [124-126] and providing commendation status to pathology labs that include a synoptic synopsis of scientifically validated data element in their reports [127]. In addition, the professional pathology colleges in Canada, US, UK, and Australia have formalized a collaboration to develop common, internationally agreed-upon, standardized cancer reporting protocols [123].

The synoptic report represents a complex innovation (i.e., new knowledge, tool, or practice) in cancer care, with its implementation and use requiring fundamental shifts in physician behaviour and practice culture [128] as well as support from the organization (e.g., changes in institutional policies/processes) and larger system (e.g., governance arrangements, integration with health IT infrastructure). Despite the demonstrated benefits, some physicians have reported reluctance to use synoptic reporting tools, with concerns including lack of flexibility in reporting complex procedures/cases [205, 206], the prospect of being monitored [205], and discomfort with using information technology [206, 207]. Changing physician reporting practice is a complex undertaking that requires

comprehensive approaches at different levels of the health system [11]. This may be particularly true for narrative reporting, a practice that has existed for millennia [208].

Implementing New Practices in Healthcare Organizations

Knowledge translation (KT) research has largely focused on potentially useful strategies (e.g., opinion leaders, academic detailing, reminder systems) for improving the adoption and uptake of evidence (e.g., clinical practice guidelines) into practice [6]. Most of these strategies fall within the realm of individual-level interventions [8-11], with the target being "autonomous" clinicians who are deemed to be more-or-less independent in their capacity to assemble and apply knowledge to modify their practices [6]. Despite the sizable amount of literature in this area, however, numerous systematic reviews have been unable to demonstrate which of these strategies work best, or even consistently, across clinical settings [9, 10, 33]. Many researchers have emphasized the unpredictable, slow, and haphazard nature of research implementation and use processes, with interventions working some of the time in some situations, but not at other times in seemingly similar situations [5, 6, 8], and the reasons for these differences unclear [156].

In reality, many organizational and socio-political (e.g., inter-organizational networks, funding arrangements) factors affect whether individuals in clinical settings actually make changes in their practice [6, 17, 22, 39, 156]. Much research has demonstrated the importance of organizational characteristics (e.g., culture, leadership, management support, evaluation/feedback mechanisms, and presence of champions) to implementation efforts in healthcare settings [6, 23, 43-55, 116]. Moreover, many of the defining features of healthcare systems, including the range and diversity of stakeholders,

complex governance/resource arrangements, and professional autonomy and specialization of many of its staff, result in many different cultures and norms as well as high levels of interdependency amongst professionals in the system [56, 57].

Consequently, many implementation processes in healthcare organizations will also be characterized by a high degree of interdependency amongst organizational members [58, 59]. Indeed, many innovations introduced in health care will require coordinated use by many individuals and professional groups to achieve benefits (electronic medical records are one example). These individuals are situated in organizational relationships wherein the implementation and use of a new tool or practice will ultimately be influenced by many interpersonal processes, including "coalition building," rhetoric, and persuasion [61, 62]. Thus, while individual-level interventions are important to change clinical practice, the complex nature of healthcare organizations means individual-level interventions alone cannot change clinical practice in a widespread, sustainable way [11, 18, 39-42].

Understanding the dynamics of innovations in organizations has a long history in management and organizational sciences [90]. Rogers [16] has conceptualized the innovation-decision process as one that unfolds in distinct stages whereby an organization moves from initial awareness or knowledge of an innovation to eventually successfully integrating the innovation into ongoing processes (or, alternatively, rejecting the innovation). Contrary to this perspective, extensive longitudinal study of innovation processes led Van de Ven and colleagues [21] to describe the "innovation journey" as a non-linear cycle during which ideas are developed (or adapted) and put into practice by people who, through their relationships and negotiations with others, make the changes

necessary to implement the innovation within a specific organizational context. They highlight that people and relationships are instrumental to this journey, which is characterized by many divergent and convergent activities wherein the initial idea often leads to multiple ideas/actions, setbacks and delays occur frequently, staff experience high levels of elation and frustration, notions of success change, and new interdependencies are established that affect the wider organization. This broader "systems" perspective [21, 65] has recently made its way into KT dialogue and debate [17], challenging our thinking of a linear view of KT (e.g., researcher-push model) and moving us toward one that is much more contextual, relational, and "living" in nature.

RESEARCH OBJECTIVE

The objective of this study is to examine the key interpersonal-, organizational-, and system-level factors (hereafter referred to as 'multi-level' factors) that influence the implementation and use of synoptic reporting in three specific cases of cancer care. The interpersonal level relates to the relational aspects at the level of the implementation team/program: e.g., teamwork and team dynamics, communication, partner engagement, coalition building, power dynamics, and use of rhetoric and persuasion to accomplish goals/tasks. The organizational level relates to institutional (i.e., hospital) factors that influence implementation and behaviour change: e.g., organizational culture, leadership, management, intra-organizational relationships, evaluation capacity/mechanisms, implementation policies and practices, infrastructure, and presence of champions. The system level refers to the broader sociopolitical context: e.g., policies such as financial

incentives/disincentives, resource and governance arrangements, and inter-organizational norms and networks.

This study involves three initiatives (the cases) in Nova Scotia, Canada, that have implemented a synoptic reporting tool within their departments/programs. The examination of each case will involve answering the following specific research questions:

1. What, if any, common factors affected implementation and use across cases? How was it that these factors "transcended" the different contexts (setting, timing, and "actors" involved)?
2. Are there context-specific factors within each case, which were not found in other cases, that affected implementation and use? If so, what are they and what are their specific relationships to the setting, timing, and actors?

The outcome of this study will be a descriptive and explanatory account of the multi-level factors that influence the implementation and use of synoptic reporting in cancer care.

METHODOLOGY

Case study methodology (CSM) [105, 161] will be used to study the three synoptic reporting cases in-depth, explore which factors were barriers or facilitators of implementation and use, examine relationships amongst factors, and uncover which factors appear to be similar (and distinct) across cases. CSM permits the rigourous study of a contemporary phenomenon within its real-life context [105], and of the complex interactions between the social actors and their actions and environments [157]. Case studies typically focus on "how" and "why" questions and explore multiple dimensions

of some particular phenomenon. Flyvbjerg [174] argues that such in-depth study (of real cases in specific contexts) may be pivotal to transitioning from a novice to an expert understanding of the phenomenon.

This complexity means that case study researchers deal with distinct contexts whereby there are more variables of interest than data points. As a result, case studies: 1) rely on multiple sources of evidence and 2) benefit from knowledge of the literature and existing theoretical perspectives [105]. The use of multiple sources is vital to CSM, as it permits corroboration (i.e., triangulation) of findings and resultant interpretations [105]. The use of existing theoretical perspectives helps guide data collection and analysis. Without a prior theoretical understanding, researchers risk spending considerable time and effort gathering basic information and "providing description without meaning" (Hartley, cited in Meyer [165], pg. 331).

METHODS

This research will examine the implementation and use of synoptic reporting tools for cancer care in Nova Scotia, Canada, using an explanatory multiple-case design. Explanatory case studies present data to explain how and why events happened: the researcher interprets phenomena by answering questions of how and why drawing upon a theoretical basis [105].

Theoretical Perspectives

The use of theoretical frameworks/perspectives provides structure to the inquiry and analysis, and helps ensure the findings from the case study are connected to and informed

by the broader body of literature. This research is informed by the empirical and theoretical literature on research implementation and the diffusion/management of innovations. In particular, three theoretical frameworks/perspectives have largely informed the design of this study (see Table 4):

1. Promoting Action on Research Implementation in Health Services [22, 51]
2. Organizational framework of innovation implementation [50]
3. "Systems" thinking / change [17]

Importantly, these perspectives were not identified with the aim of determining which is "best" at explaining implementation and use processes in the cases selected for study. Rather, these perspectives, when taken together, present a range of interpersonal, organizational, and system influences on practice change and thus identify potentially important factors to study.

Sampling

In case study research, limiting one's study to three or four cases will help ensure that a researcher is able to study each case in sufficient detail and depth [161, 209]. In this study, three cases will be studied:

1. Synoptic reporting in the Nova Scotia Breast Screening Program (NSBSP);
2. Synoptic reporting in the Colon Cancer Prevention Program (CCPP); and
3. Synoptic reporting in the Surgical Synoptic Reporting Tools Project (SSRTP).

These cases have been sampled on the basis of replication logic [105] as well as Stake's criteria [161]: relevance to the phenomenon; provision of diversity; and provision of good learning opportunities. Using replication logic, these cases were selected as they converge and differ with respect to factors that, based on the literature and theoretical

perspectives, are likely to influence the implementation and use of an innovation in clinical practice. For example, the implementation of all three initiatives has involved formal leadership, relatively small implementation teams, clinical champions, and the development of monitoring and feedback mechanisms. At the same time, the cases represent diverse contexts, including differences in relevant professional groups (e.g., specialties, disease sites), institutions (e.g., academic/tertiary care centres, community hospitals), mode of change (e.g., top-down, bottom-up), implementation support and resource characteristics, and history/timing.

Data Collection Procedures

This study will use multiple data collection procedures, gathering evidence across cases as well as across the various levels (interpersonal, organizational, system) of each case, to gain rich, detailed information about each case and to increase the likelihood of achieving triangulation of data.

Interviews with Key Informants

One-on-one semi-structured interviews will be conducted with key informants at the different levels of each case. For each case, a minimum of 14-16 key informants will be interviewed (see Table 5): users of the synoptic reporting system (e.g., radiologists, gastroenterologists, surgeons); individuals directly involved in planning or carrying out the implementation; organizational members relevant to the initiative; individuals involved at the system level (e.g., funders, policy-makers); and users of the final synoptic report (e.g., oncologists, coders). While the latter group may not have been directly

involved in implementation efforts, their acceptance and use of the synoptic report is important to widespread implementation and use. Some informants may be asked to partake in several interviews (e.g., initial and follow-up interviews) depending on the case and data collected.

Patton [162] and Rubin and Rubin [210] will be used to guide the interview design and research questions. Interview questions will be adapted based on each case's unique context as well as the person being interviewed and his/her role in the implementation. The semi-structured format will permit the interviewer to remain focused so that the research goals are achieved and the participant's time is used efficiently, yet also provide the freedom to probe additional issues that may be pertinent to the current research but are not specifically addressed by the interview script [162]. Following each interview, the questions and responses will be reviewed to determine whether or not the issues were answered in sufficient depth and, if not, questions will be revised before the next interview [210]. Though theoretical perspectives have been used to guide this study, when information arises that conflicts with these perspectives, we will depart from the interview script and explore that particular concept/issue further. In subsequent interviews, that issue will be integrated into the script, if relevant in the context of that specific informant.

One investigator [RU] will conduct all interviews. Each interview will be audio-recorded to ensure the data are retrievable and captured in true form, and will be transcribed verbatim by an experienced research coordinator.

Non-Participant Observation

Non-participant observation [162] will be utilized to observe training sessions (format, quality of training) and initial surgeon reactions to viewing/using the innovation. Thus, these sessions will provide another opportunity to collect data on surgeons' perspectives on the innovation and any barriers that surgeons perceive at the time of training. These sessions will be conducted for one case only (SSRTP) since the implementation of the surgical synoptic report is ongoing, permitting prospective observation of user training and early support activities.

Document Analysis

Document information will be sought out and analysed for each case. This includes project plans, team/organizational records related to synoptic reporting, training/support manuals, agendas and meeting minutes, formal/informal evaluations conducted, and media or professional articles/newsletters on initiative. These records will be reviewed to gain an historical and contextual perspective on the initiative and to corroborate and augment evidence from both interviews and observations [105]. Where documentary evidence conflicts with findings from other sources, we will attempt to resolve these contradictions through further inquiry (e.g., follow-up with informants, contact with implementation team).

Physical Artifacts

Each synoptic reporting tool will be examined to gain insight into the technical operations related to using the system. This will entail inputting 'test' cases into the

system to experience tool use as well as viewing the final synoptic report to observe its design/format. Field notes/perceptions related to these experiences will be used to corroborate and augment evidence (specifically related to system/tool issues) from other sources.

Tool Audits

Tool audits will be conducted to determine 1) the proportion of eligible clinicians using the synoptic reporting tool and 2) the proportion of eligible procedures at each institution that were reported using the synoptic reporting tool. This will entail an audit of the synoptic reporting system/database as well as the relevant institutional administrative system (e.g., admission/discharge/transfer or operating room scheduling systems). The latter is required to determine the number of eligible procedures (e.g., endoscopies, surgeries) performed at that institution in a specified period of time. Eligibility criteria for the audits include: the physician/surgeon is a registered user on the synoptic reporting system and a synoptic template is in use for the specific procedure (e.g., lumpectomy for a malignant breast tumour).

Analysis

Yin [105] describes a number of important strategies of case study analysis: developing case descriptions, relying on theoretical frameworks/perspectives, using data from multiple sources to augment and triangulate findings, and examining rival explanations (i.e., other plausible explanations for the findings; one rival explanation is that psychological theories, such as the Theory of Planned Behaviour [211], better explain

implementation in one or more of the cases studied). In this study, data analysis will involve a three-stage process: production of a case record/history for each case; in-depth analysis of each case; and cross-case analysis. Like other qualitative methodologies, analysis will begin with the first data collected.

The first stage in the analytic process involves case description. That is, a detailed case record (or history) will be constructed for each case, including an in-depth description of the history and context of the initiative (including the impetus for the initiative, timeline, key milestones and activities, and organization of the project and implementation). This descriptive record will also involve situating the case within its socio-political context, particularly as it pertains to the provincial healthcare environment at the time of implementation.

The second stage will attempt to gain an in-depth understanding of each synoptic reporting initiative and how its experiences relate to the research objective as well as the theoretical literature. This stage will involve four analytic steps, which will be performed separately for each of the three cases:

i. Thematic analysis for each of the following evidence sources: interviews, documentary evidence, and observation. This analysis will follow the thematic analysis approach presented by Braun and Clarke [212], involving coding, collating codes, and generating, reviewing, and refining themes. This approach is similar to the analysis steps outlined by other researchers [209, 210, 213]. NVivo 9 (QSR International, Australia) will be used to help manage the data and aid in coding processes.

ii. Cross-source analysis of themes. This analytic process will compare, contrast, and synthesize findings from each source to gain an understanding of how the data from each source corroborates and augments data from other sources, and to identify any areas of inconsistency and potential contradiction.

iii. Explanation building to integrate evidence, link the data to theoretical perspectives/literature, and develop a deeper understanding of what occurred [105]. This technique involves iteratively and flexibly moving back and forth between prior knowledge (theoretical perspectives, other literature, research objective) and emerging, case-specific data to get a deeper understanding and theoretically-sound explanation of what actually happened and what was important throughout the process. An important aspect of this process is considering and questioning other explanations. This process will enable us to explain the implementation processes and the multi-level factors that influenced implementation and use in each case, and to examine existing theoretical constructs and determine their appropriateness to these contexts. In this way, we are able to explore existing theoretical perspectives and revise theory, when appropriate.

iv. Presentation of findings in relation to the overall objective of the study, the theoretical perspectives, and rival explanations.

The final stage will be to conduct a cross-case analysis to compare and contrast themes between the cases. Each case will be treated as a separate study and findings (similarities and differences) will be compared across cases to develop theoretically informed, generalisable knowledge on implementing innovations in clinical practice that can be applied to other settings and contexts [105].

One critique of CSM is that case studies are subject to confirmation bias, specifically toward confirmation of preconceived ideas [174, 175]. That is, researchers can selectively describe and explain the studied events "to support a favoured theory by underplaying evidence inconsistent with the theory or supporting an alternative" (pg. 164) [175]. To minimize confirmation bias in this study, all members of the research team will participate in components of the analysis and compare their findings. The focus will be attend to *all* the evidence collected, display and present the evidence and interpretation(s) separately, consider other plausible interpretations, and seek out additional evidence where inconsistencies or contradictions exist [105]. Moreover, the research team will strive to increase the "trustworthiness" of this study through detailed documentation and description, including development and maintenance of a case study database (consisting of a complete set of all the data collected, along with the treatment of the data during the research process), maintenance of a chain of evidence (or audit trail), and rich descriptions of each case and its context.

DISCUSSION

Well-conducted case studies can make significant contributions to the knowledge base of a particular area [158] and have the potential to transform practice, either within the case(s) being studied or across similar situations where individuals can learn from the findings [168]. Beyond informing the adoption and implementation of synoptic reporting, we anticipate this study will: 1) add to the development and application of theoretical knowledge (particularly "systems" perspectives) in the growing KT field and 2) contribute to our knowledge base on the multi-level factors, and the relationships amongst factors in specific contexts, that influence implementation and use of

innovations in healthcare organizations. Both contributions are important to improving our understanding of implementation processes in clinical settings, and helping researchers, clinicians, and managers/administrators develop and implement ways to more effectively integrate innovations into routine clinical care. This is especially relevant in the present healthcare environment wherein new knowledge and technologies are growing and changing rapidly, and the treatment and management of many diseases are increasingly complex and multidisciplinary.

Table 4. Description of the three theoretical perspectives guiding the case study.

Construct / Factor	**Description**
Promoting Action on Research Implementation in Health Services (PARiHS)	
Evidence	"[K]nowledge derived from a variety of sources that has been subjected to testing and has found to be credible" [108]. Four sources of evidence are research, clinical experience, patient experience, and local information.
Context	The "environment or setting in which people receive health care services, or…the environment or setting in which the proposed change is to be implemented" [109]. Context consists of: • *Culture* manifests itself through the values, beliefs, and assumptions embedded in organizations and is reflected in "the way things are done around here" [109]. • *Leadership* "summarizes the nature of human relationships such that effective leadership gives rise to clear roles, effective teamwork, and effective organizational structures" [109]. • *Evaluation* includes performance monitoring and feedback at the individual, team, and system levels.
Facilitation	• A "technique by which one person makes things easier for others" [51]. Facilitation models range from *doing for others* to *enabling others*.

Table 4 continued.

Construct / Factor	Description
Organizational framework of innovation implementation	
Management support	Managers' commitment to the implementation process, including investments in quality implementation policies and practices.
Financial resource availability	The actual or potential resources that allow an organization or team adapt to, implement, and sustain change.
Implementation policies and practices	"[T]he formal strategies (i.e., the policies) the organization uses to put the innovation into use and the actions that follow from those strategies (i.e., the practices)" [50].
Implementation climate	"Employees' shared perceptions of the importance of innovation implementation within the organization" [112]. The extent to which employees view innovation use is "rewarded, supported, and expected within their organization" [68].
Innovation-values fit	"[T]he perceived fit between the innovation and professional or organizational values, competencies and mission" [50].
Champions	"Charismatic individuals with significant personal authority who identify with the innovation and throw their weight behind its adoption and implementation" [50].

Table 4 continued.

Construct / Factor	Description
*The need for systems change**	
Nature of knowledge	"The way in which participants (individuals) in the system understand the nature and characteristics of the new piece of knowledge and accept it" [17].
Local autonomy	The extent to which individuals, team, and the unit involved "can make informed, autonomous decisions about how they can use the new knowledge to improve outcomes" [17].
(Re)Negotiation	How individuals "negotiate and renegotiate relations with others (individuals, teams, internal, external relations) in their system" [17].
Resources	How individuals "attract necessary resources to sustain the changes/improvements in practice" [17]. Involvement of key stakeholders at various levels of the system is critical to controlling and attracting resources.

*In this recent theoretical paper, Kitson [17] critiqued the critical social science, action science, diffusion of innovations, practice development, management of innovations, and learning organizations and systems theories literature to explore the underlying assumptions and theories used to describe healthcare systems and how knowledge is translated into practice.

Table 5. Proposed key informants.

CASE*	**DESCRIPTION OF INFORMANTS**[†]
NSBSP	• 4-5 radiologists • 3-4 implementation personnel (leaders, team members)[‡] • 3 organizational members (e.g., managers/directors of relevant departments) • 2 executive- or funding-level decision-makers • 2 report end-users (e.g., surgeons, coders)
CCPP	• 4-5 gastroenterologists/general surgeons • 3-4 implementation personnel (leaders, team members)[‡] • 3 organizational members (e.g., managers/directors of relevant departments) • 2 executive- or funding-level decision-makers • 2 report end-users (e.g., surgeons, radiation oncologists, coders)
SSRTP	• 4-5 surgeons • 3-4 implementation personnel (leaders, team members)[‡] • 3 organizational members (e.g., managers/directors of relevant departments) • 2 executive- or funding-level decision-makers • 2 report end-users (e.g., radiation oncologists, coders)
Minimum number of key informants = 42-48	

*NSBSP = Nova Scotia Breast Screening Program; CCPP = Colon Cancer Prevention Program; SSRTP = Surgical Synoptic Reporting Tools Project.

[†]The specified number represents the minimal number of key informants per category.

[‡]Implementation personnel may be interviewed on several occasions (e.g., initial and follow-up interviews) depending on the case and data collected.

CHAPTER 3: RESULTS

The third chapter of this dissertation is the Results Chapter and is comprised of two sub-chapters.

Chapter 3.1 is a manuscript, published in Current Oncology, which presents the pilot study conducted for this research. The main aims of pilot study were to develop, trial, and refine (where needed) components of the study design and its data collection instruments.

The student, who is lead author (contributor) on the manuscript, has transferred copyright of this publication exclusively to Multimed Inc. The author, however, has retained a number of nonexclusive rights to the publication, as stated in the Authors Rights, including "[t]he right to include the article in full or in part in a thesis or dissertation" (see: http://www.current-oncology.com/index.php/oncology/about/submissions#authorRights). The citation for this publication is:

Urquhart R, Sargeant J, Porter GA. Factors related to the implementation and use of an innovation in cancer surgery. Curr Oncol, 18(6):271-279, 2011.

Chapter 3.2 provides a description of the final analysis and presents the study findings. Related to this chapter, Appendix F contains the final coding structure used in the analyses.

Chapter 3.1. Pilot Study (manuscript)

BACKGROUND

The operative report records details of a surgical procedure and findings, and thus documents information that is important to subsequent patient care and management. The traditional method of reporting findings from surgery is the narrative report, involving a descriptive free-text account of the procedure, the suspected or confirmed findings, and proposed treatment. Although report dictation is an important practice, a survey of academic general surgeons found that only 18% of general surgery programs provide training in this skill [214]. As medicine becomes increasingly multidisciplinary and technology-supported, several issues related to narrative reporting provide an impetus to change reporting mechanisms.

First, for patients with cancer, a clear and thorough recording of the surgical procedure and findings supports accurate diagnosis and staging, and therefore facilitates improved estimates of prognosis and postoperative treatment planning. The completion of a cancer operation is a unique singular point in time at which the surgeon has not only specific knowledge of the technical details of the procedure, but also detailed knowledge of important presentation, diagnostic, staging, and pre-surgical care elements of the patient's cancer journey. However, narrative reports inadequately and inconsistently provide the information required to understand the disease and to make informed patient care decisions [70, 84].

Second, much literature demonstrates that the quality of the surgical procedure is linked to outcomes for patients with cancer [215]. Surgical volume and surgeon training and specialization are associated with improved outcomes, but an understanding of the relationship between the surgical procedure and patient outcome

could be improved substantially with data on actual intraoperative processes. Yet, data on these processes are (in most jurisdictions) lacking, given that dictated reports do not consistently contain the data items of interest and do not permit efficient data capture or collection because chart reviews are required to gather the information. However, high-quality data on surgical processes are essential for optimal outcomes analyses and subsequent efforts to improve outcomes [216].

One solution to both issues—completeness of operative reports and availability of data on actual surgical processes—is to replace narrative reporting with electronic synoptic reporting. A synoptic report captures data items in a structured format and contains information critical for understanding the disease and the subsequent effects on patient care. Use of synoptic reporting has been shown to improve completeness and timeliness of pathology and operative reports for a variety of malignancies [69, 79, 84, 86, 87] and can efficiently generate data from the perioperative period [201].

The synoptic report is a complex innovation (new tool or practice) in cancer care, requiring fundamental shifts in physician behaviour and practice culture [128] and also changes in existing organizational processes and structures (for example, automated dictation systems, transcription procedures). Accordingly, successful implementation of synoptic reporting for cancer surgery requires surgeon engagement and adoption, and organizational support (for example, provision of infrastructure, workflow changes). Because knowledge translation researchers have focused largely on improving the uptake of evidence in individual clinicians [22], guidance on the multilevel (team, organization, system) factors affecting implementation processes in healthcare organizations is limited [50].

The objective of the present study was to identify the key multilevel factors influencing implementation and early use of a Web-based synoptic reporting tool for breast and colorectal cancer surgeries at two hospitals in Halifax, Nova Scotia. The implementation was part of a national initiative occurring in five provinces across Canada.

IMPLEMENTATION

Innovation

The surgical synoptic reporting tool implemented in Nova Scotia was the Web-based Surgical Medical Record (WebSMR) originally developed in Alberta (by Alberta Health Services and Softworks Group Inc., Edmonton, AB) [201] and adapted locally for this implementation. In WebSMR, information related to patient presentation (for example, symptomatology, diagnostic procedures), preoperative period (for example, investigations, use of preoperative safety checklist, neoadjuvant treatment), operative procedure (for example, technical details, intraoperative decision-making), and follow-up planning is divided into discrete fields, many of which are based on practice guidelines. Data are entered using drop-down menus, option buttons, and check boxes. Software characteristics include prefilled demographics, branching logic, smart navigation, and automated clinical staging calculations. Some sections contain text boxes to document additional information not captured in the individual fields. All details considered essential to the operative report are mandatory. Upon reviewing and submitting the report, an electronic signature is added, and the final synoptic operative report, presented in a "checklist" format, is ready for immediate placement in the patient's chart (with transcription and subsequent surgeon review

and sign-off no longer required). The final report is also automatically faxed to all involved in the patient's care (for example, the referring physician, surgeon's office, cancer centre, and family physician).

Initiative

In an attempt to capitalize on Alberta's synoptic reporting experiences [84, 86, 201], the Canadian Partnership Against Cancer funded a pan-Canadian pilot project to implement WebSMR for 4 disease sites (breast, colorectal, ovarian, head-and-neck) in five provinces (Alberta, Manitoba, Ontario, Quebec, Nova Scotia). The Nova Scotia project included breast and colorectal surgeries performed at two academic hospitals, which serve a population of approximately 400,000.

Implementation occurred over a 2.5-year time period and included establishment of national data standards for the two disease sites, interprovincial adaptation of the Alberta templates (data fields could be modified or added, but the national elements remained), integrating the WebSMR software into the complex provincial information technology (IT) environment, and developing knowledge translation and change management strategies to engage the relevant clinical and administrative communities. The provincial implementation team consisted of the project lead (surgical oncologist), a project coordinator, and an IT lead (part-time, hired October 2009).

Surgeon adoption of WebSMR was voluntary, but for the pilot project, the implementation team selected two diseases (breast and colorectal cancer) to whose treatment a defined number of surgeons (4 breast, 3 colorectal) was dedicated. These 7 surgeons were approached for inclusion in the pilot project, and all agreed to

participate. The implementation team hoped these surgeons would be "early adopters" and thus would lead the way for others as the project expanded. WebSMR was subsequently implemented in June 2011 at one community hospital; implementation of a head-and-neck cancer surgery template is also ongoing.

The knowledge translation and change management strategy involved inviting the lead of the Alberta initiative to visit Nova Scotia on two occasions to introduce the concept to surgeons (including presentations at general surgery rounds, oncology rounds, and a surgical oncology refresher course); a full-day "kick-off" meeting to bring together people from the Alberta initiative with representatives from each of the key provincial partners (for example, hospitals, provincial health IT services, cancer agency); small group sessions and one-on-one meetings with key partners to discuss the project and gather support; and customized training sessions (small group and one-on-one) for surgeons and administrative end users of the report (for example, health records personnel, coders). Moreover, the implementation team established three working groups (IT, information management and quality, and privacy) early in the project to discuss the impact the innovation would have on the Nova Scotia environment and to discuss issues related to its implementation. Members of these working groups included representatives from the clinical, research, and administrative communities (health records, coding and classification services, IT, and cancer registry, among others).

Evaluation

Case-study methodology [105] was used to study the implementation of WebSMR in Nova Scotia. Three existing frameworks informed development of the study, including choice of methods and analytic techniques:

1. Promoting Action on Research Implementation in Health Services framework [22]
2. Organizational framework of innovation implementation [50]
3. Framework for change in health service organizations [48]

These frameworks were selected based on our knowledge of the empirical and theoretical literature on research or innovation implementation and because of our interest in the multilevel factors affecting the implementation processes. Taken together, these frameworks present a range of multilevel influences on implementation and practice change. Our study was approved by the relevant institutional research ethics boards.

Data were collected using interviews, nonparticipant observation, document analysis, and a WebSMR audit. Semi-structured interviews [162] were conducted with key informants to gain an overall view of the implementation and in-depth perspectives on the experiences of the team members and the users with the implementation. Participants were asked to describe and discuss their views on the innovation, their role in the implementation or project, their experiences throughout implementation, and any specific barriers to or facilitators of implementation and use.

Nonparticipant observation [162] was used to examine the training sessions and initial surgeon reactions to viewing and using the tool. This observation provided the opportunity to collect descriptive and reflective data on the perspectives and

concerns of the surgeons related to the tool, how the data would be used (for example, performance feedback or reporting), and any barriers the surgeons perceived at the time of training. Documentary records were reviewed to gain a historical perspective on the initiative (for example, Why and how did the initiative begin? Who were the specific people or partners involved?) and to corroborate and augment evidence from the interviews and observations [105]. Where documentary evidence conflicted with findings from other sources, we attempted to resolve the contradictions through further inquiry (for example, follow-up with interviewees, contact with the national project team). Audits of WebSMR and the operating room scheduling systems at the various institutions were used to determine the proportions of surgeons trained on WebSMR who subsequently used the tool, and of eligible surgeries reported using WebSMR during the 6-month period from November 1, 2010, to April 30, 2011. (All surgeons were trained by end October 2010.)

All interviews were audio-recorded and transcribed verbatim. Interviews, field notes from the observation sessions, and documents were analyzed using the thematic analysis approach presented by Braun and Clarke [212], which involves coding the data and then collating the codes with the aim of generating, reviewing, and refining themes. This approach entails searching across the entire dataset to find "repeated patterns of meaning"; the resulting themes must be present throughout the dataset, not just in a single data item—that is, data from a single interview, even if highlighting an important concept or issue, would not be included in the final analysis.

We first conducted separate thematic analyses for each method; we then used cross-method analysis of themes to compare, contrast, and synthesize findings. Next, we used the analytic technique of explanation-building [105] to coalesce and integrate

the evidence, to develop a deeper understanding of the implementation process and of the multilevel factors that influenced implementation and use, and to link the data to theory and to the broader literature.

FINDINGS

WebSMR went "live" July 2010. Surgeons were trained and registered on the system in an incremental manner, providing a test period during which any technical difficulties (or other user issues) could be worked through and resolved before the system was expanded to other surgeons. Table 6 summarizes the implementation milestones.

The 9 key informants interviewed included 2 surgeons, 3 implementation team members, 2 managers of relevant organizational departments, and 2 report end users (1 clinician report user, 1 coder). Six training sessions were observed, and numerous documents (for example, the project plan, lessons learned, and national project scope and evaluation) were retrieved from the provincial and national project teams. From these evidence sources, 7 themes were identified: 5 appeared in all three sources, and 2 were present only in the interviews and documents (Tables 7 and 8). This finding was anticipated, because the purpose and "richness" of each method varied.

Innovation–Values Fit

The innovation aligned with the values, interests, and strategic directions of the relevant partners in the province (surgeons and clinicians, organizational departments, and the cancer agency, among others). Values related to the clinical utility of synoptic

reporting (for example, educational tool for residents and community surgeons, enhanced communication with oncologists, improved patient care) and to the broader benefits of improved data capture and quality monitoring and improvement. The promise of standardized data capture was a key facilitator to partner buy-in and subsequent WebSMR implementation. Many interviewees felt that synoptic reporting was another step toward improved performance monitoring and reporting.

Flexibility with the Innovation and Implementation

The implementation team demonstrated a high degree of flexibility throughout the planning and implementation processes. With respect to the innovation, the team recognized that the environment in Nova Scotia differed from that in other provinces, and they aligned the innovation's attributes to the local context. This alignment included integration of the WebSMR application with existing IT systems ("IT integration"); adaptation of the templates to local practice; and modifications to the amendment process and the final amended report.

The IT integration was a challenging task, but crucial to the functioning of the system and to buy-in from stakeholders. For example, integration permits the final report to be automatically sent to the patient's chart (electronic or paper) upon submission. Moreover, the team demonstrated flexibility and responsiveness during the implementation, and a capability to adapt and customize implementation policies and practices (for example, user training, support) to meet partner needs.

The Innovation Is Not Flawless

All interviewees discussed specific elements of the system or the report, or both, that created uncertainty or frustration (technical difficulties, relevance of data elements, length of final report, and amendment process, among others); they expected that many of these issues would be resolved through a process of feedback and revision. Barriers and facilitators were perceived to be largely related to the innovation itself (for example, IT challenges, utility for complex cases, customization of templates).

Similarly, the innovation itself is not static. Because scientific evidence and practice guidelines change, the templates will require ongoing review and revision. Currently, the review process is planned to occur every 6 months for each of the templates; national and provincial processes are both in place to support that schedule.

Strengthening the Implementation Climate

The team worked to improve the implementation climate by increasing the skill level for innovation use (for example, customized training for surgeons and for administrative end users, coding and review of test scenarios), by providing incentives for use (for example, continuing medical education credits for surgeons), and by removing obstacles to use (for example, ongoing 24/7 telephone support for surgeons, in-person support on the first day of use, purchasing of more computers for the operating theatres). Change management strategies commenced early in the planning process, involved a broad range of partners, and were tailored depending on needs and preferences. Importantly, engaged partners also helped to enhance the implementation climate by promoting the initiative with colleagues and by having

staff members attend meetings with the implementation team to increase their awareness and understanding of the initiative.

Resource Needs and Availability for Implementation

A number of resources were needed to implement WebSMR, including specific human resources (IT and clinical expertise) and additional IT infrastructure to integrate the tool with existing IT systems. Documentary evidence revealed that the team perceived the project to be underfunded from the IT and clinical perspectives. Nonetheless, the project lead secured the resources required to complete the work; in part, this was accomplished by diverting funds from the project lead's stipend to support the necessary IT work for the project's implementation. Team members did not necessarily perceive funding as the main threat to sustainability.

Partner Engagement

Early and ongoing contact with partners was viewed as a critical facilitator to implementation. The implementation team used various methods to engage partners throughout the duration of the project (for example, large- and small-group meetings, working groups, e-mail communication, peer contact). Discussions with partners began even before the project was formalized, which was helpful for gaining buy-in.

Surgeon Champion and Involvement

A surgeon is needed to champion the innovation to colleagues and to provide the clinical expertise to support a credible implementation process. This need appeared particularly pertinent in terms of garnering support from surgeons. The time

investment required to champion, and the need to be compensated accordingly, was also highlighted.

The audit revealed that all surgeons who were trained (4 breast, 3 colorectal) used WebSMR in the ensuing 6 months. Between November 2010 and April 2011, 91.2% of eligible breast surgeries and 58.0% of eligible colorectal cancer surgeries were reported using WebSMR.

DISCUSSION

The present study sought to identify the multilevel factors influencing implementation and early use of an innovation in surgical oncology practice. The factors identified demonstrate the complexity of implementation processes. We found that surgeon users believed in the utility of the innovation and that the innovation "fit" with individual values and interests, but that the successful implementation and early use of the innovation was affected by many factors external to the individual user. Factors such as alignment with professional group and organizational values, flexibility during implementation, partner engagement, resource needs and availability, surgeon championing, and implementation climate all relate to the work of the implementation team and of the organization itself and the larger system in which it operates. All of those factors were important for initial buy-in and subsequent implementation. People planning for, introducing, and leading change must therefore consider and act upon a broad range of inhibiting and facilitating factors in their attempts to embed a new practice into normal work routines.

Our findings are consistent with the literature on innovation implementation in health care. Research has demonstrated the importance of champions [44, 50, 53] and

of leadership and management support [22, 48, 50] to the success or failure of implementation efforts. In the present study, leadership was closely tied to many of the factors identified, including attainment of the necessary resources and funding to implement the innovation and establishment of a supportive implementation climate. Moreover, Kitson [17] suggested that innovation in health care is most effective when it involves key stakeholders, particularly as it relates to control of immediate physical resources, the immediate context, and the external environment. Early and ongoing involvement of partners, and the willingness and capacity of the implementation team to adapt the innovation to meet partner needs and expectations, was especially germane to the successful implementation of WebSMR within the provincial health infrastructure.

In fact, one of the biggest "lessons learned" was that each jurisdiction involved in the national pilot project was unique and, therefore, that there was "no one way" to implement WebSMR. Health IT infrastructure, for example, is quite different across provinces. Thus, tools and technologies implemented in one jurisdiction may require significant modification and customization if they are to be successfully implemented in other jurisdictions. Understanding this reality and planning appropriately (for example, allocating funds, acquiring expertise) is critical to supporting further roll-out of surgical synoptic reporting. For example, a greater appreciation of the extent and specifics of the IT resources required for WebSMR implementation early on would have allowed the team to navigate the IT challenges in a more timely fashion, speeding up implementation and reducing frustrations for both the implementation team and others involved in the project. In addition, although clinical leadership regarding specific aspects of the project (for example, template

content) was definable, an underappreciated and unfunded amount of more general clinical leadership ("flag-waving") was also required to push through many of the challenges during implementation.

As others have demonstrated, a strong implementation climate does not guarantee innovation use [68]. In the present study, we observed differences in WebSMR use between breast and colorectal cancer surgeons. Our evidence indicates that barriers to use are related mainly to aspects of the innovation itself, including technology issues, access to computers, and uncertainty about specific data fields. Those barriers raise two salient points:

- Use of the innovation must be as easy as what users currently do.
- Early users of the innovation must not only believe in its value, but be willing to use the system despite the inefficiencies and uncertainties encountered during implementation.

Nonetheless, those barriers were largely similar for both groups of surgeons. Thus, other factors may be affecting WebSMR use. During WebSMR implementation and training, colorectal cancer surgeons demonstrated interest in the capabilities related to standardized data capture (performance feedback, for instance), and yet their experiences with other projects in the province, which had promised similar capabilities, but had failed to meet expectations, led to scepticism about this one (see observation data in Table 8). Additional factors include a greater number of (real or perceived) technical details in colorectal procedures; organizational characteristics ("culture"), given that the breast and colorectal cancer surgeries are largely performed at two different institutions; and the socio-historical context of advocacy and improvement within the breast cancer community in Canada [217]. These factors

require further study and suggest that, to plan and intervene appropriately, leaders must understand the multiple contextual issues that help create the prevailing implementation climate.

One limitation of our study is the small number of participants interviewed, including only 2 surgeons (1 breast, 1 colorectal). Thus, it is possible that the sample is not representative of the people involved in the project, particularly the surgeons who are the key participants interacting with the innovation. Nonetheless, the 6 observation sessions also permitted data collection on attitudes and perspectives of surgeons about using the synoptic reporting tool, with many of the same issues and perspectives arising in both evidence sources and being repeated across surgeons. Furthermore, given the pilot nature of much of the work to date, we are unable to examine factors affecting the sustainability of this innovation in practice. Indeed, initial implementation success does not predict institutionalization [218]: many evidence-based practices have proved difficult to sustain beyond the initial pilot or implementation period [138]. In the present study, the promise of improved monitoring and reporting on surgical processes and outcomes facilitated the adoption and implementation of WebSMR. To demonstrate the value of the innovation, that capability must be realized in the short term if its use among colorectal cancer surgeons is to increase and if its institutionalization and expansion to other hospitals and disease sites is to be supported.

An improved understanding of the multilevel factors influencing the implementation and use of innovations is critical to planning and targeting effective change interventions in healthcare settings [39]. Not only do multiple factors, at multiple levels, influence the implementation of innovations, but the complexity of

the relationships between those factors requires thoughtful and rigourous study. Our findings will inform the study of additional cases of synoptic reporting implementation, enabling cross-case analyses and identification of higher-level themes that may be applied in similar settings and contexts.

Table 6. Timelines and key milestones of the surgical synoptic reporting tool implementation in Nova Scotia.

Timeline	*Milestone*
Apr–May 2008	Kick-off meeting for project, with Alberta surgical synoptic reporting team and Nova Scotia partners
	National meeting in Montreal, QC, with key decision-makers from participating provinces
May–Nov 2008	Development of project plan
	Engagement of partners through small-group meetings
	Establishment of 3 working groups [information technology (IT), quality/information management, privacy]
Feb–Dec 2009	IT "gap" analysis with visiting software vendor
	Funding delays
	Completion of privacy impact assessment and threat risk assessment
	Formal request for funding proposals to conduct the IT work identified by the gap analysis
	Hiring of part-time IT lead (October)
	Work to integrate provincial IT systems starts by end of year
Jan–Jun 2010	Continuation of IT integration work
	Intensive change-management focus as project nears "go-live" date
Jul–Aug 2010	System goes "live" (July)
	Training and initiation of a small number of surgeons
	Testing period and resolution of identified issues
Sep–Dec 2010	Training of all surgeons, initial adoption, and use
	Consensus on national data standards for surgical reporting[a]

[a] Adaptation or customization of disease site templates and work toward establishment of national data standards occurred throughout the first 2 years of the project.

Table 7. Seven themes, with representative quotations from the interview data.

Theme	*Representative interview data*
Innovation–values fit: synoptic reporting aligns with values, goals, interests, and strategic directions	
	"My preconceived notion [was that] it would be beneficial to those taking care of the patients and ultimately [to] the patients." (Surgeon 1)
	"I think for [many partners], they see the value of synoptic because it is a standardized format, everything is electronic ... being able to pull out and monitor progress and monitor the data, that was a big piece. Quality is a big piece of it, and that all fits within what they are doing now." (Team member 1)
Flexibility with the innovation and implementation	
	"I thought that, from a coding perspective, they were receptive to anything that we had to say, and we certainly had lots of one-on-ones with [the project lead] and said 'This is the challenge. This is what we think is missing. This is what we need to be clear on in terms of breast conservation versus mastectomy. This is how we code.' ... [The team was] more than receptive to take our concerns, our input, and then [to] offer solutions or feedback." (Manager 1)
	"When we thought things were [close to going live,] we pulled together the partners at each of the sites, [and] so we held meetings ... basically identifying, okay, what are their needs? ... What do they need from us to roll it out?" (Team member 1)
	"They were flexible. They were open to our questions and suggestions, concerns." (Manager 2)
The innovation is not flawless; it will require continual review and revisions	
	"One of the things I would like to see is, when we have the final printed report, that any field that has not had it entered, have that eliminated so that it won't be 7 or 8 pages long, it will be just 2 or 3 pages and that would crisp it up so nicely." (Surgeon 1)
	"For particularly complex cases, [WebSMR] bugs me because I can't describe that complex finding." (Surgeon 2)
Strengthening the implementation climate	
	"[In meetings with partners,] we went through what ... we had to do.... What are users that need to be trained in the end, and how do I train them. So, for example, some of them were one-on-one sessions, some of them were small group sessions.... The three different districts had different needs, and so it was just tailored to what they wanted." (Team member 1)
	"Before we engaged in the training, ... I was very cognizant that I didn't want to keep going and saying 'Okay, we are going to be on,' then 'We are going to be on,' then 'We are going to be on,' [and] so we in fact, with the exception of myself, we never ... told somebody they are going to be online and didn't have that. So, although it took a fair long time. ... there was never ... a date given and then [someone] saying 'Okay, it is not going to be this; it is going to be 2 months from now.' And, similarly, we made sure that the training occurred very close to when they were going to start." (Team member 3)

Resource needs and availability for implementation
"[Meeting the needs of our partners] required extra interfaces, and it required interfaces that had to be built that were outside of the actual scope, but were still required. And so there was a lot of fighting with that, you know, to get that and [to get] an IT resource." (Team member 1)
"I think that ... what is purported as the advantage of this is also the problem: The advantage being that this is grassroots, that it is being driven by the surgeon. Unfortunately, I think ... there [are] not a whole lot of things that will work this way, and you know, there [are] only so many hours in the day." [Team Member #3]
Partner engagement: early and ongoing contact with partners was key to implementation[a]
"We ... received an invite to attend a meeting to discuss the project.... We received some education at [that meeting] about what the project entailed, and we were all asked at that time about what our experience was, or what ... we bring to the table in terms of how it was relevant, and how we would support then the implementation of it." (Manager 1)
"I think the fact that we listened to, met the requirements of what our partners said—that was probably a huge thing of why they were so helpful to us. ... Without that engagement, nothing would have happened at all." (Team member 1)
Surgeon champion and involvement[a]
"You need a clinician who can give ... time, who can champion ... and [who] gets compensated accordingly." (Team member 1)
"[Leading this project] is a ridiculous amount of time.... But at the same time, ... there needs to be a clinical context and ... somebody with a more clinical background." (Team member 3)

[a] Theme present in the interview and documentary data only (not observation data).

Table 8. Findings from non-participant observation and documentary evidence.

Evidence type	*Findings by theme*
Nonparticipant observation (*n*=6)	
	Innovation–values fit: synoptic reporting aligns with values, goals, interests, and strategic directions
	Surgeons indicated willingness to use innovation; most stated that they saw value in new tool, but the key was to make the system as easy to use as existing practice
	Most surgeons expressed interest in standardized data capture and the implications for performance monitoring and research; some questioned who "owned" the data; others expressed skepticism related to promises from other initiatives of similar capabilities that had not yet materialized
	Flexibility with the innovation and implementation
	Training sessions were customized to meet the particular surgeon's or department's needs: some sessions were one-on-one, others were small-group; all occurred on the surgeon's "turf"
	The innovation is not flawless; it will require continual review and revisions
	All surgeons had some questions related to specific data elements and their relevance to the operative report; most also suggested at least 1 or 2 elements that they felt should be in the template
	Strengthening the implementation climate
	Trainers were responsive to surgeons' questions and requests regarding the templates or its elements, minimizing initial issues and concerns
	The information technology (IT) lead joined all training sessions, either in person or by teleconference; his presence was helpful in addressing technical issues and concerns
	Small-group training appeared to work well in terms of contributing a clinical perspective, because training was conducted by nonclinical trainers—for example, initial skepticism concerning particular elements could be talked through with colleagues and (sometimes) resolved
	Resource needs and availability for implementation
	Ongoing 24/7 technical support will be required during WebSMR rollout to minimize technology-related challenges
	Additional tools and resources are needed to realize the potential of this system in terms of data mining and performance monitoring and feedback
Documentary evidence	
	Innovation–values fit: synoptic reporting aligns with values, goals, interests, and strategic directions
	The national evaluation found that surgeons using the innovation believe that synoptic reporting better prepared them for surgery and that the tool will revolutionize data capture and lead to improved quality of care and patient outcomes

	The main facilitator to adoption was the prospect of outcomes reporting and data mining; yet, one of the main project challenges was the lack of tools and resources for measuring and reporting outcomes
Flexibility with the innovation and implementation	
	Each province's template was customized for local implementation—a step that was crucial for local buy-in and adoption
	Accepting that each jurisdiction was unique and customizing the tool and training to that jurisdiction was critical to the implementation and will remain so with further rollout
The innovation is not flawless; it will require continual review and revisions	
	Barriers to adoption and use were largely related to the innovation itself and included ease of access and use, IT-related challenges (forgotten passwords, login difficulties), complex cases, and complexity or length of the tool
Strengthening the implementation climate	
	Change management strategies occurred broadly (not just with surgeons) and was tailored depending on user needs and preferences
	All provinces emphasized that training should not be underestimated; the more training, the better the implementation experience
	Facilitators to adoption and use included customization of the final report for end users and system access improvements (for example, putting laptops in operating theatres)
Resource needs and availability for implementation	
	Nationally, a key success factor to WebSMR deployment was having key expert (IT) resources
	The Nova Scotia team perceived that the project was underfunded from both the IT and the project (clinical) lead perspectives; the project lead diverted funds from his stipend to support the necessary IT work for the project's implementation
Partner engagement: early and ongoing contact with partners was key to implementation	
	The early engagement of partners, especially surgeons, was viewed as a critical success factor for implementation
	At all pilot sites, implementation required engagement with many different stakeholders
	The innovation's limits and abilities should be defined from IT, information management, and privacy perspectives, and not just surgeon perspectives
Surgeon champion and involvement	
	Surgeon involvement and leadership was a critical factor for success; included were surgeon enthusiasm and a willingness to work together on a national scale to create pan-Canadian data standards and templates

Chapter 3.2. Study findings

DESCRIPTION OF STUDY CONDUCT AND ANALYSIS

Pilot Study

A pilot study was carried out on the SSRTP case, involving nine key informant interviews, observation of six SRT training sessions, and document analysis (see Chapter 3.1). The objectives of the pilot study were to: determine the suitability of the interview guide; test the recruitment process; and develop a coding framework for the study. The pilot did result in minor modifications to the interview guide, specifically the addition of several probes (e.g., engaging stakeholders, adapting the SRT). Otherwise, the same data collection instruments were used in the pilot and final study. The recruitment process was not altered with pilot work. The coding framework was developed using both deductive and inductive concepts. The deductive component was related to the theoretical perspectives and interview guides. The inductive component was directly related to the collected data, with codes based on the language encountered in the interviews and documents (e.g., legacy infrastructure).

The pilot study also provided considerable insight into the issues being studied. Analysis of pilot data led to one important change in study design: namely, the inclusion of a third theoretical perspective. Specifically, a "systems thinking" perspective [17] was incorporated due to its focus on the relational aspects of SRT implementation as well as the complexity of implementation processes, both of which were observed in the pilot data. Thus, both the theoretical perspectives and empirical observations from the pilot work informed the final research design. The SSRTP case included the pilot data in the final analysis, with all pilot data integrated in the final dataset and treated in the same manner as the data collected afterward.

Data Collection

Key informants were purposefully sampled based on their involvement in the implementation efforts (either directly or indirectly) and/or their use of (or refusal to use) the SRTs. Given that the researcher was familiar with the cases, she sought key informants whom she perceived to be 'information-rich' and to have played differing roles in the cases. Snowball sampling was also used: the researcher asked implementation team members whether there were other individuals with whom it would be valuable to speak. All potential informants were initially contacted via email or telephone. If there was no response, a second attempt was made by email or telephone call approximately one week later. If there was no response after two attempts, a third and final attempt was made via telephone. The same approach was used to contact surgeons for observation sessions.

Documents were identified and accessed through a number of mechanisms: those related to each case were primarily accessed through interviews and follow-up requests with implementation team members; those related to the Nova Scotia healthcare system and relevant national initiatives were accessed primarily through Internet searches; and those related to the SSRTP case and its national organization and coordination were accessed through the researcher's relationship with the Canadian Partnership Against Cancer and its pan-Canadian Synoptic Reporting Tools Project. In several instances, key informants other than implementation team members identified and provided relevant documents. Access to the SRTs was gained from implementation team members. Specifically, an implementation team member in each case demonstrated use of the SRT in his/her office and provided the researcher with sample end reports.

Analysis

Analysis commenced with the first data collected. The researcher constructed detailed case descriptions for each case to describe the history and context of the initiative, the organization of the initiative and its key activities, and the SRT that was implemented (see Appendices B-D).

The three cases were treated as separate studies and analysed independently. A thematic analysis was conducted for each case [212], involving coding, collating codes, and generating, reviewing, and refining themes. The coding framework developed during the pilot study was subsequently refined and used for all analyses. Modifications to the framework were minor and entailed collapsing initial codes into a larger code that denoted similar concepts and adding a small number of codes related to new system-level concepts that arose. Refinement to the coding framework was completed after approximately 6 additional interviews beyond the pilot study were coded. At this point, no new concepts emerged and the researcher perceived the framework was inclusive of all concepts (comprehensive), yet manageable in terms of number of codes to apply and organize the data (practical).

All interview transcripts and field notes were coded line-by-line in their entirety. This was performed manually rather than with the assistance of data management software due to the researcher's prior comfort and experience with manual coding. The data were coded by labeling the code in the margin of a hard copy of the transcript; questions or brief reflections about the data were also noted in the margins. During the pilot study, documents were coded similarly to interview transcripts and field notes. However, following the pilot, coding was not performed on documents in a line-by-line manner. Rather, documents were read (and re-read) to

identify contextual/historical data, record concepts/codes and link them to specific document excerpts, and triangulate findings from other sources (i.e., interviews and observation).

Codes were collapsed into categories (i.e., related concepts were combined) through an iterative process that included: critically analyzing each concept and category to identify similar and distinct concepts and categories, linking the same concepts and categories across all the data collected, reviewing the research questions and re-reading the study protocol, reviewing the theoretical perspectives and re-reading the publications associated with those frameworks, consulting several case study methodology and general qualitative research texts (which guided the entire analytic process) [105, 161, 162, 164, 210], and discussions with members of the research team.

An analogous iterative process was performed to identify themes. Refinement and delineation of the main themes involved re-examining the data and categories associated with each theme, the sources of data for each theme and triangulation across sources, and each theme to see if the concepts and categories associated with that theme were conceptually distinct from other themes. The researcher also moved back and forth between the case-specific data and the theoretical perspectives as well as other literature sources [16, 21, 39, 116, 219]. This moving back and forth (reviewing categorical groupings, reading and rereading literature, and then reviewing the groupings again) was imperative to developing a deeper understanding of what occurred in each case and to considering and questioning alternative explanations for the findings [105]. While three specific theoretical perspectives helped guide the study, the researcher made concerted efforts to seek out conflicting evidence in the

data and to examine whether other factors were key facilitators or enablers of SRT implementation and use, including those at other 'levels' of the system (e.g., individual-level factors, such as those described in psychological and behavioural theories [12, 220, 221]). Numerous criteria were considered throughout analysis of each case to facilitate a credible and coherent analysis (see Table 9).

Detailed reflections (or 'memos') were kept throughout analysis. The reflections consisted of information related to the concepts and categories, possible relationships between concepts and categories, and evolving interpretations. They also linked particular insights and interpretations to the conceptual frameworks and other literature. Emergent findings were discussed on multiple occasions with members of the research team to assist the analytic process and questioning of the data.

The final stage of analysis was a cross-case analysis to compare and contrast the themes across cases. Each similar theme was examined in regards to the 'direction' the theme took in the context of each case. For instance, one overarching theme – or key factor – may have been a facilitator in one case due to its presence, but a barrier in another case due to its absence (e.g., the presence of clinical champions may have enabled implementation in one case, whereas the absence of clinical champions may have impeded implementation in another case). Divergent themes were examined in regards to their specific importance to the case/context.

Rigour

Numerous methods were used during research design, data collection, and analysis to increase the rigour of this study. These included:

1. Use of multiple theoretical perspectives to guide research design, analyses, and interpretation, helping to build a wider explanation of the phenomenon and a means of exploring a range of plausible theoretical interpretations [222-224].
2. Strategic selection of three cases to support greater confidence in findings. This strategy included selecting cases based on replication logic [105] and to provide good learning opportunities [161].
3. Pilot work to refine data collection and analyses processes, including the development of a coding framework and refinement of interview guides, and inform the final study design. Use of pilot data, in addition to theoretical perspectives, helped to ensure that the final study reflected questions relevant to contemporary cases as well as significant theoretical concepts/issues [105].
4. Interview guides that included questions/probes reflective of all constructs present in the three theoretical perspectives, but questions were open-ended to minimize non-biased responses and to elicit a variety of perspectives and viewpoints.
5. Use of key informants across four units of analysis (individual user, implementation team, organization, and larger system) and multiple data collection methods. This allowed researchers to uncover converging findings across informants, units of analysis, and data collection methods (i.e., triangulation) [223, 224].
6. A single researcher to conduct all interviews, which were audio-recorded and transcribed verbatim. The researcher audited the transcripts by listening to the audio-recording while concurrently reading the transcript to ensure accuracy of transcription.

7. Considering other plausible explanations for the findings and seeking out additional evidence where inconsistencies or contradictions existed. Both helped minimize the confirmation of preconceived ideas [105, 174] and the possibility that the researcher selectively described and explained the events to support a favoured theory or perspective.
8. Maintaining a case study database [105], which consisted of a complete set of all the data collected for each case (interview audiotapes and transcripts, field notes from interviews and observations, and documents) and all records related to the treatment of the data during the analytic process. The latter consists of paper and electronic files to demonstrate which codes were collapsed into categories, how categories were refined and collapsed into broader themes, and refinement of themes.
9. Maintaining a chain of evidence [105] throughout data analysis (often referred to as an audit trail [105]). This involved documenting an explicit trail that identified the links between the data collected and the interpretations/conclusions.
10. Member checking to verify specific factual data and to ask participants for their responses/reactions to findings. This technique was employed selectively when the researcher wished to confirm factual data and to verify the credibility of her interpretations surrounding particular issues (most often when these issues might be perceived as negative by those involved in the case). The format for member checking ranged from a brief email/phone call to an in-person meeting to provision of a written summary of findings.
11. Multiple meetings/discussions of the research team to review the analytic procedures and discuss and question the findings.

FINDINGS

Table 10 presents key informant participation for this study by case and unit of analysis. Six individuals invited to partake in the NSBSP case did not respond; one individual invited to partake in the CCPP case did not respond; and no individuals invited to partake in the SSRTP did not respond. However, one surgeon in the SSRTP case refused to be observed during training. All individuals who did not respond were clinician users. Two informants participated in two interviews (e.g., initial and follow-up interviews) due to the length of the interview and timing of data collection. All interviews were conducted in-person in the key informant's office, except for four interviews in community settings that were conducted via telephone since they could not be arranged in-person. All interviews for the pilot study were conducted between November-December 2010; all ensuing interviews were conducted between August 2011-February 2012. Table 11 presents the documents reviewed for each case.

The following sub-sections present i) the findings of each case and ii) the cross-case analysis. All quotations and data excerpts presented are illustrative of the influencing factor. The individual quotations and data excerpts did not drive the factor's identification; rather, all factors were identified and elucidated through the analytic process described above.

Case Findings: Key Multi-Level Factors that Influenced SRT Implementation and Use in Each Case

Case A: Nova Scotia Breast Screening Program

Case History

In Nova Scotia, synoptic mammography reporting began in the mid-1980s at one academic hospital. The impetus was to develop a database (Diagnostic Reporting System; DRS) that facilitated radiologists' abilities to track patients subsequent to suspicious imaging to ensure they received appropriate and timely follow-up care. The initiative was started as a research project, with funds from a local research foundation to purchase computing software and hardware. One individual developed the DRS with self-taught computing skills. Within a few years, it was implemented at a nearby community hospital. At the time, the concept of *synoptic reporting* was unprecedented, with the developer having no knowledge of a similar system nationally or internationally.

Congruent with accumulating evidence in the medical literature and the introduction of population-based breast cancer screening programs in other Canadian provinces, in 1991, the provincial Department of Health and Wellness (DoHW; formerly Department of Health) established the NSBSP as a provincial program. The program developed and implemented a similar database (Mammography Information System; MIS) to report and capture data on all screening mammographies in the province. The NSBSP also became the host of the DRS, essentially creating one database to capture all mammography (screening and diagnostic) in Nova Scotia.

Given the role of provincial programs in the healthcare system (see Appendix A), the NSBSP could not mandate implementation and use of these synoptic reporting

systems. Although the screening program is provincial in scope, expansion of the SRTs across the province's hospitals has occurred in a gradual, largely unplanned, manner without an organized project team *per se* to oversee their implementation. Nonetheless, implementation has been primarily led and carried out by the program's clinical and managerial leadership and a technical support person.

By October 2008, all hospitals in the province had implemented the MIS. This was in response to a DoHW policy, established several years earlier in 2005, that mammography fees would not be paid unless an institution was accredited through the Canadian Association of Radiologists (CAR) Mammography Accreditation Program. Subsequently, all institutions in the province that conducted screening mammography needed to be CAR accredited, which includes standards around performance monitoring and quality assurance. In the years that followed, the DoHW strongly advised all institutions providing screening mammography to use the MIS, in keeping with these standards. By 2010, the DRS had been implemented at all diagnostic imaging departments in the province that perform mammography, yet radiologists in three health districts continue to refuse to use this system to report diagnostic mammography, regardless of the 2005 provincial policy.

The capabilities and functions of the MIS and DRS position the systems somewhere in the middle of the evolution of synoptic reporting technology [69]. The end report that is generated is not synoptic in nature; rather, the report consists of a series of standardized paragraphs, separated by structured headings, which reads similar to a traditional narrative report.

Influencing Factors

Nine key factors influenced the implementation and use of the SRTs. These factors existed at the interpersonal, organizational, and system levels. One factor related to characteristics of the SRT itself and consequently was conceptualized as existing at the level of the *innovation* [116]. Figure 1 depicts the key factors and relationships between factors.

Interpersonal Level

1. Stakeholder involvement: high in the beginning, low during expansion. Key stakeholders, including radiologists who performed mammography and hospital administrators, were highly involved in early development and implementation of the DRS. Radiologists at the hospital wherein the tool was developed worked closely with the developer to create the content of the report and ensure the final report flowed in a logical manner.

> *Meeting a lot with radiologists, looking at their report[s] … Constant feedback, back and forth, literally spending [our] time down there with them.* [Team member #3]

This early involvement was perceived to have fostered a sense of ownership amongst radiologists at the hospital where it was developed, which continues to host the SRTs. Despite the involvement of key stakeholders early on, expansion of the SRTs across the province has not similarly involved high levels of stakeholder involvement. This was evident in interviews with key informants who were not involved in the initial development and implementation, at all levels of the system, with most of these individuals unable to speak in any depth about the SRTs.

Radiologists who do not use the DRS overwhelming expressed that low stakeholder involvement is a barrier to SRT use.

> *They get out there and realize that no one else likes it because no one was involved in the development.* [Physician #2]

> Ongoing engagement of physicians and RNs in the community is difficult. It is a challenge to keep physicians supporting the program. [Excerpt, Provincial Health Services Operational Review Final Report; RNs = registered nurses]

Key informants also discussed their ability to provide feedback on the SRTs and the extent to which feedback was heeded. Generally, the feedback process was informal, with individuals contacting a member of the implementation team to suggest changes. The NSBSP has taken note of feedback and incorporated feedback when the suggested changes were considered advantageous.

> *They wanted a number of changes before they would use [the DRS]. We made the ones that it was agreed would be beneficial to the program.* [Team member #2]

However, there has been little communication to users to articulate the plan for changes or to explain why the requested changes may not have been incorporated.

> *We could write in and suggest changes, … but they didn't get implemented because of issues with funding, access to the software, you know? … But I didn't understand how the system worked, so I couldn't understand why when I asked for something, it didn't happen.* [Organizational member #1]

Interviews with implementation team members and documentary sources indicated that acting on feedback has often been related to resources and the capacity to

actually make the changes; these individuals perceived the inability to take action as harmful to SRT acceptance and use.

> *We didn't have the time or the resources to even pull out data because that is money for us. ... As with anything else, there was no money.* [Team member #1]

2. Managing the change process: addressing barriers, communicating, and providing training and support. The implementation of a new tool in practice requires that people change existing ways of doing things. In the NSBSP, managing the people and processes involved in the change process was key to SRT implementation and use across the province. This involved dealing with the resistance that change often brings, providing people with the knowledge and skills to use the SRTs, and articulating the value of the particular tools and how they fit into the 'bigger picture.'

Radiologists, implementation team members, and organizational members perceived change management practices to be sub-optimal in several ways. Communication about the SRTs, their implementation, and subsequent revisions was lacking (several informants stated they received no communication whatsoever about the tools prior to their implementation). While SRT development and implementation was initially a grassroots endeavour, coming directly from radiologists themselves (i.e., "bottom-up"), expansion across the province was often viewed as being a "top-down" approach with users being *told* what to do.

> *This is the first that I have heard of it.* [Physician #4, on being asked about the revised DRS that the screening program was implementing in late 2012]

Any time you want to develop any type of new system, anywhere, you have to first get the people that you want to use the system to be involved before you roll it out. … This was a case of some clipboard holder comes to our hospital and says 'here it is, you have got to use it.' That essentially was the message that we were getting, which is bullshit. You can't be doing that. [Physician #3]

Training and support processes were in place during implementation, with three individuals typically spending about two days on site to train radiologists, technologists, and clerical staff. Following the site visit, there was no formal support process in place but radiologists were provided telephone numbers to a number of individuals (NSBSP staff, a senior radiologist) who could provide advice and guidance. Users described the implementation experience (training, support) and change process as challenging and an obstacle to use.

At first, it was a pain in the butt … we went through a lot of growing pains. [Organizational member #3]

The initial frustration was such that it was a deal breaker. [Physician #4]

Radiologists perceived numerous barriers to using the tools in practice, including a big learning curve, general resistance to change, and specific aspects of the tools (e.g., a lack of integration with existing IT systems and discontent with the final report format). Many of these perceived barriers could have been addressed by improved change management practices. This includes conveying to users how the SRTs fit into the 'bigger picture' of improving breast health/care in Nova Scotia.

I think that part of the problem was that people didn't really understand how it fit into the grand scheme of things and, uhm, perhaps if [the implementation

team] had been able to get that concept across better, [radiologists] would have been more accepting. [Physician #1]

However, implementation team members articulated they had no resources to adequately perform change management, including the provision of high quality training and support and professional incentives to use the SRT. They also perceived that one critical element to sustaining and expanding SRT use is adequate resources, including time, for training.

We didn't provide a lot of training … We just didn't have any resources. [Team member #2]

Organizational Level

3. Monitoring and feedback mechanisms help demonstrate value and maintain support. Through use of the SRTs and their databases, the NSBSP has established ongoing monitoring and feedback mechanisms to continually demonstrate the value of these tools and their program for women in Nova Scotia and their care providers.

What you do, you have got to show it is being effective, and even if you can show it in little bits, then you can build on that and build on that and build on that. [Team member #1]

… a core biopsy program was started to coincide with the program start in June 1991. Database development has permitted tracking these examinations. … the core biopsy program in Nova Scotia has made positive impacts on reducing wait times, hospital stays and physician services. It has made a huge impact in greatly decreasing benign breast surgeries … Nova Scotia has

achieved the lowest Benign:Malignant breast surgery rate in the country. [Excerpt, 2011 Annual Report]

The program provides evaluation and performance reports for multiple audiences, including the public, district health authorities/hospitals, and individual users (both radiologists and technologists). It also presents and publishes its evaluation and research efforts in traditional academic forums. These monitoring and feedback mechanisms have been instrumental to informing policy and funding decisions (e.g., eliminating teaching of self-breast examination, reversing funding cuts for services for women aged 40-50, decreasing the number of mobile screening vans), maintaining administrative support at the system level, and acquiring resources to improve their program and update/refine the SRTs.

> Providing the districts with these quarterly reports has resulted in a significant reduction of wait times over the past year in every district. The wait time for "Abnormal Screen to Resolution without tissue biopsy" is now below the Canadian target of 35 days for the first time. This value which was at 56 days one year ago has dropped to 31 days. [Excerpt, 2011 Annual Report]

> *The [Department of Health] wanted this to be successful, and very early on we showed success. … We were showing the tremendous benefit [of] core biopsy by decreasing surgery, in the first year. … It was like 60% of the surgery was malignant if you had a core. If you didn't, it was 25% and that was actually with the first report. And so, of course, that was very powerful to government, to other people so, so they were supportive and they wanted us to carry on without changing.* [Team member #1]

4. A strong quality improvement culture. Both interview and documentary data suggest that the NSBSP has a strong culture of innovation, evaluation, accountability, and efficiency, with a small staff of extremely committed individuals. The program is viewed as a national leader, being the first in Canada to develop and implement SRTs as well as many other innovations (e.g., physician-assisted navigation [225], Pink Rose Project). Piloting innovations and continuously evaluating/improving them (i.e., plan, do, study, act) has become a way of doing things.

> Quality is the key word for successful breast cancer screening. Without a reliable database, the organization is extremely difficult. [Excerpt, 2011 Annual Report]

> The program is considered to be on the leading edge and a credit to Nova Scotia. It is described as a well organized program that has shown leadership nationally and which benefits the population overall. [Document excerpt, Provincial Health Services Operational Review Final Report]

The program is especially protective over its data and has retained ownership of the data, unlike other provincial programs. This is a consequence of both history (the program owned the data from the beginning, before development of the provincial program model/structure) and strong leaders, who have cogently maintained to the DoHW their desire that the data not become the property of the DoHW. Their concerns relate to maintaining privacy and integrity of the data and ensuring appropriate use of the data.

The monitoring will be by the [program]. Uhm, you know, that is an issue with the [Department of Health], they want to be pulling out all the data. … What is in the box is our program, we deal with it. They look after the box if they want, but we do what is in the box. [Team member #1]

Interview data indicated that those 'outside' of the program have perceived this strong culture as exclusive, with limited concern for others' opinions and practices. Subsequently, the culture has been a large enabler of SRT development and implementation, but has also impeded implementation and use in some health districts.

Nova Scotia Breast Screening clinic is one of the most paternalistic organizations in the country … it is my way or the highway. 'We are smarter than you. Don't think. Just do what we tell you to do.' So that type of attitude does not get anywhere when they are trying to implement new systems. It doesn't. [Physician #2]

5. Consistent, effective leadership. SRT implementation has been led by a small, consistent group of individuals whom have worked together for more than two decades, including the clinical leaders and the initial developer. These leaders are highly respected by staff, colleagues, and system administrators. Importantly, they have cultivated and reinforced the predominant culture by establishing a clear vision for improvement through monitoring and evaluation and building a small staff committed to executing that vision.

To get things done, you need a small cohesive group. You need a vision, an absolute vision, you need hard work, you need an eye for opportunity and

> *data, data, data, and of course integrity. In everything that we have done, there has been a reason for doing it. You don't do it just because, you don't do it for self interest, … [We've] been very careful about that.* [Team member #1]

Interview data revealed a number of power relations over the course of the program's history, often related to issues surrounding the program's leadership and governance (e.g., others wanting control of the program and/or its resources). Nonetheless, the leadership has remained constant, with leaders demonstrating the ability to get work done. Indeed, despite considerable resource (time and funding) constraints, the program has acquired the necessary resources and expertise to significantly upgrade the SRTs and support their implementation in most districts.

> Currently, limited financial resources, outgrown infrastructure, insufficient program management capacity, and lack of administrative resources are key operational challenges. … It must be emphasized, however, that the NSBSP provides an extremely good service on a relatively small budget. [Document excerpt, Provincial Health Services Operational Review Final Report]

6. Insufficient resources for SRT development, implementation, and expansion. The interview and documentary data clearly demonstrated that few resources were available for SRT development and implementation. This included a lack of dedicated time, IT expertise/skills, and funding. Certainly, the implementation team felt that many aspects of SRT development and implementation were negatively impacted by a lack of resources. Development of the SRTs was described as "piecemeal" due to

lack of resources, and expansion across the province has been highly dependent on IT expertise and support.

> *It was spending time learning the data structure and the commands to write queries and writing code and the environment for Unix … there [were] no other resources, it was really a one-man show at the time.* [Team member #3, on initial development]

> *Synoptic reporting … the rollout has taken a long time because of the not having a support person.* [Team member #1]

Although the program operations are funded by the DoHW, documents revealed that it receives much additional funding from external organizations (e.g., granting agencies, foundations, federal departments), including funds to update the SRTs, develop synoptic templates for other imaging modalities, and develop/carry out improved change management strategies for a future implementation of a substantially revised DRS (planned for late 2012/2013). Substantial revisions to the DRS were perceived necessary to update aging technology, broaden the program's reporting and analytic capabilities, and provide functions requested by end users (e.g., voice recognition software). As stated above, using data from the SRTs to demonstrate the value of their program has been key to attracting resources.

> *As we fed data to Health Canada, then they would give us money to do certain other things and in time it became clear to Health Canada that we really do have quite an amazing database and it is things other programs would want, I suppose. So … we asked for money to, uh, do synoptic reporting for MRI. … Health Canada paid for that, but that is because of other things we*

demonstrated. We have demonstrated the value [of our work]. [Team member #1]

7. Clinical and administrative champions facilitate SRT implementation.

Implementation team members perceived the existence of champions for SRTs, including clinical and administrative champions, had positively contributed to SRT implementation and use. They cited numerous 'provincial' champions across the province, particularly in the two health regions wherein the SRTs were first implemented, and felt these individuals were instrumental to achieving buy-in and support for implementation.

Administratively, we absolutely did [have champions]. We have … the head of diagnostic … [and] hospital administrators who saw [synoptic reporting] as a very positive thing. [Team member #1]

There was a perceived need for local innovation champions, particularly radiologists. Implementation team members indicated that the existence of local champions was the biggest factor for radiologist buy-in and use. Where radiologists wanted the system locally and championed/supported its use, implementation went well. Conversely, the lack of a local champion was perceived to impede implementation and use. Related to this, at some institutions, respected senior colleagues who resisted the SRT were perceived to influence younger colleagues' (who had used the SRT in their training) willingness to use it.

[We] need champions at the districts, especially rads … the biggest factor for radiologists, if local leaders wanted the system and supported it, it went well. [Team member #2]

Organizational and System Levels

8. Administrative and managerial support are critical to enabling and/or impeding implementation progress. The program has had a very good relationship with system and hospital administrators, particularly senior-level executives at the DoHW who were viewed as particularly supportive. Indeed, it was the DoHW's policy – and subsequent enactment of that policy – that led all institutions to use the MIS. Interestingly, key informants at the healthcare system level were supportive of SRT implementation, but clearly had little in-depth knowledge about the systems or their use.

> *All government levels were supportive, Liberals, New Democrats, you know because one started it and one developed it and, you know, they all supported it.* [Team member #1]

> DOH is seen as committed to, supportive of, and involved in the NSBSP. [Excerpt, Provincial Health Services Operational Review Final Report; DOH = Department of Health]

Department heads who saw the value of the SRTs played a key role in convincing radiologists to use the tools. While departmental managers may not have had positional authority in regards to radiologists' use of SRTs, their support for the tools, or lack thereof, considerably impacted the implementation experience.

> *In [Organization X], I was the boss, so we used it and there was no choice. Uhm, I felt that if we were to be part of the program we have to use this. … In general the people there bought in very well to it, but I think it is mainly because they didn't know there was a choice. I didn't tell them there was a*

choice. 'This is how it is. If you are going to do mammo, this is how it goes.' [Organizational member #1]

We had issues in [District X] … and it was basically around [the manager]. I mean she just wasn't doing her thing, she wasn't doing her homework or what she was supposed to be doing. She was terribly negative and … we had to go through [her boss] many times to get things sorted out. So that was an interesting, uh, an eye opener to me, that the manager can really affect things big time. [Team member #1]

Innovation Level

9. The innovation's attributes influence users' willingness to use the SRT.

Characteristics of the SRTs undoubtedly influenced SRT implementation and use. Specifically, complexity/simplicity of the input system and end report (e.g., ease of use), the relative advantage the tool has over existing practices, and the extent to which the tool is consistent with individuals', departments', and institutions' values, interests, and needs (i.e., compatibility) all contributed to individuals' perceptions of the SRTs and their willingness to implement and use them.

Some organizational members and radiologists, particularly those who were familiar with the system and had used it for more than a decade, stated the SRTs were user-friendly and faster than dictating reports.

As far as I can remember, from a technical point of view we really found it user friendly and really good. [Organizational member #3]

Though the DRS has undergone several major updates over time, radiologists who were not using this SRT did not find it user-friendly and had many issues with the technology: e.g., the tool was perceived to make their job more difficult, it could not accommodate different imaging modalities (e.g., ultrasound), and it could not easily report on multiple lesions. These radiologists did not view the current tool as being advantageous over current reporting practices. One particular issue that nearly every key informant, outside of the implementation team, discussed was the end report that was generated. This report was perceived as inadequate and confusing to review, with key informants from multiple levels of the system (radiologists, organizational members, and system members) stating they did not view it as a true synoptic report.

> *Whatever system is out there it can't make our job more difficult, the report that comes out has to be the same or better, not worse, uh and the people that are reading those reports have to understand what we are saying and in this case none of those are true.* [Physician #3]

Those who support and use the SRTs do so largely because the tools align with their values and interests, particularly in terms of the data that are collected and monitored, and the perceived impact on patient care and physician feedback/learning. Several institutions chose to implement the DRS due to the ability to track patients and provide quality follow-up care.

> *Really, it is not about the report, it is about the database, you know? So, it is not great for issuing reports sometimes, you know, it doesn't say what we want it to say perfectly, but we shouldn't give up on it because it is all about the database.* [Physician #1]

[The department] had missed booking a core biopsy as recommended, therefore asked to have [the diagnostic synoptic reporting tool] implemented asap. [Team member #2]

That the SRTs are 'standalone' IT systems (i.e., they are not integrated with other hospital IT systems and thus cannot share data with existing systems) meant that the implementation team did not have the additional task of interfacing these systems to existing IT infrastructure. However, IT integration is a desired feature by individuals at all levels of the system, with the lack of IT integration perceived as another barrier to use.

Case B: Colon Cancer Prevention Program

Case History

In 2008, the DoHW announced funding to establish a population-based colorectal cancer screening program in Nova Scotia. This was in alignment with scientific evidence as well as events in other Canadian provinces (by 2007, three provinces had announced the development of organized screening programs). Synoptic reporting for colonoscopy was implemented with the roll-out of this program, beginning in Spring 2009. The impetus for synoptic reporting was quality improvement, with CCPP leadership believing that measurement was critical to improving colonoscopy performance, and appropriate follow-up of participants in the screening pathway. The CCPP, including implementation of the SRT, was funded by the DoHW and located at Cancer Care Nova Scotia, the provincial cancer agency.

As part of the program, all endoscopists (gastroenterologists and surgeons) in the province were required to use the SRT for screening colonoscopy (the

recommended investigation following a positive fecal immunochemical test [FIT]). Refusal to use the SRT meant that endoscopists would not be permitted to participate in the CCPP. Moreover, by participating in the CCPP, endoscopists were required to sign an agreement stating they would use the SRT for all of their diagnostic colonoscopies, with the goal of having a single database capturing all colonoscopy in the province.

SRT implementation was phased in over a 2-year period across the entire province (nine health districts). The CCPP core team, which included the program's leadership, several technical/IT staff, and an implementation coordinator (hired part-way through the roll-out), managed the implementation. This included acquiring and customizing the SRT, carrying out a Privacy Impact Assessment and establishing the system architecture, coordinating and trouble-shooting the province-wide implementation, and endoscopist training.

The implementation team selected the endoscopy reporting software and database from the Clinical Outcomes Research Initiative (CORI) for its SRT. The team procured CORI from its developers at Oregon Health and Science University, free of change. The application was modified as little as possible, though some customization was necessary. The software's capabilities position CORI at the advanced end of synoptic reporting technology [69]. The final report is in narrative form: although it is entered synoptically, CORI takes the responses and creates them into standard sentences and paragraphs. Upon completion, the end report is available for immediate entry in the patient's chart.

By the end of data collection for this study (Winter 2012), CORI was integrated with hospital IT systems in one district, allowing patient demographics to

electronically enter the system and the colonoscopy report to enter the patient's electronic medical record (EMR). An image capture program has also been integrated with CORI in this district to allow endoscopists to take and store photos of the colon during the procedure. For the remaining eight districts, the team has worked out an interim solution to electronically send patient demographics to CORI, but a variety of processes are used to ensure the colonoscopy report enters the patient's record, depending on the hospital (e.g., copying and pasting the report into the EMR, and having the endoscopist 'double-report' using both CORI and the hospital's Dictaphone system).

Influencing Factors

Eight key factors influenced the implementation and use of CORI. Again, these factors existed at the interpersonal, organizational, system, and innovation levels. Figure 2 depicts the key factors and relationships between factors.

Interpersonal Level

1. Stakeholder involvement: limited in breadth and depth. The implementation team involved key stakeholder groups in its planning and implementation. For example, clinicians were members of the CCPP Steering and Clinical Advisory Committees, while several also sat on two working groups related to synoptic reporting. Two endoscopists (both with high involvement in the CCPP) modified the CORI template for provincial use, and local implementation teams at each district were asked to provide data on a standard worksheet to inform SRT implementation at their hospitals.

Though implementation team members discussed informing and consulting the clinician community regarding the SRT, the breadth and depth of involvement appeared limited and was perceived as inadequate by many key informants at the system, organization, and user levels. In fact, most informants perceived a low level of engagement and many endoscopists stated their input was not requested at any point throughout SRT implementation.

> *Firstly, nobody ever asked me and secondly, I have tried to make some comments and, uh, I have been told that they are working on it. … I don't sense that those that are implementing this are going out to the users and saying how can we make it better. Nobody has asked me.* [Physician #3]

> *Overall, no. [Dr. X] … I think he obtained input and I guess he didn't need any from me.* [Physician #2]

Implementation team members discussed their approach of obtaining input from local planning committees; this approach was described as "structured" and appeared to emphasize the implementation team's needs for implementation versus stakeholder needs. Key informants also discussed varying degrees of receptivity to the feedback they had provided; some stated their feedback was well-received while others described an atmosphere of resistance.

> *[Our feedback] was well received in Halifax and the changes were made, as far as they could make.* [Organizational member #4]

> *There has been a lot of push back, a lot of push back when we have come to them with issues.* [System member #5]

Limited stakeholder involvement and perceptions that their concerns were not always listened to and acknowledged led some key informants to describe unsatisfactory and sometimes 'shaky' relationships with the implementation team. These relationships undoubtedly influenced the implementation experience. Several system and organization members stated their beliefs that low stakeholder involvement and the resulting weak relationships likely contributed considerably to some of the challenges the implementation team encountered, including the inability to integrate CORI with existing IT systems in most districts.

> *I would have to say [our relationship is] a little bumpy, [that] would be my first response.* [System member #1]

> *We probably would be all integrated right now had they actually heard the need.* [Organizational member #3]

2. Managing the change process: addressing barriers, understanding organizational processes, communicating, and providing training and support. Managing the people and processes involved in the change process was also key to CORI implementation. In this case, every key informant discussed, oftentimes at length, issues related to change management. These included managing resistance and other barriers to implementation, understanding organizational business processes and how they differ across institutions, communicating about the change process, equipping people to use CORI, and aligning people to the value of the tool.

Implementation team members as well as system and organizational members discussed a high level of resistance from certain groups. Though the experience

varied across institutions, these groups included health records, endoscopy managers, and, to a certain extent, surgeons (compared to gastroenterologists). The implementation team discussed many instances wherein they perceived particular groups and departments were resistant to CORI implementation because it went against their usual 'ways of working,' though the extent to which the team worked with these groups to manage resistance was unclear.

> *I found for Dr. [X] … his light came on pretty quickly, yeah, this is definitely the way to go. As soon as he was out of the room, we were dealing with the endo manager and especially medical records, they were extremely resistant.* [Team member #4]

Endoscopists also discussed particular barriers that required addressing during implementation: e.g., general inertia to change and physician autonomy.

> *When you start measuring quality you start finding things. What are you going to do with it? And the thing is that there is resistance because as physicians no one has ever done this to us and that is why it is such a novel concept.* [Physician #1]

Several key informants stated that adequately managing the change process requires an understanding of organizational processes (e.g., registration of patients) and how those processes (and the people involved in them) will be impacted by the change. This was particularly germane in this case since implementation team members sought to integrate CORI with existing IT systems to ensure seamless transfer of information across systems and into the institutions' health records. Key informants in IT and health records perceived this understanding was generally lacking from the implementation team in the beginning.

If you want this to truly be a provincial system in nature, you need to understand that the business processes that one organization have are not the same as the business processes that another organization has … on the surface, a colonoscopy conducted here in Halifax should be the same as a colonoscopy conducted in Sydney or Yarmouth. The problem is the business processes associated with getting that colonoscopy procedure are unique to the facilities. And that is often the biggest problem, trying to get [the team] to understand you can't just look at [Region X] and make a blanket assumption that that is across the province because it is not. [System member #5]

The CCPP had a formal communications plan and relayed information about the program through mass media, organizational newsletters and other communication channels, lectures at continuing medical education (CME) events, and a 'dog and pony' show across the province. These strategies informed stakeholders about CORI and that it was coming as part of the new screening program, yet appeared less effective at relaying the details of the change process, including clear communication regarding any new tasks that might arise because of SRT implementation. This latter issue was particularly pertinent to organizational managers, who had to deal with changes in workflow and workload without additional supports. With the exception of those who sat on Steering/Advisory Committees, key informants discussed low *personal communication and contact* with the team before and during implementation.

Communication was poor. [Organizational member #3]

The failure to tell us that we weren't complying with certain requirements until [we] had a significant backlog developed makes it even worse, because you have then got to go back and correct a whole bunch of things. [System member #1]

The team, whose clinical members were all gastroenterologists, trained all endoscopists in the CCPP to use CORI. This entailed spending approximately a half-day with each endoscopist, sitting with him/her following the procedure, and demonstrating and assisting with data input. Endoscopists had the opportunity to trial CORI before inputting real patient cases and were generally pleased with training. For those endoscopists having difficulty using/operating the tool, the team provided additional training/support.

Some of the people are computer illiterate … hated it, hated it, and, uh, did it poorly as a consequence. Uhm, so we would have to send people up to [Community X] three times, you know, because they weren't getting it, you know? So, initially there were some teething problems. [Team member #1]

However, many expressed frustration with ongoing support mechanisms and the timeliness of support processes.

They are put in a queue and so the patient is on the table and they are asleep and the surgeon is there, the gastroenterologist is there, and so far we haven't ironed that piece out yet. Yeah, it is so frustrating for them, you know, no dedicated [support]. There really needs to be a dedicated person to these large programs, so that when you call that 1-800 number you talk to that person, you know? [Organizational member #4]

To facilitate acceptance of CORI, the CCPP has introduced several incentives, including credentialing for screening colonoscopies and skills training workshops for credentialed endoscopists.

Key informant interviews with organizational managers, including those highly involved in local implementation efforts, suggested that they did not perceive the value of CORI. Related to value, most endoscopists also discussed the fact that feedback and performance data, preferably in real-time, would reinforce the value of using the tools and help to spread and maintain buy-in.

> *Some of the basic stats should be available all the time, real time. … I am not sure if you would get more people in, but I think you might maintain the interest better.* [Physician #4]

3. Implementation as part of the provincial screening program: a 'top-down,' policy-driven approach. The positioning of CORI as a component of the provincial colorectal cancer screening program and the subsequent approach taken by the implementation team certainly influenced implementation policies and practices and stakeholders' implementation experiences, and played a fundamental role in use of the tool. Specifically, endoscopists were required to use CORI if they wanted to perform screening colonoscopies. By positioning the tool in the screening program, the implementation team could mandate and monitor use of CORI for screening colonoscopies, and refuse to pay colonoscopy fees if users did not input their data into the CORI system. This policy ensured use of CORI for all screening colonoscopies in the province. Although endoscopists also signed an agreement stating they would also use CORI for diagnostic colonoscopies, and one health

district issued a policy that CORI be used for all endoscopic procedures, the CCPP could not mandate and monitor use of CORI for non-screening colonoscopies.

> *We didn't ask them. 'You [want to] be part of this program? This is the way it is set.' They had no choice.* [Team member #1]

> *I have no choice.* [Physician #3]

Nevertheless, key informants voiced much displeasure with this 'top-down' approach and the aggressive implementation timeline. The positioning and approach meant that stakeholders felt they had little control in regards to the implementation and how it would play out in their respective institutions. This has influenced stakeholders' perceptions of the tool and its implementation, as well as use of the tool for diagnostic colonoscopies (which most endoscopists were not doing).

> *[Being part of a provincial program] didn't make one easier to implement. It didn't help greater support and uptake.* [System member #3]

> *I am not a fan of CORI right now simply because it was pretty much presented 'well, you have to do this.'* [Organizational member #3]

Both interview and documentary evidence suggested that historical issues related to the organization that governs the CCPP – Cancer Care Nova Scotia – might have amplified stakeholders' discontent with the implementation approach. Specifically, prior experiences (e.g., a predominance of Halifax personnel participating at Cancer Care Nova Scotia meetings) and perceptions (e.g., that Cancer Care Nova Scotia and the QEII Health Sciences Centre, its host institution, are "one in the same") have

previously affected support outside of the district in which the organization is physically located.

> Buy-in and support outside of Halifax is sometimes more difficult … one challenge facing CCNS is the ability of engaging district people in provincial work … Distance and the need to travel to meetings, when telehealth or teleconferencing is not an option, often results in a preponderance of Halifax personnel participating at meetings. This increases the perception that CCNS is more focused on Halifax. [Excerpt, Provincial Health Services Operational Review Final Report; CCNS = Cancer Care Nova Scotia]

That the implementation team chose to implement CORI before the tool was integrated with other hospital systems also greatly hindered the user experience and resulted in many inefficiencies for organizational members and endoscopists: e.g., some departments have had to print reports and physically deliver them to health records departments while some endoscopists have to complete reports twice, using CORI and dictation, to accommodate policies of the CCPP and their respective institutions.

> *We are still waiting for that interface, so that interface that has been years now in the making. … That is really, we are at a disadvantage when that doesn't get fed into our [electronic health] system … It is double the work.* [Organizational member #4; interview occurred 35 months post-implementation]

Implementation of CORI at the same time as the screening program led many stakeholders to remark that the implementation team focused greater on participant education and recruitment, and the processes around FIT testing and

laboratory/pathology protocols, than on CORI implementation. This was perceived as having a negative impact on CORI implementation and use, since CORI implementation was not an inconsequential occurrence for the affected groups (e.g., health records, endoscopists) and changed work processes in their day-to-day practice. Implementation team members acknowledged their emphasis on other parts of the program.

> *We still have so much work to do around participation in screening that to dominate it with the colonoscopy message, I think would be a disservice to the screening program.* [Team member #2]

Documentary evidence supported these viewpoints, with very few of the documents acquired via the implementation team providing any great detail about CORI implementation; e.g., the documents pertaining to implementation planning and program evaluation focused on other aspects of the screening program (e.g., awareness and knowledge of screening, recruitment and participation, satisfaction with screening kit).

4. Project management related to SRT implementation was unsatisfactory. With respect to SRT implementation, many system and organizational members felt the implementation team demonstrated limited skills in project management (e.g., creating a detailed project plan, including the right people at the right time, and engaging in debriefing sessions to learn from past experiences), which they perceived impeded the implementation experience. Indeed, several key stakeholders stated they had never seen a project plan with respect to CORI implementation, and one could not be located for the document analysis. Including the right people at the right time

was perceived as particularly important from an IT/information management perspective as well as a privacy and governance perspective.

> *Lack of proper project management and communication on the part of [the implementation team]. There was no detailed project plan, uhm, you know, no proper project management techniques were put in place.* [System member #5]

> *People like myself, people like [Team member X], while we may have accountability around management information systems, are we the right skill set for doing some aspects of that? Absolutely not. ... So, even being able to present our project requests and our asks and trying to get to the right tables and being able to be listened to and stuff like that [is challenging], you know?* [System member #4]

The team was lauded, however, for acquiring the expertise of an information management expert near the end of implementation; this person was viewed as having the right knowledge and skillset, and an asset to ongoing implementation.

> *[Mr. Z] is very good, I have to say that he is likely the best thing that happened to that team. You know, uhm, I can't say for sure but I mean he seems to be doing his very best and letting us know.* [Organizational member #3]

Endoscopists did not discuss this particular aspect of implementation as being important to their acceptance or use of CORI.

Organizational Level

5. Clinical champions and respected clinical colleagues facilitate SRT implementation. Key informants at the organization, system, and implementation team levels identified numerous clinical champions, at the provincial and district levels, for CORI implementation and perceived that championing from these clinicians facilitated user acceptance and implementation of the tool. Some of those championing SRT use were linked to the CCPP or closely involved in SRT development and implementation; these individuals were highly respected across the province. Several endoscopists also remarked on their advocating for the tool.

> *One of the main supports was having Dr. [X] … his history in the province made, you know, his championing of it carried a lot of weight. And the same thing with Dr. [Y], he is very well respected, everyone knows him, the whole province, … so when you have those two … it has smoothed out a lot of wrinkles.* [Team member #4]

> *Implementing it was a question of really selling people on it. … I talked my two partners into it.* [Physician #4]

No administrative champions were specifically identified (though they may have existed at certain institutions). A lack of local clinical champions was also identified for some health regions, predominantly due to ongoing frustrations with the tool.

> *Dr. [Z] was on the committee at the time and he was supposed to be the champion, but it turned out that he was frustrated with the system, so you know, he was better offside, to be left offside … so no, there is no real*

champion [here], except that they are, you know, I have to say the physicians are very respectful of Dr. [X]. And they do listen to what he is saying and they are trying. [Organizational member #4]

Organizational and System Levels

6. Administrative and managerial support are critical to enabling and/or impeding implementation progress. The data indicated that executives and administrators at the DoHW and health districts supported the implementation of CORI. These individuals perceived value from a quality improvement perspective, with SRTs aligning with higher-level strategic priorities and directions. The implementation team indicated that acquiring resources from the DoHW (e.g., funding for staff) was relatively unproblematic during the planning and implementation phases. Certainly, this facilitated implementation and allowed the team to expand CORI in a rapid manner. Moreover, one health district established a district-wide policy that all endoscopic procedures be reported using CORI.

I will be honest. In [District X], admin was actually quite supportive of this, which is, it was completely refreshing. [Organizational member #1]

[We] would put forward the budget request and the [DoHW] would honour that budget request and we were resourced in what we needed to do. [Team member #2]

Conversely, support from organizational managers was low in some institutions. Lack of managerial support was largely related to low involvement and input during implementation, the introduction of new roles/tasks with no clear person

to undertake the additional work, lack of IT integration (which added to the workload in many departments), and a limited understanding of the tool's value.

> *Everyone says these systems will be cost-savings and time-savings, but I don't believe CORI is either.* [Organizational member #2]

> *We are not supportive of using it for anything other than the FIT testing at this point.* [Organizational member #3]

Although management support was not necessary for CORI implementation, low support influenced the implementation experience for the implementation team as well as endoscopists in those institutions.

System Level

7. Structural, infrastructural, and socio-historical components of the healthcare system impeded implementation progress. The data demonstrated that characteristics of the provincial healthcare system, including its administrative and delivery structure, legislative/regulatory contexts, and IT infrastructure were perceived as being profoundly obstructive to the implementation of CORI and similar tools. The nature and history of inter-organizational relations/interactions within the province's health system were also viewed as negatively impacting CORI implementation.

In the existing health system structure, health districts are responsible for delivering care, yet the CCPP, which is positioned under the provincial cancer agency, is responsible for implementing and delivering a population-based screening program. As a provincial program, the provincial cancer agency is not responsible for service delivery (or even monitoring service delivery), but rather has a mandate to act

in an advisory capacity to the DoHW, develop draft standards, and educate and communicate about standards and best practices. At the same time, a centralized IT organization provides operations support for most (but not all) provincial IT systems, but is not responsible for implementing new IT systems. These structures create many challenges in terms of role clarity, governance, and sharing of patient information across organizations, which in turn created many issues and frustrations over the course of CORI implementation, including issues related to ownership of the CORI database/data and IT integration.

> *There is a tension between whose policies are whose. Are they the policies of the health authority or are they the policies of the Department [of Health and Wellness]? There is debate about what the Department can make policies about when it comes to point-of-care.* [System member #2]

> *The structure is not ideal because you have the DoH, you have the provincial programs, which are a part of the DoH but are housed externally, [they] use external infrastructure. CORI, for example, is physically located here at [District X]. It is in [District X's] server environment, while it is all within the secure NSHealth environment, through the network, they are physically separate. [The centralized IT organization], while again another branch of the DoH, considers itself to be an external agency, so there is a lot of grey around. We are all DoH but we all treat each other as separate entities. Uhm, so there is a lot of us and the mentality that gets in the way.* [Team member #3]

Privacy legislation in Nova Scotia at the time of CORI implementation included more than 40 different pieces of provincial and federal legislation, all relevant in some way to the collection, sharing, and/or use of personal health information. These Acts were largely developed in an era of paper-based records and the rules for providers, health records, and facilities were not always consistent across pieces of legislation. In addition, each hospital has its own policies and procedures related to privacy, security of personal health information, and data integrity. This legislative and regulatory environment was viewed by implementation team members as especially prohibitive.

> *There is a wall there and nobody is really willing to ask 'why is that wall there and does that wall really need to apply in this case?' You know, the wall might be there for a very good reason. But, you know, should we put a door in for these guys? Maybe yes, maybe no, but I don't think those risk assessments are really ever done. It is the 'just talk to the hand.' It is a no.* [Team member #4, on privacy]

A review of several key pieces of legislation (including Nova Scotia's *Freedom of Information and Protection of Privacy Act* and *Hospitals Act*, and the Federal *Personal Information Protection and Electronic Documents Act*), the *Pan-Canadian Health Information Privacy and Confidentiality Framework*, as well as documents to support their interpretation, suggests that the legislation is not necessarily prohibitive, but rather the ways in which the Acts are interpreted and implemented.

The legacy of IT infrastructure in the province was viewed by key informants across all units of analysis as impeding the progress of implementation as well as the user experience. There is no single IT platform in the province, nor has there been a

provincial plan on how to best leverage information management/IT systems. As a result, the IT landscape consists of a 'patchwork' of systems that are often not interfaced and thus require clinicians to access multiple systems to provide care.

> There is a need for an integrated cancer information management strategy and plan. … A plan would also define the linkages between the cancer system and the provincial care delivery system. … There is a need to develop integrated systems that extend across districts, and that has appropriate interfaces between key systems to support improved information flow and reduce redundant actions. [Excerpt, Provincial Health Services Operational Review Final Report]

> *To have [CORI] sit on top of different business process, different information systems, different staff structures in terms of where their IT person sits, is a challenge. And then to have your work interface in this one system, then sit amongst a whole host of priorities at a provincial level, is another layer of complexity. For me, that has been the biggest challenge.* [Team member #2]

Underlying these structural, infrastructural, and regulatory components, key informant interviews and documentary data suggested a widespread resistance by districts and the organizations tasked with supporting the districts to work together and think beyond their individual organizations and programs. Limited collaboration and existing relationships amongst organizations within the healthcare system (which were sometimes perceived as precarious) were described as obstacles that often 'got in the way' of SRT implementation.

To a certain extent, healthcare in this province is about the last bastion of adopting IT technology. Some other industries have done much better at it and have gone through the learning curves, but a lot of [the IT-related difficulty] is also based on, I would say, … there is going to be issues with the adoption of these systems until there is a change of culture within the environment. In particular, there is a lot of, a lot of, 'this is the way it should be done and this is how we will do it' rather than collaboratively working together on a solution. That is true, I think, of the healthcare sector environment. That whole mentality has to change and until it does, implementing any system is going to be difficult. [System member #5]

Technology is not the barrier, uhm, there are, it is organizational and the history of, of you know, the system itself and the players and so on. [Team member #3]

Innovation Level

8. The innovation's attributes influence users' willingness to use the SRT. The complexity/simplicity of the tool, including the final report, and the extent to which the tool aligned with their values, interests, and prior experiences influenced users' perceptions of CORI and their experiences with use. Nearly all endoscopists stated that CORI was relatively easy to learn and use, and that it saved time when compared to dictating. Overall, most endoscopists reported few major issues with CORI itself, though there was some dissatisfaction with certain features (e.g., quantity of data

elements, elements not always matching clinical experience) and the final report (e.g., length of report, difficulty finding information).

> *As far as using the computer program, it's basically very intuitive. There are one or steps that aren't but they are simple once you get the trick of it and it's really intuitive.* [Physician #4]

Technical issues, however, were a large source of frustration for users. These included difficulties with login, technical glitches between CORI and the software used to take images during the colonoscopy, and lack of 'cross-talk' between institutions. The latter proved challenging in some health districts since endoscopists seeing a patient at one hospital could not locate a previous report created in another hospital, or a colonoscopy scheduled in one hospital but subsequently changed to another hospital meant the patient could not be located in the CORI system at the later hospital.

> *The biggest issue for me is when we are taking pictures. So there are two different programs, one is called Dykenmiser and the other is CORI, and you have to take pictures with Dykenmiser. You do them, then you download them, send them to CORI and then you have to get into CORI and accept them. And, to be honest, it asks you every time that you do something, it says 'okay?' and you have to click on okay and it happens 10 times ... and at times the whole thing just shuts down. ... There are so many times that I have had to physically turn the computer off and turn it back on and then you have lost your information and then have to start over again. That is a stumbling block.* [Physician #2]

Though technical issues were sometimes related to the hospital/provincial IT infrastructure, users were particularly annoyed when they were unable to access the CORI technical support person in a timely manner to resolve them. While issues with CORI did not negatively affect use for screening colonoscopies (as it was mandatory), it did impact endoscopists' willingness to use for diagnostic colonoscopies.

All endoscopists perceived SRTs (in general) as being compatible with their individual and professional values, despite any specific issues with CORI. Moreover, most had experience with similar industry-developed endoscopy tools (though these tools were not SRTs *per se*, but rather image handlers that also collected clinical data) and/or with surgical and/or pathology synoptic reporting. Similarly, key informants at the system level stated that CORI aligned with the values, needs, and strategic priorities of their organizations. The perceived value of CORI related to clinical utility (e.g., patient management, improved communication with the patient/other providers, improving colonoscopy practice) and use of data for health planning and performance monitoring/feedback.

> *[There are] obvious benefits in terms of the efficiency of the family doc getting the report or the referring physician getting the report almost instantaneously, the efficiency of, uh, having a standardized report, all the elements get in there … and the quality benefits of the patient having some information and things like that.* [Physician #1]

> *The whole issue of quality and accountability and having tools to be able to enable that is a big conversation for lots of people, … and, uhm, the ability to use and leverage [CORI] in a way that is helpful for folks.* [System member #2]

Case C: Surgical Synoptic Reporting Tools Project

Case History

Based on the successful development and implementation of synoptic reporting for cancer surgery in one Canadian province, as well as the evidence amassed in that province on the benefits of synoptic reporting [84, 86, 201], a pan-Canadian collaboration was established to expand surgical synoptic reporting to other Canadian jurisdictions. Consequently, the SSRTP in Nova Scotia commenced as a pilot project for breast and colorectal cancer surgery, funded and led by the Canadian Partnership Against Cancer, a national organization funded to implement Canada's cancer control strategy. The national initiative also included pilot projects in four other provinces. As a pilot project, a small number of surgeons were selected to participate across disease sites and hospitals. Thus, the Nova Scotia SSRTP was implemented at three hospitals, two academic/tertiary care centres and one community hospital, and involved 9 surgeons performing breast and/or colorectal cancer surgeries.

Planning and implementation occurred over a 3.5-year time period and included developing and maintaining all the necessary documentation (e.g., Privacy Impact Assessment, Threat Risk Assessment) for implementation, adapting the SRT templates (data fields could be modified or added, but the national elements

remained), coordinating development of software upgrades and interfaces for IT integration, coordinating and trouble-shooting the implementation at the three institutions, and performing change management strategies to engage and support the relevant clinical and administrative communities. The tool 'went live' at the first hospital in July 2010. The provincial implementation team consisted of three individuals: a surgical oncologist lead, a coordinator, and an IT lead (part-time, hired later in project). Use of the SRT was voluntary. The team had no authority to mandate use nor the capacity to influence use through organizational or provincial policies.

The SRT was the Web-based Surgical Medical Record (WebSMR)**,** originally developed in Alberta and jointly owned by Alberta Health Services and Softworks Group Inc [201]. Its features and capabilities place WebSMR at the cutting edge of synoptic reporting technology [69]. The tool is integrated with each hospital's existing IT systems, allowing seamless transfer of information across systems, including transfer of the final operative report, presented in a synoptic "checklist" format, to the patient's EMR immediately on completion. Once completed, the report is also automatically faxed to all involved in the patient's care (e.g., the referring physician, surgeon's office, cancer centre, and family physician).

Influencing Factors

Eight key factors influenced the implementation and use of WebSMR. These factors existed at the interpersonal, organizational, system, and innovation levels. Figure 3 depicts the key factors and relationships between factors.

Interpersonal Level

1. Stakeholder involvement: early, ongoing, and collaborative. Early and ongoing involvement of stakeholders and their depth of engagement were critical to SRT implementation. Engagement of key stakeholders occurred from the very beginning (at the 'pre-planning' phase) and stakeholders from every relevant organization and at every layer of the system (e.g., administrators, middle managers, surgeons, and 'on-the-ground' end users of the report such as registry staff and hospital coders) were members of the Management Committee and/or one of three Working Groups.

Key informant and document data indicated that stakeholders were viewed as partners in the project, with their input on problems and solutions frequently sought and incorporated into the project planning as much as possible. Nearly all system and organizational members expressed high satisfaction with their depth of involvement and the implementation team's responsiveness to their feedback and recommendations. They felt the team listened to them and tried hard to meet their needs, preferences, and expectations. This included getting locals surgeons involved in adapting/revising the templates, modifying the final report to meet health records' requirements, integrating WebSMR with existing hospital IT systems, and having the WebSMR database hosted at the centralized service delivery organization for IT services.

> During the initial meetings with the IT working group in 2008 and 2009, IT representatives from all the key partners agreed on an approach to integrate WebSMR with the existing systems within the NS IT infrastructure. [Excerpt, Lessons Learned Document, Canadian Partnership Against Cancer; NS = Nova Scotia]

I thought that from a coding perspective, they were receptive to anything that we had to say and we certainly had lots of one on ones with [Dr. X] and said this is the challenge, this is what we think is missing, this is what we need to be clear on in terms of breast conservation versus mastectomy, this is how we code. … [They were] more than receptive to take our concerns, our input, and then offer solutions or feedback. [Organizational member #2]

Only one person expressed any discontent with the level of involvement, but thought the team had improved substantially in this regard with the planned introduction of a new surgical SRT and expansion at another hospital (the current tool is being replaced with substantially improved software).

This early, collaborative approach was important for several reasons. First, it allowed implementation team members to develop and maintain the relationships necessary to implement WebSMR at the hospitals and succeed in integrating the tool with existing IT systems. The latter task was time-consuming and required the team to find substantial resources that were not initially allocated, but crucial to the functioning of the system and to acquiring buy-in from stakeholders.

Great, lovely, they are a lovely bunch to work with. … I was always very happy with them, uhm, you know they really know what they are doing. [Physician #5]

Second, it provided the team with a much better awareness and understanding of local conditions and therefore the ability to adapt and customize the innovation (e.g., templates, IT integration) and implementation accordingly (e.g., practices such

as user training and support). Much of the initial SSRTP planning occurred in conjunction with the national organization leading the initiative and the province that had developed and successfully implemented WebSMR previously. However, collaboration with local stakeholders revealed the Nova Scotia context to be different from that of other provinces and the innovation and its implementation would require adaptation if it was to be successful locally.

> *We had meetings about how we were going to make this work … and it was through their conversations and their expertise that we chose [a particular strategy], knowing that you wouldn't get everything, but it was the best to make it a seamless system because there are certain parameters that our partners said had to happen: it can't be more work, you have to build on what exists, you have to make sure that you know that it is beneficial to all parties, [that] it gets the right information. There are core things that they told us had to happen, so we had to work within those parameters.* [Team member #2]

> It was important to consider the unique attributes of each province with regards to policy and governance, IT infrastructure, legal environment, culture, language and health system. [Excerpt, Canadian Partnership Against Cancer: Synoptic Reporting Tools Project Evaluation]

Third, the approach helped create a sense of ownership amongst stakeholders. This was important since a sense of ownership appeared to lead local system and organizational members to take responsibility for the implementation in the areas/departments they have influence or control; this goes beyond mere buy-in or passive agreement that the change is a good one.

[WebSMR], uhm, that is our system that we designed, … I think we are going to be able to develop it for other types of surgeries, not necessarily cancer. [Organizational member #4]

It was about … listening to [our partners] and respecting what they are saying. [Their] language and voice is reflected in the work. Without doubt, that is the number one thing that has made this successful and will continue to make it successful because there are so many competing issues that come at this. [Team member #2]

2. Managing the change process: building demand, communicating, providing training and support, and making it easier for SRT users. Managing the 'people issues' that come with change was important to WebSMR implementation and use. In this case, managing the change process included building demand for SRTs, communicating about the change, providing people with the tools to change, and removing barriers/providing incentives to change.

WebSMR was the first SRT introduced to many of the stakeholders; therefore, it was important for the implementation team to understand what appealed to different groups and to sell WebSMR accordingly. That the data did not indicate high levels of resistance to WebSMR implementation, and that all stakeholders perceived value in the tool (see Innovation Attributes below) and understood the desired endpoint, suggests the team was successful in this endeavor.

It is really building, and being responsive to those needs and those people. … you have to be out there showing them and building that demand for it. If they don't know it is out there they aren't going to demand it. [Team member #2]

My experience has been they know what they are doing, they know where they need to go, and want to go, uhm, and continuing to make those strides with their colleagues. Change management is never an easy thing. [System member #2]

The implementation team relayed information about WebSMR through various mechanisms such as organizational newsletters and other existing communication channels, and lectures at CME and other educational events. Nonetheless, the data indicated that much of the *effective* communication – i.e., communicating the reasons for the change, how individuals' work will be impacted, and what is expected of them during and after implementation – occurred through personal (one-on-one or small group) contact. Nearly all key informants stated they had personal contact and one-on-one discussions with the implementation team early in the implementation, either through formal or informal means. System and organizational members expressed high satisfaction with the extent of contact they had with team members. They also expressed satisfaction at being able to bring their staff to meetings so all relevant personnel was informed of (and had the opportunity to participate in) implementation efforts.

The team was terrific actually. They gave a lot of information, they held enough meetings in a way to keep us informed as to what the progress is or what their, uhm, barriers are, what the users liked and what we needed, you

know, and what we had to have by way of information in terms of content in the report. So all of that to me was the way that it should be done.

[Organizational member #4]

Several surgeons did state they were not informed about plans for performance monitoring/feedback or further expansion, demonstrating the importance of ongoing communication post-implementation.

Why isn't there something that is sent around in e-mail … a monthly update, how are we doing? I didn't know how many other people are using WebSMR, I have no idea, how many cases. [Physician #4]

The implementation team provided training to both surgeons and administrative end users (e.g., hospital coders), customized based on what the individual/group requested, and created/funded a technical support position to provide ongoing support for surgeons. Observation of surgeon training, both one-on-one and small group sessions, revealed that the trainers were extremely responsive to surgeons' questions and/or requests (many of which related to the SRT development and content, and support during initial use) and had a good rapport with most surgeons. The team also put concerted efforts into removing obstacles to (e.g., in-person support on the first day of use, purchasing more computers for the operating theatres) and providing incentives for (e.g., continuing medical education credits) use. A part of this also involved choosing the most adaptive surgeons to participate in the pilot project and holding a 'testing' phase over the summer months with only two surgeons to refine the tool before training other surgeons. Such strategies were especially important given that WebSMR use was voluntary.

[In meetings with partners] we went through what … we had to do … what are users that need to be trained in the end and how do [we] train them. So, for example, some of them were one on one sessions, some of them were small group sessions, and … we set those up depending on the needs. … The 3 different districts had different needs and so it was just tailored to what they wanted. [Team member #2]

All pilot sites stressed that training should not be underestimated. In fact, the more training provided the better the implementation experience was. [Excerpt, Canadian Partnership Against Cancer: Synoptic Reporting Tools Project Evaluation]

[I was reluctant] the first couple of days because I said I am not a computer person, but they made it easy … making it easy makes it easier. [Physician #3]

Surgeons expressed no issues with training and many were particularly pleased with the high level of support provided early in implementation, specifically the 24/7 telephone access to a technical support person, as well as the ongoing support process.

With WebSMR, there has been very good support. [Physician #4]

Only one surgeon recalled several occasions when he was unable to reach the support person in a timely manner.

3. Implementation as a project pilot impacts SRT implementation and use. That the implementation of WebSMR occurred through a pilot project influenced both

implementation and use of the tool. Key informants at the system level perceived that its positioning as an *externally-funded* pilot project likely helped gain the 'go-ahead' from system administrators, since it presented a value-added opportunity they did not have to directly fund and resource. These individuals indicated they might have been hesitant of supporting a new full-scale initiative.

> *It was approached as a pilot project. I think it was just, it was just a little bit more accepted [like that].* [System member #4]

At the same time, as a pilot, team members had to gain buy-in from all relevant stakeholders, which likely impacted the collaborative approach they adopted. That is, they *had* to reach out and engage stakeholders to gain their support and leverage their time, expertise, and resources. Certainly, the resulting 'grassroots' approach was perceived as extremely time-consuming, but ultimately benefited the implementation.

> *We listened to them and we worked within what they were telling us and we fought for what they required versus just saying 'no, we have to do it this way.' ... we had to keep their buy-in ... without that, nothing would have happened at all.* [Team member #2]

The deliberate decision not to implement the tool before they achieved IT integration also positively impacted WebSMR implementation and use.

> *I wouldn't have changed anything in terms of the implementation because I don't think, you know, we talked about implementing before it was integrated and all that kind of stuff. That was just such a, we had heard so strongly that there was no appetite for that, uhm, quite frankly, I think if we had done that, the actual getting it live and interfaced would have been less of a priority.* [Team member #1]

With the exception of one surgeon, the positioning of WebSMR as a pilot project was not mentioned by surgeons, yet clearly the voluntary nature of the pilot impacted whether they opted to use the tool.

Organizational Level

4. Specific resources, human and fiscal, were needed for SRT implementation.

Resource needs and availability impacted implementation in this case. In particular, interview, documentary, and observation data indicated that specific expertise and knowledge – IT and clinical – facilitated successful implementation. Implementation team members and system-level informants stated a lack of IT and information management expertise during the first 1.5 years of planning/pre-implementation hindered the implementation experience, contributing to delays and frustration.

> *If we could have had [IT expertise] when the requirements were first being built in February, that would have been really important, because there were some issues that came because I didn't have the right people.* [Team member #2]

> *When they finally got to us, we had to do a lot of backpedalling, ... we are trying to get them to bring us in at the grassroots earlier.* [System member #5]

Concurrently, there was a perceived lack of national IT leadership: while an initial 'IT gap analysis' was conducted, this national undertaking did not evaluate the IT work against specific provincial requirements and thus was perceived as inadequate by the implementation team and IT stakeholders. Although IT resources were not part of the

initial approved budget, team members eventually secured funds for IT expertise and additional IT infrastructure, despite significant resource constraints.

> There were challenges with the application vendor understanding the NS environment. … The vendor did not fully understand how the province operated and therefore did not correctly scope WebSMR customization. Fundamentally the gap work was not defined in enough detail before approval which led to: 1. Revising the project plan and go-live dates to include a bigger contingency; 2. Additional unforeseen requirements; 3. Unapproved requirements … [Excerpt, Lessons Learned Document, Canadian Partnership Against Cancer]

> *I was told many times [by the national team], 'this is not an IT project at all, it is a clinical project and you don't need IT support, anyone can do this work.' No, I can't ... I do not have the technical knowledge to figure out an AL 6, AL 7 versus an AL 35 message, and figure out the different code and nitty gritty and such. Can't do it, sorry not me.* [Team member #2]

Interview and observation data indicated that surgeons also valued the IT expert, hired after securing funds for this role. Observation revealed that this individual's presence during training was particularly valuable in terms of resolving technical issues that arose (which occurred on numerous occasions), discussing and offering solutions for surgeons' IT-related concerns, and introducing a confident and knowledgeable IT support person who surgeons could access during their initial use of the tool.

A clinical expert (specialist surgeon) was a member of the implementation team, with additional clinical expertise available through the national team and its various working groups. Nonetheless, implementation team members emphasized the substantial time commitment that comes with providing this expertise, including meeting with colleagues to garner support, working with health records and coding staff to address clinically-oriented issues and resolve concerns, working with national and provincial colleagues to modify templates, and responding to colleagues' questions about the templates, and stressed that this time commitment is unrealistic in most situations without some level of appropriate compensation.

> *There needs to be a clinical context and I think that the, what is purported as the advantage of this is also the problem: the advantage being that this is grassroots, that it is being driven by the surgeon. Unfortunately, I think … there is not a whole lot of things that will work this way and, you know, there is only so many hours in the day.* [Team member #1]

> The amount of work required from the clinical side was greater than expected … Proper funding for this role should be considered. [Excerpt, Lessons Learned Document, Canadian Partnership Against Cancer]

5. Clinical champions and respected clinical colleagues facilitate SRT implementation. That well-respected clinical colleagues were leading and championing the initiative played a key role in acquiring buy-in for implementation (at all levels), facilitating a credible implementation process, and convincing surgeons

to use the SRT. This was demonstrated in interview, documentary, and observation data.

> *They are certainly very knowledgeable and keen and [Dr. Z] in particular as a physician champion, being able to work with his colleagues has been very positive.* [System member #2]

Amongst surgeons, much of this championing happened informally, in hallways and on operating room floors. In fact, nearly all surgeons indicated it was their respect for and trust in their clinical colleague that influenced their decision to use WebSMR, despite any hesitancy about changing practice or problems with the tool.

> *[Dr. Z] has taken on this project himself and I am there to support him.* [Physician #4]

> *I trust [Dr. Z].* [Physician #6]

Organizational and System Levels

6. Administrative and managerial support are critical to enabling implementation. Key informant interviews and documentary data indicated the SSRTP had strong support from administrators and managers at the system and organization levels. Given the positioning of the project, this support was fundamental to implementation success.

> *Obviously there has been a high level of commitment to the project and an expectation that we will continue to support and to manage it.* [System member #3]

> *None at all, no hesitation at all.* [Organizational member #4, when asked if there was any reluctance in supporting WebSMR implementation]

> … tremendous support from HITS-NS and DHAs from providing system resources, working through interface development and testing of the application. [Excerpt, Lessons Learned Document, Canadian Partnership Against Cancer; HITS-NS = Health Information Technology Services Nova Scotia; DHAs = district health authorities]

Importantly, support for this initiative was not automatic; the implementation team perceived skepticism early on, particularly in regards to the pilot nature and how that would impact on sustainability. However, key informants stated they felt the team accomplished such a high level of support via widespread stakeholder engagement and personal contact with key stakeholders throughout the system.

> *[Our work] needs to be a lot more like the synoptic surgical-based approach in terms of the bigger, like getting that buy in at really upper levels so it will begin to trickle down. Because [on similar projects] we have sort of worked, we have worked more with some end users, we have tried that bigger piece but it just didn't seem to go quite the right way like the synoptic surgical one went. Part of that may have been [getting buy-in from upper levels].* [System member #4]

<u>System Level</u>

7. Unclear roles, existing relationships, and infrastructure within the healthcare system impact SRT implementation. Interview and documentary data revealed that

unclear roles and prevailing relationships (or lack thereof) across healthcare system organizations and the existing IT infrastructure impacted implementation. Though these system attributes did not obstruct implementation, managing them required substantial time and effort on the part of the implementation team and necessitated additional (human and IT) resources. The lack of clear roles and effective working relationships within the existing system meant the implementation team had to spend time understanding the core business of each organization and bringing key individuals together to develop implementation strategies that would work for all stakeholder organizations.

> *It was not until I understood how that system worked, it was frustrating but once I figured it out, it was a lot easier and then it was like okay I know exactly what I ask of this person, nothing more, nothing less, so that helped.* [Team member #2]

> *Organizational interactions are absolutely the number one, especially in healthcare, because there are so many players, so many organizations.* [Organizational member #3]

The often unclear and indistinct roles of organizations within the system, and their relationships to the SSRTP, were also exemplified in the interviews wherein key informants identified different organizations (sometimes incorrectly identifying their own organization) as the 'business owner' for WebSMR implementation. Many key informants expressed their belief that sorting out governance issues would be an ongoing challenge.

The problem is … we have got a hybrid cancer system that is not totally clear on who does what and how. From my perspective, … that becomes problematic because you don't know … who owns it and who really wants it. There is no trouble finding people who support it, the trouble is finding the group that owns it. [Team member #1]

The legacy of IT infrastructure in the province – described by key informants as a 'patchwork' of disparate systems that were implemented and evolved in a largely unplanned way – means that the costs of these types of projects can be excessive. This was illustrated in the SSRTP where additional funding was required to perform the technical work needed to integrate WebSMR with existing IT systems.

We have 3 different hospital systems, you know, [Hospital A] has their own Meditech Magic, then there is Meditech out in the districts, and then [District B] has the best of breed, a combination of a whole bunch of things. The lab systems are not all the same, the operating room systems are not all the same, nothing is the same. So it is a huge challenge, particularly as we seek to share information … they are all individual and so those are huge challenges and it takes an enormous amount of resources. [System member #2]

Though the implementation team discussed legislative/regulatory requirements, such as those related to privacy and data security, they did not view them as barriers to implementation but rather tasks that had to be completed.

You know, from my perspective, I don't really, I am not all that invested in caring about [privacy impact assessments and related things]. I realize that has to be done and all that I care about is that it gets done. [Team member #1]

Innovation Level

8. The innovation's attributes influence willingness to implement and use the SRT. Characteristics of the innovation undoubtedly influenced WebSMR implementation and use. These characteristics included complexity/simplicity of the templates and the final report and compatibility with surgeons' and other stakeholders' values and interests. Regarding complexity/simplicity, most surgeons indicated the tool was relatively easy to use, though took more time to complete than traditional narrative (dictated) reporting. The colorectal cancer template was perceived to be more detailed and less refined than the breast cancer template. Most surgeons also expressed discontent with some aspect of the tool (e.g., some elements are not intuitive or do not appear clinically relevant, complex cases are not always easy to report, amendments are problematic, and the final report is too long) though their views on these aspects were not universal. Users of the end synoptic report (e.g., coders, cancer registry staff) perceived it to be largely advantageous over narrative reporting.

> *I really think that drop down menus have made it easier, uhm, I really think the technology is user-friendly.* [Physician #6]

> *The downside [is] some information that goes down, I don't know if it is clinically relevant or useful … some of it is probably clinically relevant or useful, but not to me.* [Physician #2]

Most surgeons discussed problems accessing WebSMR at some time. These problems largely related to IT issues, such as login difficulty and computers not being available/accessible in surgery lounges. Several surgeons stated that when they were unable to access the system, they would use dictation to report the surgery. The

implementation team has worked on many of the aspects creating discontent, including modifying the amendment process, addressing accessibility issues, and refining the content of the templates. The latter has occurred in conjunction with their national counterparts.

> *It is not on the computer in Room 23 and we do breast surgery in both. So now it is a matter of going from 23 to 20 and … it is difficult. If they are busy in that room [or] somebody else is already on the computer, I still dictate*. [Physician #3]

Data across multiple sources strongly indicated that synoptic reporting aligned with surgeon values and prior experiences as well as organizational and system values, directions, and priorities. Perceived value related to clinical utility, organizational efficiencies, and the potential for performance monitoring and quality improvement. Nationally, the prospect of "outcomes measurement and reporting" (i.e., performance monitoring and feedback) was found to be a main driver of surgeon engagement and use. In Nova Scotia, while some surgeons broadly discussed the benefit of these capabilities, most did not identify performance monitoring and feedback as one of their main reasons for using the tool. Rather, most identified other clinical benefits (e.g., enabling best practices, standardization and timeliness of information, communication with other care providers, and resident/ community surgeon teaching). Observation of training sessions revealed that *all* surgeons observed perceived value in the SRT, but many stated that the key to use was to make the system as easy to use as their current practice.

> *I think that we probably all agreed that in the traditional system of just dictating operative notes, there is great variability of information that is*

provided, uhm, it created problems for communication for what was found, oncologists trying to figure what we did or didn't do and uhm, also from a quality assurance perspective. You know, there are certain things that should be in there and [the synoptic report] can help achieve addressing those issues. It is just a good thing. [Physician #1]

All surgeons supported the notion that synoptic reporting should be standard practice. [Excerpt, Canadian Partnership Against Cancer: Synoptic Reporting Tools Project Evaluation]

That informants at the system, organizational, and clinician user levels repeatedly discussed the potential uses for benign disease and other clinical areas demonstrated the value ascribed to the tool.

There should be synoptic radiotherapy template. There should be a synoptic consultation note from medical and radiation oncology or any kind of oncologist, that assesses a patient, etc., etc. You can see the application of this being far. [System member #4]

Use of Synoptic Reporting Tools

The extent of use of the SRTs was revealed via key informant interviews and document analysis (NSBSP, CCPP) and a brief review of one SRT database (SSRTP). Table 12 describes use across the cases.

Cross-Case Analysis: Common and Case-Specific Factors that Influenced SRT Implementation and Use

Table 13 describes the key factors in SRT implementation and use by case and specifies the direction (i.e., facilitating or impeding) each took in the context of each case.

Commonalities Across Cases

The cross-case analysis revealed *five* similar factors across cases that affected SRT implementation and use. Two interpersonal-level factors – *(1)* the involvement of stakeholders during implementation and *(2)* managing the change process – were similar across all three cases and found to be particularly important to SRT implementation and use. At the organizational and system levels, *(3)* the support of administrators/managers in the organization and broader healthcare system and *(4)* the existence of innovation champions were also perceived as key to implementation and use across cases. That these factors transcended the different contexts (settings, timing, and actors) demonstrates their importance to gaining buy-in and support for SRT implementation, promoting a sense of ownership and accountability for SRT implementation, acquiring and leveraging resources (human and fiscal) to make the implementation a reality, and providing people with reasons to change their practice and the tools to help them succeed.

At the level of the innovation, *(5)* the attributes of the tools themselves (e.g., complexity/simplicity, relative advantage in practice, and compatibility with values and interests) influenced SRT use across cases. With few exceptions, data across sources and cases revealed there is a huge appetite for synoptic reporting: due to its

clinical utility and potential for performance/quality improvement, the innovations align with the values, priorities, and interests of nearly all in the healthcare system. This alignment (or compatibility) was instrumental to gaining organization- and system-level support for implementation (e.g., resource support and policy directives in the CCPP, much 'in-kind' technical support and staff time in the SSRTP) and to convincing clinicians to use the tools in spite of, at times, frustration and perceived inefficiencies. While performance/quality improvement aligned with organizational and system priorities and interests, it is noteworthy that many clinician users did not discuss this as a reason *per se* for their adoption and use of SRTs. Across all cases, clinicians who were involved in implementation efforts or who were identified as clinical champions saw performance monitoring and feedback as a key capability of SRTs. While other clinicians broadly discussed the role SRTs could play in quality improvement, performance monitoring and feedback did not play a large role in their decisions to use, with many stating they had little information about this capability. Despite high compatibility with values and interests, the data revealed many historical/socio-political and interpersonal issues (e.g., poor communication, weak relationships) that made implementation challenging. Moreover, in an already-overburdened environment, clinicians across cases emphasized that using a SRT (or any new tool in practice) must be as easy as what they currently do, at least after the initial learning curve.

Though the analyses were performed independently, by the same researcher but at different times, the key factors influencing implementation and use in the CCPP and SSRTP were similar. The similarity is perhaps not surprising given similarities in settings, timing, and actors: i.e., the initiatives took place at

approximately the same time in the same province and involved some of the same stakeholders at the system and user levels (i.e., colorectal surgeons). However, the 'direction' that specific factors took (i.e., facilitating or impeding) often differed between cases, with the implementation teams approaching the implementation quite differently with respect to many of these factors. The cases also had many differences (e.g., resource characteristics and availability, implementation positioning) with entirely different implementation teams. That commonalities existed in spite of the differences, and that many of the same overarching factors were also common to the NSBSP case, strengthens our findings and helps to extend and refine theory in the area of innovation implementation in healthcare.

Distinctions Across Cases

Several organization-level factors were critical in the NSBSP case but not in the CCPP and SSRTP cases, specifically the presence of ongoing monitoring and feedback mechanisms, a strong quality improvement culture, and consistent leadership. Conversely, the positioning of the tool and its implementation (i.e., as part of a provincial screening program or pilot project) and the structural, infrastructural, and socio-historical components of the larger healthcare system influenced implementation in both the CCPP and SSRTP but were not particularly germane to implementation in the NSBSP. The cross-case analysis suggests several key contextual factors, including the timing of implementation and technical requirements of the tool, contributed to these differences.

The structure of the healthcare system, and the decision-making processes within the system, that existed at the time of SRT development and early

implementation in the NSBSP were quite different than those that existed in the late 2000s when the CCPP and SSRTP tools were being implemented. For nearly the first decade of mammography synoptic reporting (during which time the SRTs were used in only two hospitals), hospitals in Nova Scotia were governed by 36 local hospital boards, essentially creating a system wherein hospitals had extraordinary autonomy over their operations. The high level of organizational autonomy meant that organizational characteristics, such as leadership and culture, likely played a fundamental role in any practice change efforts. Weak or virtually nonexistent relationships between organizations, except with the DoHW, likely strengthened this local autonomy by creating an environment with limited inter-organizational influences.

By the late 2000s, however, the health system was comprised of nine district health authorities managing 34 hospitals, along with numerous provincial programs and organizations with mandates related to health care operations and support (e.g., one centralized service delivery organization for the province's shared IT services). This structure weakened the autonomy of local hospitals and required that the organizations tasked with delivering and supporting health care work together in a more *interdependent* system. However, this interdependency created considerable challenges, as revealed in both the CCPP and SSRTP cases, in a system wherein roles, mandates, and governance structures have not been clearly defined; legislative and regulatory frameworks are inconsistent; and relationships amongst organizations are weak or have been burdened by conflict and tension. For instance, data from the CCPP revealed that individuals' and organizations' previous interactions and

relationships with Cancer Care Nova Scotia, the organization that hosts and oversees the CCPP, likely influenced interactions in this case.

The technical requirements of the SRTs also contributed to differences between cases. The mammography SRTs, while they have some minimal integration with other IT systems, are essentially 'standalone' tools, meaning they are not interfaced with hospital IT systems to permit the electronic transfer of information into and out of the tools. The CORI and WebSMR tools, however, have the technical capabilities to interface with other hospital IT systems; integration was a priority of both initiatives. Thus, the CCPP and SSRTP implementation teams had to navigate the existing health system, with its indistinct roles and piecemeal IT infrastructure, and develop relationships with individuals in different organizations to achieve IT integration. For both cases, the existing system structures/infrastructure and roles/relations created frustrations and influenced implementation activities and timelines.

That the presence of ongoing monitoring/feedback mechanisms was a key factor in the NSBSP case, but was not particularly influential in the other cases, may reflect differences in terms of early implementation versus expansion and sustainability. Data from the NSBSP indicated that ongoing monitoring and feedback was instrumental in demonstrating the value of the program (and of its SRTs), which, in turn, helped the team acquire and maintain support to *improve and expand* the program (including its SRTs). Implementation team members in the other cases were planning (SSRTP) or in the early stages of implementing (CCPP) ongoing monitoring and feedback mechanisms. Data from these cases revealed that the potential performance monitoring/quality improvement capabilities of SRTs certainly aligned

with the interests and priorities of system and organizational members, while the prospect of performance monitoring and feedback appealed strongly to some clinicians but much less so for others. However, data did not suggest that the presence (or absence) of monitoring and feedback mechanisms influenced – in a significant way – the implementation and early use of the SRTs.

The cross-case analysis also revealed that the specific settings in which the SRTs were implemented (i.e., clinical departments, hospitals) appeared to play less of a role in terms of the factors important to implementation and use than timing and other contextual issues. On a broad level, there were no features or characteristics of clinical departments or hospitals that appeared more influential in terms of enabling or facilitating implementation. SRTs were implemented in different clinical departments and units (i.e., radiology, gastroenterology, surgery), and at both tertiary and community hospitals of varying sizes and procedural volumes. In fact, in one hospital, organizational members and clinicians were extremely supportive of one SRT; held divergent views on another SRT, with some individuals highly supportive and others resistant; and were highly resistant with respect to the other SRT. The data across cases indicated that such diversity, within and across settings, was largely related to the interpersonal-level factors and to individuals' experiences and relationships with implementation team members and local 'actors' championing the initiative.

Table 9. Criteria for thematic analysis of each case (adapted from Braun & Clarke [212]).

PROCESS	**CRITERIA**	
Transcription	Data transcribed in appropriate detail; transcripts checked against tapes for accuracy	Y / N
Coding	Each data item given equal and full attention	Y / N
	Coding process was thorough, inclusive, and comprehensive (themes not generated from a few vivid examples)	Y / N
	All relevant extracts for each theme are collated	Y / N
	Themes checked against each other, and back to original dataset	Y / N
	Themes are internally coherent and distinctive	Y / N
Analysis	Data have been interpreted rather than just described	Y / N
	Analysis and data extracts match each other	Y / N
	Analysis tells a convincing and well-organized story	Y / N
	A good balance between analytic narrative and data extracts is provided	Y / N
Synthesis	Assumptions about thematic analysis are clearly laid out	Y / N
	Good fit between what you claimed to do and what you have done	Y / N
	Language and concepts are consistent with objectives	Y / N
	Researcher is positioned as active in research process	Y / N
Overall	All phases were completed adequately, without rushing	Y / N

Table 10. Key informant role and setting (if applicable), by unit of analysis.

	Case A: NSBSP	Case B: CCPP	Case C: SSRTP
Implementation team[a]	Team member #1 Team member #2 Team member #3	Team member #1 Team member #2 Team member #3 Team member #4	Team member #1 Team member #2 Team member #3
	3	*4*	*3*
Clinician users	Physician, tertiary[b,c] Physician, community Physician, community Physician, community	Physician, tertiary[b,c] Physician, tertiary Physician, tertiary Physician, community[c] Physician, community	Physician, tertiary Physician, tertiary Physician, tertiary Physician, tertiary Physician, community[c] Physician, community
	4	*5*	*6*
Organization	Department head, tertiary Department head, community Manager, community Manager, community Report end user, tertiary	Department head, tertiary Manager, tertiary Manager, community Manager, community Report end user, tertiary	Manager, tertiary Manager, tertiary Manager, tertiary Manager, community Report end user, tertiary Report end user, tertiary Report end user, tertiary
	5	*5*	*7*
System	Health district CEO Executive, Department of Health Manager, provincial service organization	Health district CEO Executive, Department of Health Executive, provincial program Executive, provincial program Manager, provincial service organization	Health district CEO Executive, Department of Health Executive, provincial program Executive, provincial program Manager, provincial service organization
	3	*5*	*5*

[a] All implementation team members in all cases were located in tertiary care settings.
[b] Heavily involved in initial tool design and ongoing refinement.
[c] Identified by other key informants as a local physician champion.
NSBSP = Nova Scotia Breast Screening Program; CCPP = Colon Cancer Prevention Program; SSRTP = Surgical Synoptic Reporting Tools Project.

Table 11. Documents collected and reviewed.

	Source	**Type**
Case A: NSBSP	Web search	Annual reports, from 2005-2011 Research/conference presentations (2 PowerPoint [PPT] documents) Communications materials (press release, newsletter) (2 documents) Media article (1 document)
	Implementation team	Sample synoptic reports History/timeline (PPT slides) Schematic of program and its processes/procedures (PPT slides) Article: professional journal (1 document)
Case B: CCPP	Web search	Communications materials (e.g., press releases, newsletters, communications briefs) (6 documents) Report on population-based colorectal cancer screening in Nova Scotia (1 document) Provincial practice recommendations (1 document) National position statements (2 documents) Report on colorectal cancer screening in Canada (1 document) Program/strategy elements of Canadian colorectal cancer screening programs (1 PPT file) Quality determinants of Canadian colorectal cancer screening programs (1 PPT file) Requirements/gap analysis of CCPP software applications (1 document)
	Implementation team	Sample synoptic reports Implementation strategy (1 document) Provincial evaluation (1 PPT file) Public presentation (1 PPT file)
	Other key informants	Professional association published consensus guidelines (1 document) Media article (1 document)
Case C: SSRTP	Web search	Communications materials (press release, 2 newsletters) (3 documents) Conference presentation (1 PPT file)
	Implementation team	Sample synoptic reports Project charter (1 document) Lessons learned (1 document) Presentation from national conference (1 PPT file)

		Presentation to local stakeholders (1 PPT file)
	Other key informants	Funder implementation strategy/directions (4 PPT presentations) Funder evaluation (1 document, 1 PPT file) (Inter)national List Serve discussion on synoptic reporting (all emails over 1 month period)
System context	Web search	Reports/discussion papers on privacy and personal health information legislation (3) Acts on privacy/personal health information, Nova Scotia (4) Act on privacy/personal health information, Federal (1) Pan-Canadian framework on privacy/personal health information (1) Hospital Business Plans (2) Consultant's report on Nova Scotia's healthcare system (1) Report/review on Nova Scotia's E-health system (1) Journal article on Nova Scotia's E-health system (1) Cancer Management Strategy for Nova Scotia (1) Evaluation of Cancer Care Nova Scotia (1)

NSBSP = Nova Scotia Breast Screening Program; CCPP = Colon Cancer Prevention Program; SSRTP = Surgical Synoptic Reporting Tools Project

Table 12. Use of the synoptic reporting tool (SRT) by case, at the end of data collection (February 2012).

Case	Data source(s)	Extent of use
NSBSP	Key informant interviews, documents	• All radiologists in the province use the MIS (screening SRT); use of this tool has been "strongly recommended" by government since 2008 in response to a provincial policy related to national mammography accreditation • Radiologists in three districts have chosen not to use the DRS (diagnostic SRT) for their reporting of diagnostic mammography
CCPP	Key informant interviews, documents	• All endoscopists in the province use CORI for screening colonoscopies; use of the tool is required for participation in the screening program • Most endoscopists in one district use CORI for all endoscopic procedures; a district-wide policy was in the process of being implemented • Most endoscopists in the eight remaining districts do not use CORI for diagnostic colonoscopy
SSRTP	Key informant interviews, database review	• 4 of 4 breast surgeons in the two tertiary care centres consistently use WebSMR to report breast cancer surgeries[a] • 3 of 4 colorectal cancer surgeons at the tertiary care centre consistently use WebSMR to report colorectal cancer surgeries • 1 of 2 general surgeons in the community hospital consistently uses WebSMR to report breast and colorectal cancer surgeries

[a] The review of the database revealed more synoptic reports than actual breast cancer surgeries, indicating some surgeons use the SRT to also report benign breast surgeries.

Table 13. Common and distinct factors influencing synoptic reporting tool (SRT) implementation and use across cases. Depending on the context, the factor was a facilitator or barrier to implementation and use; + indicates a facilitating influence, - indicates an impeding influence. Factors that were common to all three cases are shaded grey.

Factor	**Case 1: NSBSP**	**Case 2: CCPP**	**Case 3: SSRTP**
Common factors			
Stakeholder involvement	+/- Initial implementation and use were facilitated by stakeholder involvement; subsequent expansion was impeded by low stakeholder (i.e., radiologist) involvement	- Implementation was impeded by limited stakeholder involvement	+ Implementation was facilitated by early, ongoing, and collaborative stakeholder involvement
Managing the change process	- Implementation and use were impeded by sub-optimal change management practices	- Implementation and use were impeded by sub-optimal change management practices, though user training was well conducted	+ Implementation and use were facilitated by high-quality change management practices
Administrative and managerial support*	+/- Implementation was facilitated by high administrative support and high managerial support in some hospitals; implementation was impeded by low managerial support in other hospitals	+/- Implementation was facilitated by high administrative support; implementation was impeded by low managerial support in many hospitals	+ Implementation was facilitated by high administrative and managerial support
Champions and respected colleagues	+/- Implementation and use were facilitated by clinical and administrative champions; lack of clinical champions in some districts impeded use	+ Implementation and use were facilitated by clinical champions and respected clinical colleagues	+ Implementation and use were facilitated by clinical champions and respected clinical colleagues

Table 13 continued.

Factor	Case 1: NSBSP	Case 2: CCPP	Case 3: SSRTP
Innovation attributes	+/- Implementation and use were facilitated by alignment with individuals' and organizations' values, interests, and needs; use was impeded by perceived tool (and final report) deficiencies and its relative (dis)advantage in practice	+/- Use was facilitated by the tool's perceived ease of use, but impeded by IT and other technical issues; implementation and use were facilitated by alignment with individuals' and organizations' values, priorities, and interests	+/- Use was facilitated by the tool's perceived ease of use, but impeded by accessibility and IT issues; implementation and use were facilitated by alignment with individuals' and organizations' values, priorities, and interests
Distinct factors			
Implementation approach	NA	+ Implementation and use were facilitated by the tool's positioning in the provincial screening program (however, the top-down, policy driven approach was met with much resistance)	+/- Implementation was facilitated by the tool's positioning as a pilot project; use was impeded by its positioning since the team had no authority to influence use through policy or similar strategies
Project management	NA	- Implementation was impeded by suboptimal project management, specifically related to the tool's implementation	NA
Resources	- Implementation and use were impeded by insufficient resources for SRT development/updates, implementation, and expansion	NA	- Implementation was impeded early in the project by insufficient IT resources

Table 13 continued.

Factor	Case 1: NSBSP	Case 2: CCPP	Case 3: SSRTP
Culture	+ Implementation and use were facilitated by the program's strong quality improvement culture; however, this strong culture was viewed negatively by some users, possibly influencing expansion	NA	NA
Leadership	+ Implementation and use were facilitated by consistent, effective leadership	NA	NA
Monitoring and feedback mechanisms	+ Implementation and use were facilitated by ongoing monitoring and feedback mechanisms	NA	NA
Components of the healthcare system	NA	- Implementation was impeded by structural, infrastructural, and socio-historical components of the healthcare system	- Implementation was impeded by relational and infrastructural components of the healthcare system

NSBSP = Nova Scotia Breast Screening Program; CCPP = Colon Cancer Prevention Program; SSRTP = Surgical Synoptic Reporting Tools Project; NA = not applicable.
*Administrators = executive officers, directors, and senior management at the Department of Health, health district, and hospital levels; management = managers and heads of organizational departments and units

Figure 2. Key factors and important relationships between factors in the Nova Scotia Breast Screening Program. Factors with bolded font are common across cases.

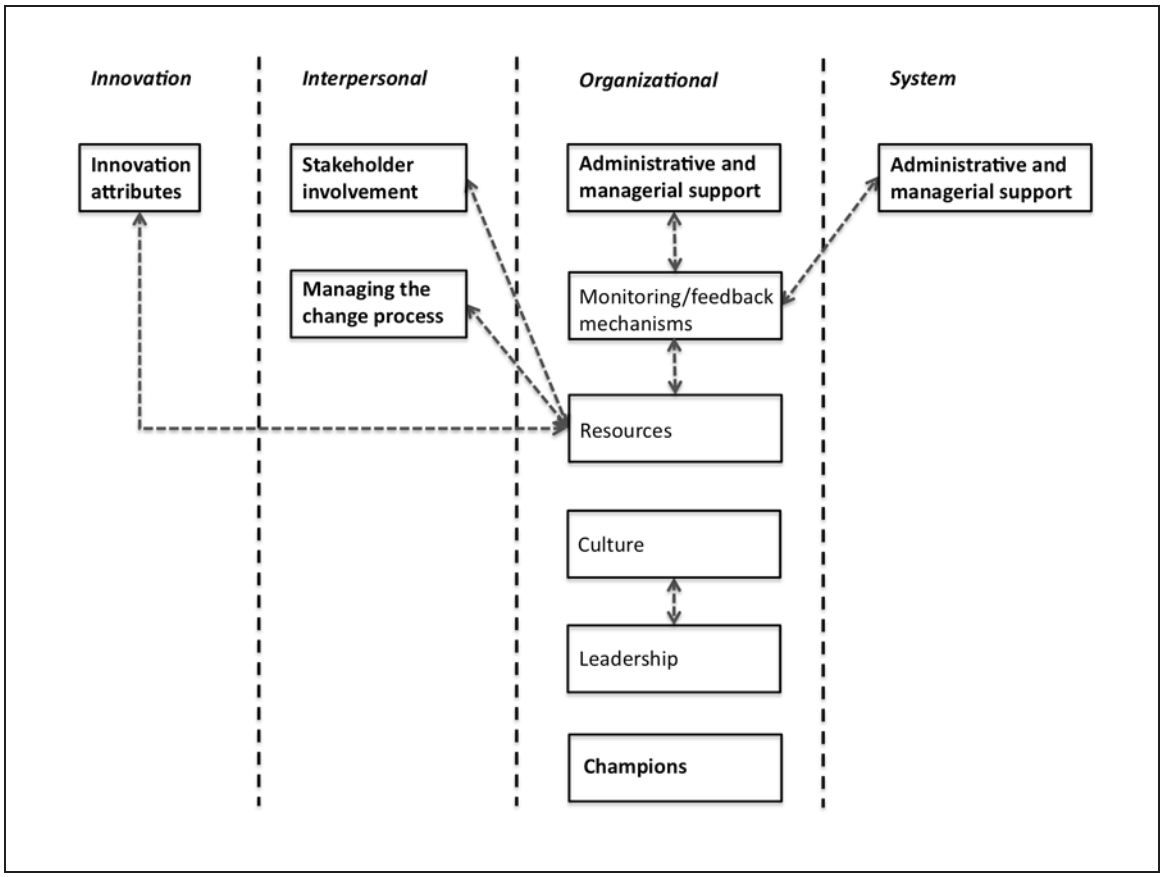


Figure 3. Key factors and important relationships between factors in the Colon Cancer Prevention Program. Factors with bolded font are common across cases.

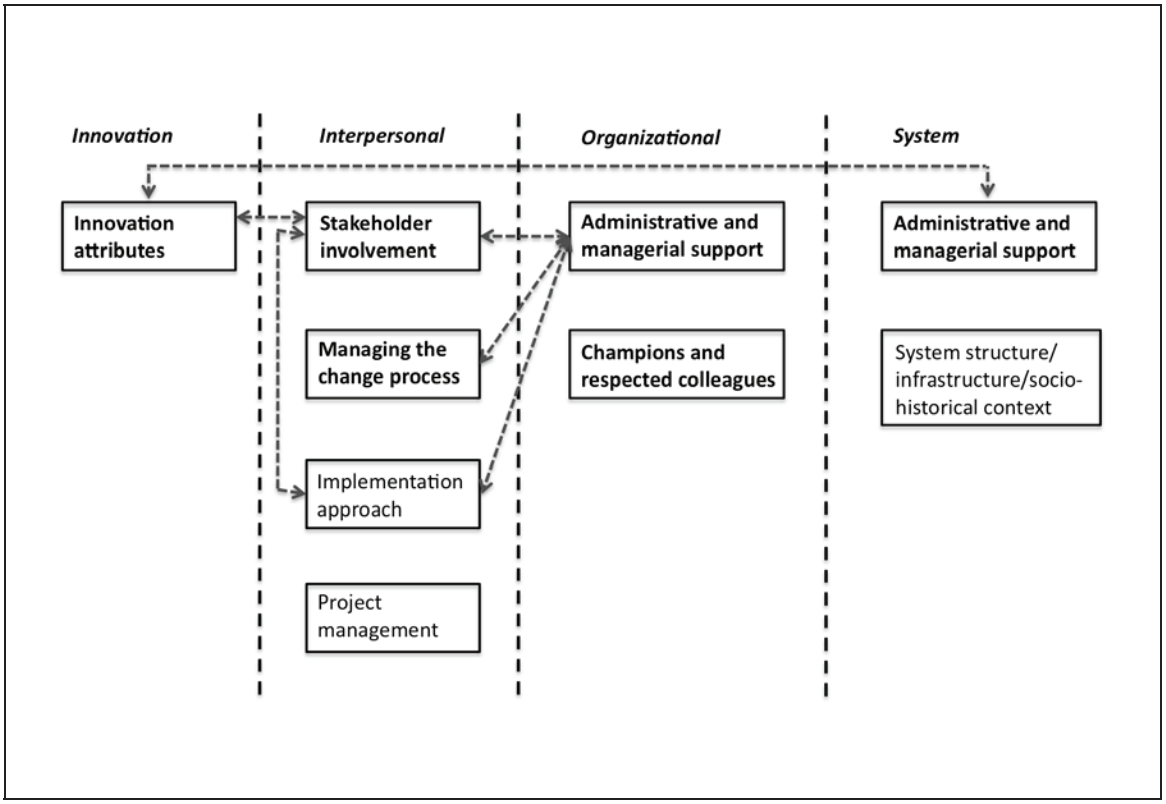
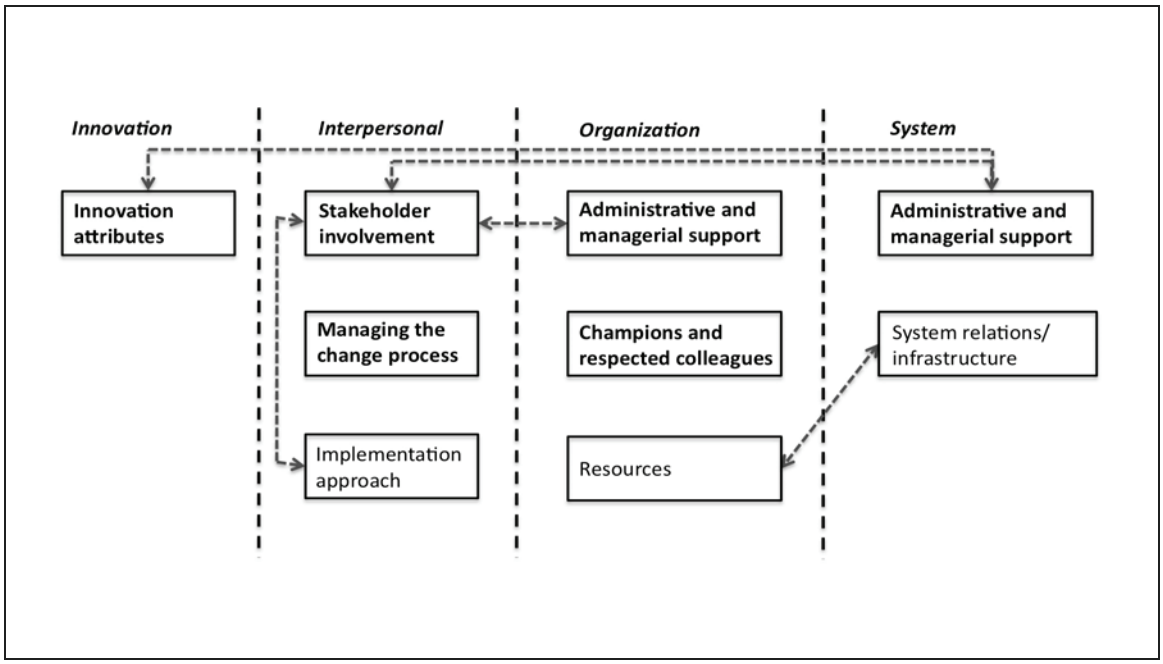


Figure 4. Key factors and important relationships between factors in the Surgical Synoptic Reporting Tools Project. Factors with bolded font are common across cases.



CHAPTER 4: DISCUSSION

Chapter 4 is the Discussion Chapter. It is comprised of the following sections: Discussion of Findings, Examining the Bigger Picture, Strengths and Limitations, Implications of Findings, Methodological Considerations, Knowledge Translation Plan, Future Research, and Conclusions.

DISCUSSION OF FINDINGS

This study employed case study methodology to examine the key interpersonal-, organizational-, and system-level factors that influenced the implementation and use of synoptic reporting tools (SRT) in three cases of cancer care in one Canadian province. Analysis of each case identified numerous factors – which existed at multiple levels of the system and which were often related – that were important to SRT implementation and use (see Table 13, Chapter 3.2). The cross case analysis revealed five common factors that were particularly influential to SRT implementation and use across the three cases studied: stakeholder involvement, managing the change process, administrative and managerial support, the presence of clinical champions, and attributes of the tools themselves. Several factors were also distinct to cases, expanding our understanding of how specific contextual aspects may affect and interact with change efforts in clinical care settings.

Relationship to Theoretical Perspectives

The theoretical perspectives used to guide this study emphasize various interpersonal, organizational, and/or system influences on innovation implementation and practice change (the constructs of each perspective are described in Table 4, Chapter 2.2). The five key factors that were common across cases were represented across the three perspectives, either explicitly as a construct or by encompassing some of the same concepts as the constructs embody. The three perspectives are discussed below with respect to the study findings. Table 14 presents each of the key factors in relation to the theoretical perspectives.

1. Promoting Action on Research Implementation in Health Services

One of the constructs of the PARiHS framework – *context* – undoubtedly influenced SRT implementation in the NSBSP, but less so in the other cases. In PARiHS, the construct of context is comprised of three elements: culture, leadership, and evaluation. Each of these elements emerged separately as key factors in the NSBSP case (with evaluation referred to as monitoring and feedback mechanisms). As discussed in the Results chapter, the NSBSP began implementing its SRTs in an era with arguably less complexity and interdependency across organizations and considerably more autonomy at the hospital (organization) level. These contextual factors likely relate to the high degree of influence of these organizational attributes in this case; in other similar situations, wherein innovations are introduced in organizations (or departments/units) that have a relatively high degree of independence over their operations and resources, it is plausible that organizational characteristics such as leadership, culture, and ongoing monitoring and feedback mechanisms play a larger role in implementing and maintaining practice changes than system-level characteristics (e.g., the introduction of a new practice tool in a family practice clinic). However, it is also possible that these same factors play a significant role in the sustainability of innovations. That is, consistent leadership, a strong quality improvement culture, and regular monitoring and feedback at multiple levels of the system (all observed in the NSBSP) are crucial to maintaining innovations after the initial implementation period has ended.

Nevertheless, it is interesting that none of these elements of context appeared particularly influential in the CCPP and SSRTP cases. In addition to the issues

discussed above, the relative infancy of the cases may partially contribute to this finding. The CCPP and SSRTP were new initiatives, with team members having a limited history of working together. Thus, these programs and projects may have been too early in their development to cultivate a strong culture – i.e., a deeply embedded set of shared values and assumptions [132] – that was conducive (or not) to innovation. Similarly, although both cases were developing regular monitoring and feedback mechanisms, neither case had established these mechanisms at the time of data collection. Therefore, perhaps not surprisingly, the initiative's actual approach to routine monitoring and evaluation (e.g., the when and how of providing feedback) was not a key factor in SRT implementation and use.

Leadership was closely linked to several of the key factors that influenced SRT implementation in the CCPP and SSRTP cases, including managing the change process, resources (SSRTP only), and champions and respected colleagues. Indeed, implementing change requires that leaders communicate the need for change, provide clarity about the change process, and follow through with the necessary resources and operational details [135, 136]. Moreover, the clinical leaders of these cases were clearly influential with clinical and administrative colleagues and thus instrumental to SRT implementation and use. This influence was one of the concepts encompassed under the factor 'champions and respected colleagues' since it was the leaders' abilities to convince others to accept the innovation and their clout with their peer groups that came across in the data as being particularly important *versus* their specific leadership approach or style.

Interestingly, neither the construct of *evidence* (even defined broadly through

PARiHS) nor *facilitation* (as conceptualized by PARiHS) was an influential factor in SRT implementation and use. Most key informants did not discuss the evidence for synoptic reporting as being a factor in their decisions to adopt and/or use the tools. When evidence was discussed, the evidence was most often data from other jurisdictions (e.g., local evaluations and verbal experiences with use) than from the scientific literature. Instead, most informants discussed the utility of these tools without reference to particular evidence, but rather to their individual, professional, and/or organizational values: as articulated by one clinician, synoptic reporting *"is just a good thing."* For clinician users, some discussed aspects of their clinical experience that support SRT use and many emphasized that the most important thing from their perspective is that the tool improves patient care, but they spoke of their clinical experiences and patients in the context of their beliefs and values, not as sources of knowledge about SRTs.

Finally, this framework emphasizes the role of facilitation – specifically, the use of dedicated, trained facilitators – in enabling effective implementation and practice change. Certainly, the implementation teams in each case were responsible for supporting affected individuals and groups before and during SRT implementation. However, key informant and documentary data did not indicate a need for a dedicated, trained individual to work with the team "to construct a programme of change that meets the individual and team's learning needs" [22] (pg. 10) but rather emphasized particular facets of implementation processes that dedicated teams (or appointed persons) must attend to and engage in. Aspects of facilitation were clearly encompassed in other factors, notably stakeholder involvement and managing the

change process and, to a lesser extent, project management (CCPP). Importantly, SRTs represent collective-level interventions that could not possibly be implemented outside of organized and resourced initiatives. Therefore, in some ways, the need for facilitation was recognized upfront, particularly the provision of practical and technical support to achieve the goal of SRT implementation. The prolonged SRT implementation in the NSBSP was partially attributed to lack of resources, both human and fiscal. In fact, much of the SRT development and implementation has been performed without individuals specifically dedicated to (or trained for) those tasks but rather by people with many other duties and responsibilities. Given the limited focus on stakeholder involvement and change management practices, it is plausible that the presence of a dedicated individual to plan and oversee the implementation would have benefited this case.

2. Organizational Framework of Innovation Implementation

As discussed in the Results chapter, many of the constructs of Helfrich et al's adapted framework [50], including management support, innovation champions, implementation policies and practices, implementation climate, and innovation-values fit, were salient to SRT implementation and use across all cases. This framework emphasizes the important role of *management support* in promoting innovations and in enacting supportive policies and practices to realizing implementation. In this study, administrative and management support was key to enabling or impeding implementation progress in all three cases, with 'administrators' referring to executive officers, directors, and senior management at the Department of Health,

health district, and hospital levels and 'managers' to mid-level managers and heads of hospital departments and units. In each case, senior administrative support was evident and perceived as being instrumental to facilitating SRT implementation. However, the level of management support varied across and within cases; in settings wherein support was high, implementation went smoother and the experience was (generally) better for end users whereas where support was low, the reverse occurred. Even when they do not have positional authority with regards to implementation, organizational managers can influence the implementation process though explicitly or implicitly demonstrating material or moral support for SRTs and using their influence – in a facilitating or hindering way – over departmental policies, priorities, and resources (including personnel). The role of organizational (or "middle") managers has received little attention in innovation implementation in healthcare [226], despite the considerable influence they can potentially exert in day-to-day implementation activities.

Another of the framework's constructs – *innovation champions* – was found critical to implementation and use across cases. In fact, the influence of clinical champions and respected colleagues cannot be underestimated. In all cases, respected colleagues, either provincially or locally, were perceived as being instrumental to the decision to use the SRTs and to continue using, despite ongoing challenges and frustrations. These individuals threw their 'weight' behind SRT adoption and implementation, and provided legitimacy to this new tool [16]. In the NSBSP, the hospitals that chose to use the diagnostic SRT had local champions who helped colleagues see the value of the tool and supported them through the 'growing pains';

in the CCPP, many informants stated their belief that endoscopists continued to persevere through and 'put up with' the implementation, despite many ongoing challenges and frustrations in some districts, due to their respect for provincial champions; and in the SSRTP, wherein use of the SRT was completely voluntary, nearly all surgeons stated they made the decision to use the tool because of their respect for and trust in a specific colleague. Many researchers have demonstrated the importance of champions to the success or failure of implementation efforts in health care [44, 47, 50, 53, 227, 228], though certainly other factors influence whether consistent changes in behaviour actually occur [227]. In this study, as observed elsewhere [227], several of the clinical champions played leadership roles in the initiatives in addition to their championing roles and were highly involved in the details of the implementation efforts.

Managing the change process – or managing the people and processes involved in this change effort – was a common factor across cases. The constructs *implementation policies and practices* and *implementation climate* are both encompassed within this factor. Helfrich et al. [50] describe implementation policies and practices as strategies that support the innovation's implementation, "specifically organizational-member technical capacity, incentives, and identification and reduction of barriers to implementation" (pg. 284). Implementation climate refers to users' shared perceptions of the extent to which a specific innovation is supported; integral to this is whether the cumulative strategies work together to increase employee skill level, provide incentives, and remove barriers to use [68]. Managing resistance and other barriers to SRT implementation and use and providing training

and support were clearly important parts of change management in all cases.

The framework's construct *innovation-values fit* was clearly important to all three cases. In this study, innovation-values fit was one of the concepts encompassed under innovation attributes, along with complexity/simplicity and relative advantage. High alignment (or compatibility) existed between individual, organizational, and system values and priorities and the implementation and use of SRTs. This alignment was hugely important to decisions around adoption of these tools, particularly in an environment of competing demands and growing resource constraints. However, it certainly did not ensure a smooth (problem-free) implementation process and it did not guarantee implementation success. In this study, other characteristics of the tool, its mode of delivery, the setting and context of implementation, and various organizational and system constraints and enablers impacted whether the SRTs were implemented and ultimately used by clinicians. For those who actually work in frontline clinical practice or health administration/policy settings, the impact of these factors may not surprising.

Finally, *financial resource availability* – the remaining construct in this framework posited to impact implementation effectiveness – varied across cases, with limited resources deemed a key constraining factor in both the NSBSP and SSRTP. The lack of financial resources as well as financially dependent resources (e.g., acquiring personnel) was perceived harmful in the NSBSP case, as limited resources hindered the ability to adequately carry out change management practices and to modify/update the SRTs based on user feedback. In the SSRTP, a lack of financial resources for information technology (IT)-related work and expertise caused setbacks

and ultimately delayed the implementation, though funds were eventually acquired that allowed the team to successfully adapt and implement the SRT in Nova Scotia. The lack of financial resource availability in both cases demonstrates disconnect between funders' expectations, policy (in the case of the NSBSP), and practice wherein programs and initiatives are expected to implement and carry out certain tasks but are not appropriately resourced to do so.

3. "Systems" Thinking / Change

The propositions put forward by Kitson [17] regarding the *nature of the knowledge*, *local autonomy* of participants in the system, *re(negotiation)* of relationships in the system, and how individuals attract the necessary *resources* were germane to the cases studied and the key factors that influenced implementation and use of the SRTs. Regarding the first two propositions, Kitson [17] asserts that successful implementation is a function of "the way in which participants (individuals) in the system understand the nature and characteristics of the new piece of knowledge" and "the level to which [participants] can make informed, autonomous decisions about how they can use the new knowledge" (pg. 224). In this study, implementation and use was profoundly affected by the way in which participants understood the SRTs. In the findings, individuals' understandings of the nature and characteristics of the SRTs were depicted as attributes of the innovation, specifically complexity, relative advantage, and compatibility. When individuals believed that the SRT held value (whether *value* related to direct patient care, education/teaching, quality improvement, or institutional efficiencies) and, perhaps to a lesser extent, would (at

least eventually) be better than the practice it replaces, they were much more apt to support its implementation and use. Interestingly, the SRTs in two cases (NSBSP, CCPP) did not create synoptic end reports, despite being described and advocated as SRTs. The reason for this was that, even though they produce reports that are narrative in nature, the systems capture and store data using discrete data fields and require mandatory input of information deemed critical to reporting the investigation or procedure. Nonetheless, many informants who used these systems were resistant to their use since they did not view these systems as 'true' SRTs and perceived the conversion of the discrete data items to narrative format to be confusing in practice. Certainly, the extent to which individuals were provided the opportunity to collaborate on decisions about the innovation and its implementation – and thus retain some level of local autonomy – were critically important to building support for the SRTs and facilitating their implementation.

The latter two propositions are highly connected to stakeholder involvement – a key factor in all three cases studied (either facilitating implementation when high, or inhibiting when low). That innovation is deemed a function of how people "negotiate and renegotiate relations with others (individuals, teams, internal, external relations) in their system" recognizes the relational aspects of change, the interdependencies of actors in the system, *and* the importance of building support for the change effort. In her theoretical paper, Kitson [17] argues that involvement of key stakeholders at various levels of the system is also critical to attracting and leveraging the resources needed to implement and sustain new ideas and tools in practice. In this study, high stakeholder involvement, at all levels of the system, was critical to navigating the

structural, infrastructural, and socio-historical components of the healthcare system; building a sense of ownership amongst local organizational and system members, leading them to influence implementation in the areas and jurisdictions they have control; and acquiring moral and material support for SRT implementation.

The importance of stakeholder involvement in this study calls for further discussion. The findings clearly indicated that most individuals resisted any change they were not a part of, and that the breadth and depth of stakeholder involvement differed across cases. The depth of involvement in the SSRTP case was further along the spectrum of engagement [219] than in the other cases, with stakeholders clearly viewing themselves as being partners in the implementation process and as having an active role in formulating solutions and making decisions. In the CCPP, somewhat divergent views on stakeholder involvement emerged between implementation team members and other informants, with team members conveying greater involvement than that experienced by informants. While the CCPP involved key stakeholders as members of working groups and established/worked with local implementation teams, the breadth and depth of engagement is fundamental to understanding the different viewpoints. Certainly, SRT implementation in the CCPP was not performed in isolation; however, the data suggested the range of stakeholders was limited and involvement took on more of an 'informing' and 'consulting' approach than an 'involving' and 'collaborating' one [219]. Data from the NSBSP demonstrated high stakeholder involvement during SRT development and early implementation, but much less involvement during expansion, which has proven challenging for that case.

The different approaches the cases took in terms of stakeholder involvement

were related to other factors: namely, the case's positioning in the provincial landscape and availability of human resources. Nevertheless, the disruptive impact that certain system (i.e., structure of care delivery, privacy legislation/regulations) and organizational (i.e., resistance of certain departments/groups) issues were perceived to have in the CCPP demonstrates the tremendous value of stakeholder involvement. These same structures, legislation, and departments/groups were present in the SSRTP and had to be navigated/managed by individuals in both cases, but did not have the same impact on implementation. For example, the SSRTP was able to integrate its SRT with hospital information technology (IT) systems in a relatively timely manner (though some delays did occur) whereas the CCPP was still working to achieve IT integration in most health districts three years post-implementation, with ongoing issues purportedly related to privacy and data sharing, ownership of data, and technical IT work that had to be completed. However, the data strongly suggested that one of the fundamental reasons for this difference between cases related to the interpersonal aspects of the implementation – stakeholder involvement and the subsequent capacity to build, negotiate, and leverage helpful relationships.

In some ways, Kitson's [17] theoretical paper appears to be a redevelopment and maturation of the PARiHS framework (Kitson was also a developer of PARiHS). In the paper, she calls for a greater integration of systems and organizational theory in knowledge translation research and places much more emphasis on the non-linear, dynamic nature of health systems and the interpersonal aspects of implementation. While concepts such as context and facilitation continue to be emphasized as important influences on practice change, the article examines these constructs in light

of the ‘organism’ view of health care organizations [229] wherein health care systems are complex, dynamic entities that rarely correspond to the linear, logico-deductive, approaches often used to understand the process of putting new knowledge into practice. While this study identified specific tangible factors that were important to SRT implementation and use, the factors and relationships amongst factors revealed an interdependent, social system wherein implementation and use were inextricably linked to people and their transactions.

Nonetheless, Kitson [17] continues to accentuate the role of a dedicated facilitator by arguing “the innovation process is inherently so complex that it requires trained experts to enable it to happen effectively” (p. 224). As discussed above, the innovations in this study could not have been implemented without individuals working within the system to make it happen. However, the implementation teams were comprised of people with various skillsets and training, and many did not have formal training or skill development in facilitation-based tasks such as project management/coordination, critical reflection, and adult learning [110]. This assertion, therefore, begs the question: *experts at what exactly?* Considering this study’s findings, one could argue experts in relationship building and/or examining and understanding processes of change and ‘making sense’ of actions (or non-actions) and interactions. Certainly, communication skills are also essential to managing any change process; these skills should include the ability to recognize the different cultures and contexts that exist, and understand that messages will be interpreted differently by the people and groups within these different cultures and contexts [97]. Nevertheless, this study’s findings do not strongly support the need for “trained

experts" in order for innovation processes to happen effectively. Perhaps innovations that are relatively complicated to understand and use, and that are less compatible with existing beliefs, values, and experiences, would indeed require more holistic-based facilitation [110] and thus individuals trained in experiential learning and critical reflection to help people and teams reflect upon, challenge, and change their attitudes and ways of working.

The Realities of Implementation

Despite similarities in overarching factors, there were substantial differences across the cases in terms of these factors and how they played out in each of the initiatives. Indeed, the implementation processes were characterized by different approaches and strategies for change, leading to different experiences for those affected by the change. The factors identified – and the contingencies and interdependencies amongst them – demonstrated that the implementation processes were highly contextual and relational in nature and often deviated from its intended, planned path.

In all cases, the implementation process was characterized by many divergent and convergent activities that continued over time (in the case of the NSBSP, more than two decades) and at different levels of the system [21]. For example, implementation teams moved between forging new relationships and leveraging existing relationships and went through times of developing strategies, implementing them, then re-inventing and re-implementing them. At times, there has been much tension between organizations, in which implementation team members had to navigate. This tension was largely due to the lack of clarity in organizational

mandates and roles within the healthcare system's structure, and previous interactions and relationships within the system. For example, while there is one centralized service delivery organization in Nova Scotia for the province's shared health IT services, the role and relationship of this organization in relation to provincial programs – which are not normally involved in the *delivery* of healthcare services – was unclear (for all organizations involved) and thus, at times, triggered misunderstanding and conflict.

The data demonstrated that setbacks often occurred and implementation timelines and resource requirements frequently changed. One illustrative example is the challenges experienced by the CCPP and SSRTP in integrating the tools with existing IT systems. Many key informants, particularly those close to the implementation processes, expressed times of disappointment and frustration, as articulated by one implementation team member: "*I did what I could and I got what I wanted but it was a very long, very frustrating process.*" Even in the CCPP, which arguably had the most linear path to implementation and certainly the quickest, the team faced many setbacks and challenges, and saw many changes to its original implementation strategy (e.g., the initial implementation was supposed to occur in one district only, but because of "politics" was changed to three districts). As one key informant stated, despite its positioning as part of the provincial screening program and thus the greater power and authority it had relative to the other cases, those things "*didn't make [CORI] easier to implement. It didn't help greater support and uptake*."

Finally, innovation implementation did not occur in clearly delineated stages (e.g., invention, testing, adoption, implementation, and institutionalization), as

depicted in much of the prevailing literature on innovation processes [16, 38]. For example, there was no clear separation between users' decisions to adopt and implementation efforts, nor did implementation efforts begin only after the innovations were considered final products. The process was fluid and will likely continue to be as the innovations evolve and expand in usage (e.g., across regions, disease sites, and investigations/procedures). Indeed, SRTs, as with many innovations, must continue to evolve, in the face of changing evidence, technology, and contexts (e.g., settings and actors involved), if they are to remain relevant and usable.

In recent years, several knowledge translation (KT)/implementation science researchers have challenged the view that change processes are rational and orderly, and progress through a series of more-or-less predictable stages [17, 18]. As emphasized by these authors and others [21, 65], an orderly, periodic progression of stages does not reflect how things actually happen in *real life*. In Van de Ven and colleagues' seminal work on the Minnesota Innovation Research Program, wherein they tracked the development of 14 diverse innovations, from concept to implementation (or termination), in real-time and in their natural field settings, they defined the innovation journey as a non-linear cycle during which new ideas are developed (or adapted) and implemented by people who engage in relationships with others and make the adjustments needed to achieve the desired effects within a specific organizational context [21]. They observed that innovations normally undergo continual adaptation, re-invention, and proliferation, and that innovation processes are messy and complex and characterized by non-linear cycles of divergent

and convergent activities (e.g., ‘expanding’ processes of exploring new directions and creating ideas/strategies versus ‘narrowing’ processes of building on given directions and implementing ideas/strategies). They observed that many different people were involved in the journey, fluidly engaging and disengaging at different times, depending on their expertise, interests, and needs for inclusion. Their work also found that receptiveness to the innovation and speed of adoption are inhibited when end users have no opportunity to re-invent or modify innovations that are developed elsewhere, and that implementation is facilitated (but not guaranteed) by the active involvement and commitment of many top managers, who do not necessarily hold homogenous opinions but often hold opposing views that ultimately enhance decisions about the innovation. The implementation experiences of all three cases within this study are consistent with this view of the innovation journey.

That the implementation process often does not follow a planned set of actions, or is highly contingent on contextual factors, does not mean that planning is futile. Rather, the findings suggest that those who are concerned with implementing change in health care settings must consider a number of factors and how they relate to one another, including the different needs/expectations of stakeholder groups, different histories of the organizations, and local priorities and resource allocation [56]. One key message from much of the organizational and change management literature is that implementation is a process that can be facilitated by careful planning and well-designed implementation periods (e.g., creation of implementation team, early involvement of key stakeholders, use of appropriate evaluation and feedback mechanisms, cultivation of champions), but cannot be fully isolated from the effects

of serendipity, uncertainty, local pressures and constraints, power dynamics, and external (socio-political) influences [230].

Thinking in Terms of Complex Adaptive Systems

As organizations and professions become more interdependent, the interpersonal aspects of change become more important. Several authors have highlighted that health systems, at least in industrialized countries, have changed substantially over the past few decades, with increasing interdependency across its various players and components [96, 231]. In Nova Scotia, as elsewhere, the greater centralization of resources and regionalization of care (creating less autonomous local organizations) and increasing resource constraints have almost certainly led health care organizations, both those delivering care as well as those supporting care delivery, to be much more co-dependent than they were in the past. However, there is an underlying tension between organizations and a resistance to working together, likely proliferated by the lack of clear organizational roles and mandates, sound governance structures and policies, organization-based funding mechanisms, and prior inter-organizational relationships. That major restructuring of the provincial health system occurred within very short periods of time (in 1996 and 2001) may have contributed to the lack of clarity and interdependencies in the system [229]. See Appendix A for a description of the organization of Nova Scotia's healthcare system.

The study's findings – particularly the importance of the *interpersonal* level, the relationships across levels, and the impact of the socio-political and historical context – suggest that viewing innovation implementation in healthcare organizations

through the lens of complex adaptive systems [63, 97, 229, 231] might be helpful to expanding and enhancing our understanding of implementation processes. Complex adaptive systems are described as systems wherein numerous agents (i.e., health system components) interact in a dynamic, nonlinear fashion. These systems are considered to possess a number of distinctive properties that distinguish them from linear systems: they are defined in terms of connections and patterns of relationships amongst agents; their development is emergent and largely self-organizing (e.g., hierarchies emerge and relationships develop over time, facilitated by the particular organizational and socio-political architecture); and their trajectory over time is fundamentally unknowable, though it often lies within certain boundaries or contains patterns of similarities [96]. Van de Ven and colleagues' work on the innovation journey [21] and Kitson's critique on KT/implementation science [17] apply the concepts of complexity science and systems theories to innovation and change processes in organizations and health care organizations, respectively.

The complexity perspective gives analytic primacy to the relationships embedded inside and outside the organization itself and emphasizes the need to analyze relationships across levels of the system [229]. In such a social system, history matters: what is happening now in the system is undoubtedly influenced by what happened earlier [96]. Indeed, the data demonstrated that historical relationships and interactions within the healthcare system were perceived to have impacted SRT implementation. In Nova Scotia, which is a relatively small province in both geography and population, there is likely an added layer of complexity. Specifically, many of the actors involved in SRT implementation have known each other and/or

worked in the same healthcare environments for years. During interviews, many key informants spoke of prior relationships they had with other individuals relevant to the cases being studied (including other key informants, though they had no knowledge of who was being interviewed for this study). These included both professional (e.g., working together in past jobs/positions, former teacher/student or boss/employee relationships) and personal (e.g., attending school together, children who attended the same school or extra-curricular groups) relationships. It would be surprising if these connections, at some level, did not influence individuals' perceptions and actions in the cases studied.

Adopting a complex adaptive systems lens would change our thinking of health care organizations as 'machines' with defined boundaries, roles, and responsibilities to a system comprised of fluid linkages and interactions, open to environmental influences, and exemplified by connections and patterns of relationships amongst actors in the system. It would also change our thinking of innovations as one operationalized idea or piece of knowledge to an evolving idea that entails ongoing re-invention and re-implementation [21]. Shifting our foci to linkages within the system and to people and their interactions, rather than reducing the problem into manageable, 'knowable' chunks and attempting to examine and understand them separately, may help researchers and practitioners better study, understand, and manage change processes by helping them recognize the tensions that exist, seek out and leverage 'attractors' in the system, adapt intervention/implementation components based on contextual influences, and test/try multiple approaches. The notions of experimentation, feedback, and learning are also

emphasized in Senge's work on learning organizations [65], Kolb's experiential learning model [232], and the practices of continuous quality improvement [233, 234], which all underscore the dynamic nature of organizations and the need for new ways of learning and working. For researchers situated in positivist paradigms, learning from and collaborating with disciplines that view the world differently (e.g., social sciences) ought to advance their understanding and study of context and complexity in healthcare systems.

Considering Other Plausible Explanations

Alternative factors to explain the study's findings, other than those presented in the theoretical perspectives, were explored in the analyses. One factor that was not a focus of study but proved important for all three cases was the innovation's attributes, specifically complexity/simplicity, relative advantage, and compatibility [16]. This factor clearly played a role in users' acceptance and use of the innovation in practice; as a result, an additional 'level' – the *innovation level* – was incorporated into the study's overall synthesis and findings. Alignment with system and organizational priorities, individual and professional values, and prior experiences (i.e., compatibility) was particularly important to facilitating use. In most instances whereby an individual perceived the value of SRTs, he/she was willing to accept its implementation and use, despite other issues or concerns. Other innovation characteristics (trialability [16], observability [16], evidence strength and quality [22, 118]) were not discussed by informants as being particularly important to SRT implementation.

Some alternative factors explored in the analyses were found inconsequential in this study. Specifically, *individual-level* factors such as attitudes, motivation, and self-efficacy did not appear particularly germane to SRT implementation and use. For example, user attitudes about the innovation frequently did not influence use: users who had negative attitudes about the SRT itself (observed in each case) used the SRT, for various reasons including policy and respect for/trust in colleagues leading the initiatives. Conversely, there were users who had positive attitudes about SRTs (and health technology in general) but chose not to use the SRTs, for various reasons including lack of involvement in the implementation process and attributes of the specific innovation. Moreover, individuals' comfort and skill with technology were not important factors in SRT implementation and use: the biggest 'resisters' were in fact tech-savvy individuals (as evidenced by interview data as well as observation of their office/working environment) whereas those who claimed they were 'not computer people' used the SRT with training and technical support. Although much emphasis has been placed on the use of behavioural and social cognitive theories [8, 12, 220, 221] as explanatory theories for moving knowledge into healthcare practice, these findings suggest that such theories and their constructs do not necessarily match the real-world experience, at least for use of complex innovations. Extending the range of theories employed in this field and modifying/integrating theory to include multiple levels of influence appear to be important steps toward advancing our understanding of clinical practice change.

Modifying and Expanding the Theoretical Base

Explanatory case studies are often used to generate, modify, or refine theory [105]. Certainly, real-life cases are complex and provide rich data, and therefore are valuable sources to refine and sharpen existing theory, especially when limited theoretical knowledge exists [235]. For this study, theoretical perspectives were specifically sought to provide insight into the interpersonal, organization, and system influences on the implementation and use of innovations in healthcare. These multi-level influences receive limited attention in many of the existing frameworks and models related to moving knowledge into clinical practice (see Ward and colleagues' [7] review on many of these frameworks and models). While the creation of a new framework or theory was not an objective of this study, the findings contribute to our understanding of several important issues that are under-developed in the existing conceptual and theoretical literature in this area: organizational management; healthcare system components, such as the structural, infrastructural, and socio-historical context; interpersonal aspects of implementation and changing practice, including stakeholder involvement; and the complex nature of implementation processes. These findings are discussed below and presented in Table 15. In addition, the findings add important insight into several elements of PARiHS, providing data that can help modify and refine this framework.

Organizational Management

The organizational framework of innovation implementation, which was developed in the management field [68, 112] and adapted by Helfrich and colleagues for healthcare

organizations [50], underscores the role of management support in the innovation implementation process. While research has demonstrated the facilitating influence of supportive senior administration and management in the implementation and use of healthcare innovations [44, 45, 52, 236-238], the role of managers and others in authority positions at the middle level of healthcare organizations is almost entirely overlooked in knowledge translation/implementation science research and under-developed in the corresponding theoretical base. To fill this gap, Birken and colleagues [226] recently presented a theory of middle managers' role in innovation implementation in healthcare, with middle managers defined as "employees who are supervised by an organization's top managers and who supervise frontline employees" (pg. 1). Expanding on Helfrich et al.'s [50] framework and using examples from the Health Disparities Collaborative [239], they propose that middle managers – due to their mid-level positioning in organizations – can have considerable influence on implementation by bridging the informational gaps that can impede implementation processes. In turn, supportive middle managers foster a positive implementation climate and facilitate implementation effectiveness (or consistent, high-quality use of the innovation [50]). Though untested, this theory makes a useful contribution to the discourse on moving knowledge into practice.

The findings from this study also contribute to the knowledge base on the role of organizational managers and others in mid-level leadership positions in innovation implementation in healthcare settings. Specifically, data from this study revealed that managers and department/unit heads can affect innovation implementation by demonstrating to their employees their moral support for implementation (e.g.,

involving staff in pre-implementation planning and seeking their input and expertise); exerting their authority over existing departmental policies, priorities, and resources (e.g., providing on-the-ground resources, such as staff time, to facilitate or ease implementation); and by influencing the development of new policy related to the innovation and its implementation (e.g., championing the innovation with senior administration who have the authority to develop and enact organizational and district-level policy). Their influence, however, can be positive or negative. Indeed, these individuals are often in a position to make implementation a priority or choose to pursue other priorities, or to allocate resources (staff, time, and funding) to support implementation or ensure that implementation is something that is carried out 'off the side of the desk'. Importantly, this study also provided potential explanations for low management support: limited understanding of the innovation's utility or value; low involvement in and input on the innovation and its implementation; and the introduction of new roles and tasks with no additional resources to carry out this new work. These issues may be illustrative of power dynamics across different levels of the organizational and system hierarchy and how they play out: e.g., mid-level managers often have little authority or control over decisions to implement new tools or technology, and limited 'say' in how the implementation occurs, yet are often the individuals with responsibility for ensuring the change actually happens.

Healthcare System Components

System-level components, such as the structural, infrastructural, regulatory, political, and socio-historical context of the existing healthcare system, are largely absent [4, 6,

7, 14, 15, 22, 50, 51, 180, 240, 241], or recognized but given scant description [91, 116], in much of the theoretical work in the knowledge-to-practice field. Findings from this study demonstrated that certain features of the healthcare system – its delivery and support structure, IT infrastructure, policy environment with respect to privacy of health information, and history of limited collaboration and weak working relationships across organizations – were problematic in the context of SRT implementation. Indeed, SRT implementation, as it was intended in both the CCPP and SSRTP cases, could not have happened without the actions and interactions of multiple interdependent actors in the system. In such endeavors, how the broader system operates and the nature of relationships amongst its various players will most likely impact, to some degree, these actions and interactions. More attention needs to be placed on the relationships amongst the various groups and organizations operating in healthcare environments. Fitzgerald [242] found that diffusion processes in acute and primary care settings were "radically affected" by the nature of the prior relationships amongst the various players in each initiative, and that high-quality relationships were able to counterbalance many negative contextual factors (pg. 1441).

The findings described in this dissertation provide a developed, nuanced picture of numerous healthcare system components that influence the implementation of new tools in clinical practice, and their relationship(s) to other important factors. The limited conceptual and empirical work on these influences in the literature on moving knowledge into healthcare practice may be partly due to difficulties in investigating them [18, 42, 191] or to the belief that, as Grol and colleagues [39] have

put it, “changing these factors is generally out of reach of those within the organization who are involved in improving health care” (pg. 122). Even if these factors are unchangeable, however, recognizing and understanding their potential influence is still important when designing interventions to affect practice change. A number of authors have recently proposed conceptual models or frameworks [243, 244] that take an ‘ecological’ perspective and more fully account for system-level factors, such as the economic, regulatory, and/or socio-political context, that need to be considered when moving knowledge into practice. These models and frameworks have adapted work from the management and business (e.g., Pettigrew and Whipp’s [245] Dimensions of Strategic Change) and social sciences (e.g., Regehr and colleagues [246] model of evidence-based social work) literature.

It is important to recognize that some of the system-level features found to be influential in this study might be more germane to the implementation of health technology innovations. However, the structure of the care delivery and support system as well as its socio-historical context could conceivably influence innovation implementation in many areas of healthcare, especially those areas characterized by high levels of interdependencies across providers, teams, and organizations (e.g., the implementation of care delivery models for persons with chronic diseases or multi-morbidities, end-of-life care, or community-based primary healthcare). In Nova Scotia, for example, many of the nine provincial programs (e.g., Diabetes Care Program of Nova Scotia, Cardiovascular Health Nova Scotia) exist to advise on and support care delivery for persons with chronic disease and thus the management of

chronic disease occurs in an interdependent system, with mutually supporting roles spanning healthcare organizations and sectors.

Interpersonal Aspects of Change

Two of the frameworks used to guide this study [22, 50, 51] do not duly capture the interpersonal and relational aspects of implementing new knowledge in healthcare settings. This is not unique to these frameworks. However, implementation – the act of actually putting a new piece of knowledge into practice – is an intrinsically social process that is entangled with the context in which it takes place [247]. It is therefore surprising perhaps that the interpersonal aspects of change are not well developed in the conceptual and theoretical literature (specifically in healthcare settings). This may be partly due to the relatively greater research focus on adoption decisions versus implementation [100], or the predominant view that putting new knowledge into healthcare practice is a highly rational, orderly phenomenon [17].

The findings from this study revealed that the interpersonal aspects of change have a considerable influence on implementation and use of new tools in healthcare organizations. For instance, the findings revealed the facilitating influence of involving stakeholders early in implementation planning and from multiple levels of the healthcare system – not simply clinician users – when implementing innovations in clinical practice (previous sub-sections of this chapter discuss the specific role of stakeholder involvement in each of the three cases). Quite simply, stakeholders who felt they were highly involved in the implementation were more willing to help the team navigate the implementation at their respective organizations, and to provide

organizational and departmental resources (e.g., staff time and expertise). Those with low involvement were, by and large, resistant to SRT implementation – despite speaking highly of SRTs in general – and cited numerous reasons for opposing the SRT or its implementation. This is important because individuals can make choices and frame events and issues in ways that influence others and thus have consequences for implementation. This power was exemplified in this study by the influence of clinical colleagues. Damschroder and colleagues [244] recently emphasized the significant role of individuals (i.e., those involved in and targeted by the implementation as well as other affected individuals) in their Consolidated Framework for Implementation Research.

Complex Nature of Implementation

As discussed in much more detail in the previous two sub-sections, the implementation processes in the cases studied were characterized by many convergent and divergent activities, often departing from planned activities and timelines due to internal and external constraints. In other words, SRT implementation was complex, and sometimes messy, requiring implementation team members to forge new relationships and work within shaky ones, span organizational boundaries, and develop and re-develop strategies to make implementation happen. This reality is rarely acknowledged in existing knowledge-to-practice frameworks and models [4, 7, 14, 50, 91, 118, 180]. Indeed, many of the complexities of real-life situations may be difficult to capture through experimental or survey research, arguably the predominant research methods in this field, and thus such research may

not be particularly helpful to expanding the conceptual literature in a way that delineates the complex, context-sensitive nature of implementation. Through the use of case study methodology, this study provides empirical data from three cases that can expand our understanding of real-life implementation processes, the multi-level factors that influence these processes, and the relationships amongst these factors and the context (e.g., setting, timing, and actors involved).

Contributions to PARiHS

The findings of this study did not align highly with the elements of the PARiHS framework. Flyvbjerg [248] contends that when findings do not support existing theoretical perspectives, these occurrences (or 'falsifications') are the main sources of theory development, providing a basis to build on new concepts and understandings. This study provides additional insight into several elements of the PARiHS framework, namely context and facilitation. PARiHS arguably presents a relatively narrow view of context, or the "the environment or setting in which the proposed change is to be implemented" (pg. 150) [51]. The findings point to additional features of context that have important influences on implementation processes in healthcare organizations. The availability of specific organizational resources, including employees' time and expertise, will increase the capacity of teams to manage both the technical and social aspects of implementation. Certainly, the structural, regulatory, and socio-historical aspects of the broader healthcare system are an integral part of the environment in which an innovation is introduced; these aspects may be especially pertinent when innovation implementation requires coordination and

cooperation across departments and organizations. In addition, the nature of both intra- and inter-organizational relationships may be a critical element of context, albeit one that may prove difficult to assess.

The findings from this study make several important contributions to understanding and expanding the potential nature of facilitation. First, the PARiHS framework defines facilitation primarily as a role that an individual (or "trained expert") fills and describes this role as "[o]ne of several change management strategies" that individuals who are implementing change may use to enhance the process of implementation (pg. 152) [51]. However, facilitation may also be defined as a set of activities deliberately employed to ease the movement of knowledge into practice [6]. As described to date, PARiHS does not view this element as encompassing activities and strategies purposely undertaken to facilitate implementation. The findings of this study suggest that a number of strategies, deliberately employed by implementation teams, act as facilitators to implementation processes. These include engaging and partnering with stakeholders before and during implementation, communicating with affected individuals about the upcoming change and how it will affect them (including personal contact with these individuals), assessing and managing barriers to change, and providing high-quality training and timely support processes.

Second, the findings suggest that facilitation may be viewed as a team or organizational capacity with many individuals taking on facilitation roles. While the PARiHS framework defines facilitators in terms of their relationship with the individuals and teams implementing a change, this study clearly revealed that

implementation teams, clinical champions, and supportive middle managers/department heads all adopt facilitator roles during implementation processes. This is important since, in many circumstances, it may be unrealistic to fund an additional facilitator role or to expect one person (particularly if he/she comes from the 'outside') to understand all of the technical and socio-cultural aspects of the change and to be viewed as credible with all affected individuals and groups. For implementation teams, it may be important to engage existing organizational members and support their role as facilitators within their spheres of influence.

Third, the PARiHS framework views each element as existing on a continuum from low to high, and posits that high evidence, context, and facilitation enable successful implementation. With respect to facilitation, it describes task-based facilitation as low and holistic facilitation as high. In this study, the facilitation provided by implementation team members and other organizational members suggests that task-based facilitation can be critical to implementation processes, at least for complex innovations that involve changes in organizational processes and/or infrastructure. Research from others has also emphasized the importance of task focused facilitation to moving knowledge into healthcare practice [139, 140, 142].

Transferability of These Issues

It is possible that the issues discussed in this sub-section may only be applicable in this specific setting and/or with respect to this specific innovation, and this is the reason for their under-development in the broader knowledge-to-practice literature. However, that these issues were found across cases increases the transferability of

these findings and suggests that this field requires further theoretical and empirical work in these specific areas. Indeed, the findings demonstrate the importance of a multi-level contextual analysis to gaining both breadth and depth to our understanding of innovation implementation and use in healthcare. Recent conceptual work on implementation in healthcare [244] and evidence-based practice [243], which has drawn on existing theories, frameworks, and models to provide a more comprehensive view of moving knowledge into practice, supports the need for this type of analysis.

EXAMINING THE BIGGER PICTURE

Case studies often provide rich detail that may lead a reader to deem that the findings are only applicable in the very specific setting that is studied. The findings of this study are presented in much detail, demonstrating the particular aspects and nuances of each case, including the SRTs, the implementation teams, and the implementation planning and execution. The findings revealed that the implementation processes in each of the three cases studied were highly contextual in nature and were characterized by different approaches and strategies for change, leading to different experiences for those affected by the change. Despite the nuances across cases and the influence of contextual factors, however, the findings help to expand and refine theory that can be applied to other settings and situations [249, 250]. Yin [105] refers to this as analytic generalization, whereby the results of the case study are compared with previously developed theory, and states that the goal of case study research is to provide a ‘generalizing’ rather than a ‘particularizing’ analysis.

Broader Principles Related to Implementation

Stepping back from the particular details of each of the cases, the findings suggest there are some overarching principles relevant to the implementation and use of SRTs and similar tools/technologies.

Policy: A Great Enabler

In two of the three cases, clinician users were required to use the SRTs for some investigations and procedures (i.e., mammography and colonoscopy screening) due to policy decisions. Thus, the considerable enabling influence of policy cannot be underestimated – for both the NSBSP and CCPP, policy was perhaps the most important factor in terms of ensuring province-wide use of the SRTs for screening purposes. Certainly, policy directives at the early stages of innovation implementation have been shown to increase the likelihood of implementation, with one of the important consequences of policy being the availability of dedicated funding [242, 251, 252].

Policy works well in terms of compelling departments and organizations to implement the innovation and ensuring that targeted members (in these cases, clinicians) use the innovation once implemented, but this study would suggest that a top-down, policy-driven approach, such as the approaches described by informants in this study, works with much resistance. The absence of choice and limited ability to provide input into how an innovation is implemented and used at a local level, which informants referred to as "top-down," can lead to a great deal of opposition to the innovation (see the following section for more discussion on adaptation). This may be

particularly germane to healthcare organizations wherein there is a high degree of professional autonomy of many of its staff [56]. Also, external mandates and policy directives do not increase a department or organization's capacity to implement an innovation [253], as evidenced in the CCPP case by the multiple 'work-around' solutions put in place at different hospitals to accommodate both the SRT as well as the processes and capacities of the organization. A disconnect between policy and capacity can lead to further exasperation with the implementation. Thus, policy in and of itself is likely insufficient to ensure *effective implementation* – that is, consistent, committed, and skilled innovation use [112]. Indeed, despite policy directives in the CCPP, the end goals of implementation have not been achieved in most districts nearly four years post-implementation (i.e., integration with existing hospital IT systems, use of the SRT for diagnostic colonoscopies) and several key informants cited issues with the *quality* of SRT use, leading to substantial backlog in terms of receiving fees for services and concerns regarding the accuracy of the data that are inputted.

At the same time, despite the great enabling influence of policy, edicts and directives are not *necessary* to ensuring the implementation and use of new tools in practice. The example of surgical synoptic reporting for breast cancer is one illustrative example. The SSRTP case had no authority or capacity whatsoever to mandate that surgeons use the SRT. However, data from this case indicated that breast surgeons have largely adopted the SRT and consistently use it in their daily practice (see Table 12, Chapter 3.2). National data, as well as the innovation experience in Alberta with respect to surgical SRTs, suggest that this holds true in

other Canadian jurisdictions. The data suggest there are several reasons for the committed, consistent use in breast surgeons. First, the tool itself is more refined for breast cancer surgery and requires less time to complete than for some other disease sites (e.g., colon and rectal cancer surgery). Second, there is a socio-historical context of advocacy and improvement within the breast cancer community in Canada [217], which may impact on breast surgeons' receptivity to and comfort with using new knowledge and tools in practice. Third, there is a greater familiarity with synoptic reporting by breast surgeons in Nova Scotia, given the long history of mammography synoptic reporting and a growing use of synoptic reporting by breast pathologists in the years preceding the SSRTP initiative. Finally, synoptic reporting for breast cancer surgery has been led and championed by a number of highly-respected breast surgeons, both on national and provincial levels.

The Power of Relationships

The enabling and impeding influence of relationships was evident throughout this study. Indeed, innovation implementation is a social process where people and their (inter)actions matter. As discussed several times throughout this dissertation, respected clinicians who champion the initiative can hold considerable influence with their colleagues in terms of supporting and using a new tool or practice. This influence relies on the relationship that the clinician user has with the particular champion. In this study, where respectful, trusting relationships existed, clinicians were largely persuaded to use the SRTs. Conversely, in those situations where policy was not compelling SRT use, the absence of a local champion, or relationships with

senior departmental colleagues who did not support the innovation, was perceived to be a contributing factor to low compliance with using the SRT.

In many instances, a clinical champion's influence extends throughout the organization to managerial and administrative colleagues, which was evident in the cases studied. This influence not only helps build support for the innovation and facilitates the acquisition and leveraging of organizational resources [47], it can have tremendous impact on policy. In this study, the influence of highly-respected clinicians who were leading and championing the initiatives was integral to developing and enacting policy with respect to using the SRTs for screening purposes. The legitimacy that clinical champions, who are respected and connected throughout their departments and organizations, can provide with respect to innovations cannot be understated.

In addition, the findings of this study suggest that involving a range of key stakeholders early in implementation planning and developing collaborative relationships with these stakeholders are important to facilitating the implementation process and supporting committed and consistent use of an innovation. Stakeholders should include not only clinician users and senior administrators, but also other organizational members who can affect – and are affected by – the implementation. Indeed, many of the 'micro-processes' of implementation have to be negotiated with local stakeholders [242]; these individuals have the knowledge and expertise – and quite possibly access to local resources – to provide solutions that are workable and sensitive to local conditions and capacities. In complexity theory, relationships between individuals are deemed more important than individual or innovation

attributes [231], and building these relationships through early stakeholder involvement can positively influence implementation [254].

The Macro Level Should Not Be Disregarded

The larger healthcare system in which an innovation is implemented can influence innovation implementation in clinical practice. As illustrated by Fitzgerald and colleagues [242] in their study of the diffusion of eight innovations in acute and primary care in the UK, the capacity of an organization to innovate will depend on the history of the organization, the structural complexity of the organization and broader care delivery system, and the quality of intra- and inter-organizational relationships. While the nature of these components, and the degree of impact they will ultimately have, will almost certainly vary by context, our findings support their importance to the implementation process. Recently, several Canadian studies [228, 255] have suggested that targeted policies and practices at the healthcare system level can facilitate implementation and use of complex innovations in oncology practice.

Issues Pertaining to Sustainability and Diffusion of This Innovation

This study did not focus on the sustainability or 'institutionalization' of innovations in practice. However, because of the nature of the NSBSP case, which has used SRTs for more than two decades, data were collected that provide some insight into sustainability issues. Certainly, many innovations that are implemented and initially successful fail to become integrated into the routines of organizations and its members [138, 256]. In the NSBSP, demonstrating the value of the SRTs, via

ongoing monitoring and feedback mechanisms, has been instrumental in maintaining resources and support (despite many viewing the SRTs as less-than-optimal tools) and acquiring further resources to update the tools. Strong, consistent leadership has also undoubtedly played a role in sustainability, although the program's strong culture appears to have both advantages and disadvantages for sustainability and expansion. Radiologists not using the tools, for example, perceived the strong culture to be paternalistic and lacking openness to others' opinions and ways of working. These same factors were not particularly influential in the other cases whereby SRTs were in the process of implementation and early use.

Thus, it might be that factors such as ongoing monitoring and feedback, consistent leadership, and a strong culture are more important once new tools are implemented and require sustaining over time. Indeed, research and program evaluation findings indicate that implementation and sustainability are dynamic, yet distinct, phenomena [257, 258], suggesting that different factors may drive implementation and sustainability processes and/or certain factors may interact differently after initial implementation to enhance or impede sustainability. For example, factors such as effective leadership or a strong culture may act as compensatory factors in the absence of other important elements (e.g., sufficient resources). Though the literature on sustainability of innovations in practice is sparse [104, 116], ongoing leadership support [259, 260] and monitoring and evaluation beyond the implementation period [138] have both been shown to positively impact the sustainability of new tools and practices. In the NSBSP, it is possible that some of the key factors were more relevant to sustaining innovations in practice while others

to initial implementation and early use, including implementation/expansion at new hospitals. The CCPP and SSRTP cases were studied during and immediately following SRT implementation and the influence of certain factors (e.g., structural and infrastructural components of the healthcare system) may have been more important during implementation and immediately thereafter while the 'bugs' were being resolved.

The study's findings also highlight a number of issues that may have implications in terms of sustainability, specifically maximizing the diffusion of SRTs across jurisdictions and clinical areas. These issues are discussed below and relate to the department or organization's 'distance' from the innovation, adaptation of the innovation, and the considerable influence of innovation champions.

Innovation Spread

The experience of the NSBSP in terms of early implementation and subsequent spread across the province raises questions in terms of the expansion (or widespread diffusion) of innovations within healthcare systems. In this case, the diagnostic SRT, for example, was used at two hospitals for approximately one decade before implementation at another hospital; it then took another full decade for the SRT to be implemented at subsequent hospitals around the province (see Appendix B for a timeline). Early implementation of this SRT was highly supported, despite any initial 'growing pains.' However, subsequent spread has been resisted by radiologists at many hospitals (though not all), with radiologists in three health districts continuing to refuse to use this innovation. This begs an important question: is it inevitable that

as an innovation spreads, people further removed from the innovation and its development – either in time or geographic distance – will become disenfranchised or alienated by it?

This study provides some insight into this question. First, in the NSBSP, stakeholder involvement was high during the innovation's development and early implementation. In fact, the SRT is a 'home-grown' product, with radiologists having been partners in its development. However, stakeholder involvement in the innovation (e.g., modification and refinement) and its implementation has waned considerably over the ensuing decades. Radiologists not using the tool were explicit in terms of their views that low involvement in the SRT and its implementation was a major barrier to its use. Thus, ongoing stakeholder involvement may be one means of mitigating the risks associated with increased time and distance from the innovation. Indeed, Wiltsey Stirman and colleagues [104] found that ongoing collaboration among stakeholders was one of the most commonly identified processes associated with the sustainability of new programs and practices in healthcare settings. Certainly, maintaining stakeholder involvement will help ensure appropriate adaptation of the innovation in local settings, which may also reduce resistance to the innovation and increase its likelihood of sustainability (see next section). Interestingly, SRT adaptation has been limited in both the NSBSP and CCPP wherein key informants, including implementation team members, expressed the view that the SRTs were 'tweaked' and refined during the first few implementations, but largely considered final products thereafter.

Second, for those hospitals in which the implementation team did not experience high levels of resistance toward the innovation, there were two main reasons for this: either a specific concern or issue arose and radiologists saw the potential value of the SRT (e.g., ensuring follow-up of patients with suspicious lesions) and requested its implementation, or a local leader supported the implementation and championed it with his/her colleagues. The former reason has clear implications in terms of carrying out high-quality change management practices during expansion: specifically, communicating the value of the innovation may also reduce local resistance. In some districts, a limited understanding of the value of the SRT was observed, as highlighted by one radiologist who said, "*don't make my job much more difficult just so that you can have an easy job collecting data*."

The facilitating impact of stakeholder involvement highlights another aspect to consider in terms of distance from an innovation: decisional proximity, or the 'distance' individuals and organizations are from decisions about the innovation and its implementation. Stakeholders in Nova Scotia who were involved in the decision-making process (e.g., as planning committee or working group members) were much more likely to support the innovations and their implementation. Those with low proximity to the decisions were less likely to view the innovations and their implementations in a positive light, even if they were informed and consulted about the innovation. This suggests that the wide-ranging diffusion of this innovation will likely be facilitated by ensuring that decisions are made in collaboration with stakeholders from all relevant jurisdictions, both those involved in initial or pilot implementations as well as those who will be asked to implement the innovation at

some future time. In situations where this is unfeasible, permitting local individuals the opportunity to make (or collaborate on) decisions about how the innovation will be implemented and used in their organizations might optimize widespread implementation and institutionalization.

Innovation Adaptation

An innovation may be defined as an idea, tool, or practice that is perceived as new by an organization, regardless if other organizations have previously used it [16, 68]. In innovation, therefore, new ideas or concepts usually come from *outside* the current department, organization, or system. However, every department and organization will differ in some ways – some small, some large – from other departments and organizations that have previously implemented the innovation. This suggests that the 'systems' that make these new ideas and concepts work must come from the *inside*: that is, "[t]o work, changes must be not only adopted locally, but also adapted locally" (pg. 1974) [240].

Given that structures, processes, and routines differ across organizations, without adaptation, innovations are often a poor fit and thus resisted by those affected by the innovation [244]. The findings from this study suggested that local adaptation – modifying and customizing the innovation to the specific context – was an important part of the implementation process, particularly in the absence of policy. Similarly, adaptation is likely important in terms of sustainability of these innovations, particularly expansion to new investigations/procedures, diseases, and jurisdictions. In a recent review on sustainability of new programs and practices in

healthcare, Wiltsey Stirman and colleagues [104] found that the *fit* between program or practice and the organization and the degree to which the program or practice could be *modified* were the most common innovation characteristics that influenced sustainability.

A number of issues pertaining to adaptation and its relationship to sustainability remain. Clearly, SRTs cannot be static tools and will require continual adaptation and re-invention to remain current with scientific evidence as well as technology. This will require ongoing infrastructure and resources (clinical and IT expertise, funding). Few researchers have examined the extent, nature, or impact of adaptations to the programs and practices once implemented [104]. Additionally, successful expansion of SRTs across jurisdictions and disease sites, highly relevant to the SSRTP case, will likely require local input and adaptation. Again, this will require resources as well as leadership willing to adapt the SRT time and time again (albeit, oftentimes to a small degree). However, many leaders in healthcare have tended to regard adaptation as a form of waste or resistance [240]. There is also a very real tension between achieving full and consistent implementation across contexts and providing flexibility for local sites to adapt the innovation as needed (and possibly improving the innovation's adoption and reach) [261]. An important component of this balance is to determine the core components of an SRT (i.e., the essential and indispensible elements) and its adaptable periphery (i.e., the adaptable elements and 'systems' related to the intervention and the organization into which it is being implemented) [244]. Being able to distinguish between these features will allow an SRT to be modified to local contexts without undermining the integrity of the

innovation. Elements of the adaptable periphery may include a hospital's IT processes and systems in which data are transferred into and out of the SRT, 'aesthetic' components of the final report, or linkage of the SRT with additional software programs that facilitate clinicians' reporting of the investigation or procedure (e.g., voice recognition or imaging software).

Innovation Champions

The considerable facilitating influence of clinical champions across all three cases may have implications for sustainability. Specifically, if much of the decision to use – and to continue using, despite concerns or frustrations – rests on the influence of a champion, what happens if this champion leaves? And, is there some point at which an innovation is sufficiently integrated into the organization that it is no longer vulnerable to the loss of a champion? Certainly, the loss of a champion early in implementation could represent a substantial risk for implementation and sustainability. However, in the NSBSP, the loss of the local champion at one of the early "expansion" hospitals occurred some years after implementation, suggesting that once the innovation is embedded in clinicians' and departmental routines, the risks to sustainability are minimized. Although the ongoing presence of a champion has been shown to maintain capacity for an innovation and thus contribute to sustainability [104], the potential impact of losing a champion, and how the impact may change as an innovation becomes more institutionalized in an organization, necessitates further investigation.

STRENGTHS AND LIMITATIONS

This study has a number of strengths. First, the strategies employed to increase rigour enhance confidence in the findings. These include use of multiple data collection methods and consideration of alternative explanations for the findings (credibility), maintenance of case study database (dependability), and use of theoretical perspectives to guide the study and a cross-case analysis to identify shared common elements (applicability) [105]. Regarding the latter, conclusions independently arising from two or more cases tend to be more powerful than those derived from one case [105]. Second, this study achieved a high level of participation across units of analysis, with only one individual in each of the CCPP and SSRTP cases failing to respond or refusing to participate. Six individuals failed to respond in the NSBSP case; the reason(s) for this is speculative but may involve clinician time/interest or even a perception that he/she had nothing of value to share. Indeed, the six individuals who failed to respond were radiologists who were practicing at institutions wherein the SRTs had been in use for more than a decade. It is plausible that the SRTs were in place at the time they commenced their practice and therefore they felt they had little insight into their implementation and opted not to respond to the invitation.

This study does have a number of limitations. First, this study was undertaken in one province only. Given that the structure and socio-political context of health care systems vary, this may limit the applicability of findings to other provinces or jurisdictions. Nonetheless, health care systems generally have a number of defining features, including a wide range and diversity of stakeholders, complex governance

and resourcing arrangements, and high degrees of professional autonomy of many of its staff [56], which should increase the applicability of these findings to innovation implementation in other health systems. Moreover, the sampling strategy did ensure that the cases varied on key constructs believed to influence innovation implementation and practice change and the health care system in the province differed considerably across the time periods for implementation. These differences across cases also facilitate the applicability of findings to other contexts. Despite the varying degrees of SRT implementation and use in the cases studied, it would be valuable to study initiatives wherein concerted efforts to implement a SRT or similar tool were unsuccessful (see the sub-section on Future Research for more discussion on studying an unsuccessful case).

Second, for the NSBSP case, a number of key informants stated it was difficult to remember what happened during the implementation period. Therefore, their recollections of this time are subject to issues of recall. Nonetheless, of the four key informants who were involved during the initial implementation efforts, their recollections of people and events during that time did not differ considerably from one another. Third, this study did not conduct a formal tool audit to gain an objective measure of SRT use. While this was initially planned, the extent of use became obvious during data collection (see Table 12, Chapter 3.2). For the pilot work (Chapter 3.1), a tool audit found that 91.2% and 58.0% respectively of eligible breast and colorectal cancer surgeries were reported using the WebSMR in the 6-month period following implementation. Since that time, a review of the database demonstrated higher levels of use.

Finally, the data were coded by one researcher. It is possible that a second coder would have resulted in a more robust coding process by incorporating multiple perspectives during code development and providing opportunities to discuss coding disagreements and refine the coding framework. However, the researcher took numerous steps to enhance the rigour of the study, including use of multiple sources and multiple data collection methods, numerous discussions with other researchers regarding analysis procedures and findings, and member checking. The latter indicated the findings resonated with participants and reflected their experience at the time of the interview.

IMPLICATIONS OF FINDINGS

There are numerous implications of these findings, both for researchers studying the implementation and use of innovations into practice (the *science*) and individuals and teams working on innovation implementation initiatives (the *practice*).

Relatively little research has explored the combination of interpersonal, organization, and system level influences on implementation and use of a new tool in "front-line" clinical practice. Moreover, few researchers have used theoretical perspectives that focus on organizational and system levels to guide their study of innovation implementation and use in health care organizations. However, research in the management, organizational sciences, and social sciences fields demonstrates that collective knowledge use is deeply embedded in organizational and policy contexts [18]. This "embeddedness" suggests that researchers who study implementation and use processes in health care need to employ methods that are better equipped to study

the multiple factors that prevent or enable appropriate practice – e.g., nature of the knowledge or practice, mode of knowledge delivery, setting or context of care, organizational and system constraints [180] – and how these factors relate to specific contexts. This study demonstrates the value of using organization and system-level perspectives and of case study methodology in improving our understanding of a complex and poorly understood phenomenon: the implementation of new knowledge and tools into clinical practice.

The use of multiple theoretical perspectives is uncommon in KT/implementation science, but arguably advantageous if the researcher is to gain a deeper understanding of the multi-level factors, and relationships amongst factors in specific contexts, that influence implementation and use of complex innovations in health care organizations. In the real word, factors at multiple levels of the health system undoubtedly influence whether, and the extent to which, an innovation is integrated into clinical practice. One way to acquire and integrate these multiple perspectives is for research teams to engage in more interdisciplinary and transdisciplinary research [262, 263]. Collaboration and integration across academic disciplines will help to ensure that each discipline's most relevant theoretical and methodological advances are utilized and that their limitations are addressed by advances in other disciplines [243]. However, achieving such collaboration is no small accomplishment: in addition to often being more labor-intensive than unidisciplinary research, many researchers find it difficult to have their assumptions, beliefs, knowledge, and methods challenged by researchers from other disciplines [264].

The findings have implications for administrators, managers, clinicians, and others who are considering or planning the implementation of SRTs and similar complex innovations. By understanding which factors are likely to influence implementation and use processes, practitioners will be better equipped to develop ways to more effectively integrate innovations into routine clinical care. The SRTs examined in this study were all electronic, requiring varying levels of integration with existing IT infrastructure. As health care institutions continue to increase their use of technology in clinical care, implementers can use the findings from this study (and others' research) to develop strategies that address the barriers to implementation and use, look for and tap into existing supports and 'attractors,' and optimize the implementation experience. Importantly, while technology issues were prevalent, including challenges with interfacing IT systems and updating/refining the tools, the findings suggest that the interpersonal aspects of change (e.g., engaging stakeholders, (re)negotiating relationships, communicating aspects of the change process) are crucial to gaining and maintaining support for implementation and facilitating clinicians' use of the innovation. Considering how the socio-political and historical context of the existing system influences these interactions, and navigating accordingly, is also important.

Not surprisingly, the implementation of complex innovations also requires resources, including adequate funding as well as the particular expertise to ensure that all necessary activities are pursued and completed in a satisfactory way. This study would suggest that identifying and securing the specific knowledge and skills that are required for implementation *prior to* commencing implementation efforts might

mitigate some of the challenges and frustrations that occur throughout the implementation process. Such expertise may be acquired directly, if funding permits, or leveraged from existing organizational or system resources.

Taken together, the findings suggest that a collaborative approach to innovation implementation, which includes the participation and involvement of multiple stakeholders (e.g., clinicians, patients, health managers/planners, policy-makers) should optimize the probability of successful implementation: it is unlikely that the complexity of interactions between the various individual, team, organizational, economic, political, and socio-historical components of the health system can be fully recognized and understood without knowledge from individuals who work within the system. The involvement of multiple stakeholders may also help implementation teams leverage and acquire key resources, including specific types of expertise required for implementation. Finally, although the relative importance of the key factors identified in this study may be context specific, it is clear that all levels require attention when planning change efforts. This statement might seem obvious, yet much of the literature on moving knowledge in to practice has arguably focused much more on the individual and innovation levels than on the interpersonal, organizational, and system levels. By doing so, the message – either explicitly or implicitly – is that these levels are more important to implementation and thus ought to be the central focus of attention.

REFLECTIONS RELATED TO STUDY CONDUCT AND ANALYSES

Tool Audits

Tool audits were initially planned for the CCPP and SSRTP cases to determine 1) the proportion of eligible clinicians using the SRT and 2) the proportion of eligible procedures at each institution that were reported using the SRT. After careful examination of the data and discussion with one member of the thesis committee who has knowledge of the cases [GP], it was decided that the benefit gained from conducting these audits, as planned, would not be worth the effort. This is because the extent of use of the SRTs became apparent through key informant interviews and document analysis, and a brief review of the SSRTP database. Use of the SRTs is presented in Chapter 3.2.

Use of Multiple Data Sources

This study used multiple data collection methods across four units of analysis (individual user, implementation team, organization, and larger healthcare system). One of the intentions of designing the study in this way was to permit the researcher to uncover converging findings and develop converging lines of inquiry across data collection methods and units of analysis (i.e., triangulation). There was much triangulation achieved, across sources and units of analysis, with respect to the key factors influencing SRT implementation and use in the three cases studied; the illustrative quotations and document excerpts in the Results chapter attempted to demonstrate this corroboration. Nonetheless, given the substantial time and effort of collecting and analyzing multiple sources of data, it is worth reflecting on the relative

contributions of the multiple sources of data, and whether the collection and analysis of all sources were helpful to gaining a deeper understanding of SRT implementation and use in each of the cases.

Key informant interviews undoubtedly provided the richest data for each case and, in this sense, contributed most to the researcher's understanding of SRT implementation and use. This is perhaps not surprising as the interviews were in-depth (ranging in time from ~25 minutes with a clinician report end user to >120 minutes with several implementation team members) and provided the opportunity to discover how the people involved in the cases experienced their involvement and the meanings they attached to their involvement [162]. Although interviews with implementation team members provided a breadth of data related to the implementation process (covering activities and experiences from pre-implementation planning to testing phases/early implementation to province-wide expansion) and interviews with other key informants tended to be more focused in comparison, all interviews were felt to be information-rich and to provide valuable data to help answer the research questions. No data were dismissed and all interviews were analyzed for new insights (concepts), and confirming and disconfirming evidence. In the NSBSP case, interviews with several key informants, whom all had a long history with the program, were particularly important to understanding early implementation experiences, including the socio-political environment of the healthcare system and the organizations in which the SRTs were developed and implemented, particularly since no documentation could be located from that time. Corroboration across key informants (and units of analysis) was high; for many of the influential factors (e.g.,

stakeholder involvement, change management, champions and respected colleagues, innovation attributes), additional interviews likely would not have yielded a fuller understanding of the phenomenon.

For the most part, the documents retrieved and analyzed provided historical and contextual information, and were helpful in corroborating and explaining data retrieved from the key informant interviews. For both the NSBSP and SSRTP cases, some documents were particularly information-rich in terms of gaining a deeper understanding of the factors that affected SRT implementation and use. These included the NSBSP annual reports, a consultant's report on provincial health care operations, and the SSRTP documents related to provincial lessons learned and a national evaluation of the pan-Canadian initiative. For example, the NSBSP annual reports provided much data related to the culture of the program (specifically, cultural characteristics such as accountability, innovation, and evaluation), the use and value of monitoring and feedback mechanisms, and the resources for SRT development, implementation, and expansion.

In the CCPP case, the documents reviewed were much less important to gaining an in-depth understanding of SRT implementation and use, but they did provide important contextual and background information. Quite simply, very few of the documents acquired provided any detail related to SRT implementation. For example, the implementation and evaluation documents acquired from the implementation team focused on other aspects of the screening program (e.g., awareness and knowledge of screening, recruitment and participation, satisfaction with screening kit) rather than on implementation and/or use of the SRT. Documents

were initially sought only to provide data about the cases themselves. However, as findings emerged, the researcher realized she would require greater knowledge about the healthcare system itself, including the various organizations and legislative/regulatory frameworks related to SRT implementation. The documents acquired, which included reviews and evaluations of various parts of Nova Scotia's healthcare system, were essential to understanding the legislative and e-health environments.

Thus, the documents did contribute to a more in-depth understanding of the cases, particularly for the NSBSP and SSRTP cases. They also corroborated much of the data gathered via the other data collection methods, and provided background and contextual detail that would have been difficult to gain via other sources. However, a large number of documents were retrieved and reviewed, and not all of them were particularly useful in terms of understanding the specific phenomenon being studied. With respect to documentary evidence, the researcher learned two lessons throughout the course of this study: i) the usefulness of the documents is often enhanced if the documents are reviewed prior to key informant interviews, where possible, so that specific and potentially important pieces of information may be explored further (however, in this study, oftentimes documents were only located and retrieved from key informants during or after an interview); and ii) it is important to be strategic in terms of the documents retrieved and analyzed. In this study, the researcher retrieved many documents in an attempt to discover everything she could about the three cases. While it is difficult to be strategic when one does not know what is available, having a more defined purpose for acquiring documents (versus attempting to discover

everything possible) would likely have saved the researcher time throughout the study.

Though they comprised only a small portion of the data collected, the observation sessions provided data that would otherwise not have been acquired: initial reactions to seeing the SRT for the first time; interactions between the trainers, who were members of implementation team, and the users of the tool; discussions amongst surgeons; and different aspects of training and how they played out in practice (e.g., one-on-one versus group training, presence of IT expertise versus no IT expertise). These data added to the richness of the overall dataset. Surgeon questions and comments during the observation sessions led to additional questions specifically around the tool itself and users' training and support experiences; probes related to these questions were integrated into interview guides for subsequent key informant (clinician and implementation team member) interviews. Moreover, the researcher's reflective notes from these sessions corroborate data obtained from other sources.

In terms of the overall synthesis of findings, the key informant interviews were fundamental to studying how and why the implementation processes unfolded as they did in each of the cases, contributing a breadth and depth of knowledge and understanding that was not possible with data from the other sources. They were the primary source of individuals' experiences of the implementation process and how it unfolded in their respective institutions, and of their perceptions of the SRT and its attributes (e.g., ease of use, relative advantage, and clinical and health system value). All interviews, and all four units of analysis, were valuable and added to the overall analysis. Nonetheless, no sources were perceived unnecessary to this case, albeit

some specific documents were of little use. Apart from the important role of triangulation, the main value of the multiple sources was to discover new dimensions to the research questions and to allow the researcher to address a broader range of historical, socio-political, and attitudinal issues. They also permitted verification, or checking the accuracy, of the data.

Ethical Considerations

All participants in this study (key informant interviews, surgeons being observed) provided written informed consent before participating, except those at one institution wherein the research ethics board did not use consent forms for minimal risk research that involved staff and employees but rather considered agreement to participate as implied consent. During the consent discussion, which occurred before signing the consent form and/or participating in the study, the researcher assured participants that their names would not appear in any report or article published as a result of this study, and that any publication or presentation of results would not attribute specific comments to identifiable individuals. Moreover, members of implementation teams were advised that it was not possible to ensure complete anonymity since it is possible that individuals directly involved in synoptic reporting initiatives (e.g., project leads, project coordinators) may be determined by the public through Internet searches and other public means. Other key informants were assured that anonymity would be maintained to the largest extent possible by not specifying/reporting their location/organization or specific job title (e.g., managers of particular administrative or clinical departments would be identified as managers only with no information

about their specific department). This meant the dissertation could not identify the specific district health authorities within which the researcher sought and received ethical approval to conduct this study. Given the small population size of Nova Scotia, particularly the health districts in rural regions, disclosure of districts wherein the researcher received ethical approval would potentially compromise individuals' anonymity. Efforts to maintain anonymity were based on research ethics board policies, not on feedback from key informants.

Despite these safeguards, however, it proved exceedingly difficult to balance in-depth reporting/presentation of results with maintaining anonymity: that is, to provide detailed information about the case and, at the same time, ensure that individuals' identities remained anonymous. In many situations, particularly insightful quotations are not presented because of the likelihood that the informant might be identifiable. In the end, the researcher decided to identify and name the cases (i.e., NSBSP, CCPP, SSRTP) because there was virtually no way to provide any detail about the case whatsoever without local and provincial – and, in many cases, national – individuals, who are knowledgeable about synoptic reporting initiatives and provincial cancer screening programs, being able to identify the program (or an interested reader identifying the case through Internet searching). The researcher sincerely hopes that key informants, particularly implementation team members, are satisfied with the attempts made to maintain their anonymity.

KNOWLEDGE TRANSLATION PLAN

The findings of this study may prove insightful and valuable for the implementation teams of each of the cases, particularly as they expand their SRTs (or updated versions of their SRTs) across the province and advocate for their use. The researcher will carry out the following activities to disseminate the study's findings to the implementation teams and provincial stakeholders:

1. Development of three case-specific research summaries, one for each of the implementation teams, that includes a condensed version of findings related to the relevant case as well as the cross-case findings. These summaries will be provided to implementation team members and provide specific guidance for each team in terms of future work. The researcher will also offer to meet with the teams in person to discuss the findings and their implications.
2. Development of a research summary that contains 'high level' findings, key messages, and implications for others in Nova Scotia who are working on similar initiatives. This summary will be distributed to all study participants and the provincial health funding organization (Nova Scotia Health Research Foundation), and made available to others upon request.

In addition to local dissemination efforts, the findings from this study will be disseminated via traditional academic fora. Specifically, an abstract has been submitted for presentation at the 2013 Annual Conference of the Canadian Association of Health Services and Policy Research and a manuscript will be submitted (a condensed version of Chapter 3.2) for publication. Several additional manuscripts may be submitted, focusing on particular aspects of the findings (e.g.,

influence of the interpersonal aspects of implementation; influence of structural, infrastructural, and socio-political components of the healthcare system).

FUTURE RESEARCH

This study suggests a number of areas for future research inquiry. First, the three cases examined in this study were successful (to varying extents) in the implementation of SRTs. It would be valuable to study unsuccessful initiatives wherein individuals/teams have attempted to implement a SRT (or similar technology) but were unsuccessful in their efforts. In Nova Scotia, the case of cancer pathology reporting provides an instance whereby numerous individuals over the past several years have tried to implement a SRT, supported by external funding and clinician buy-in, but were unsuccessful. At the time this study was planned, these efforts were just beginning and the implementation of synoptic reporting for cancer pathology was considered for inclusion as a case in this study. However, after discussion with committee members, there was concern about the extent of data that could be collected for this potential case (as efforts were in the 'exploration of interest' stage). At this point, however, the case of SRT implementation in pathology reporting would be worthy of study.

That the role of evidence, specifically scientific evidence, did not play a major role, in either of the cases studied, in clinicians' decisions to use SRTs raises an interesting question with respect to scientific evidence and clinical practice: is there something fundamentally different between SRTs (and similar innovations) and other innovations that make their way into practice (e.g., new therapeutic agents) in terms

of scientific evidence? Perhaps for those innovations that just 'make sense' in the context of clinical practice, clinicians are not as apt to seek out corroboration from the scientific literature. Certainly, use of SRTs should not negatively affect a patient's health and many of the benefits are observed immediately in practice (e.g., having the final report in the patient's chart immediately upon reporting the procedure). Issues of safety and effectiveness are thus less relevant to this innovation than to many others. There are areas of clinical practice (e.g., surgery [240, 265-267]) wherein scientific evidence has historically played less of a role in the innovation process than clinical acumen and experience, and the strength or quality of evidence does not necessarily have a large influence on the decision to adopt innovations in healthcare [189, 242]. Further research on the role of scientific evidence in clinicians' decisions to use SRTs and similar innovations, how this evidence is weighed alongside other factors (e.g., values and judgments), and whether and how its impact differs across types of innovations would not only provide greater insight into the sometimes ambiguous nature of evidence [108, 268] but also assist in innovation adoption and implementation efforts.

As stated previously, this study sheds some insight into factors that potentially affect the sustainability of innovations in practice. Indeed, the impact of certain factors – specifically, ongoing monitoring and feedback mechanisms, consistent leadership, and a strong culture, which were all important in the NSBSP case only – on the sustainability of tools in practice requires more study. The findings also point to the need to investigate how certain factors (e.g., culture) may play both facilitating and impeding roles in terms of expansion and sustainability. Certainly, the important

issue of spread and how distance from the innovation – both temporally and geographically – may impact subsequent implementation warrants further study. There is also a need to study how SRTs and other innovations adapt and evolve over time to continually meet users' needs and expectations. In particular, the growth of technology in the health sector will require an improved understanding of the most effective and efficient ways to modify and update technology. An greater understanding of the nature of trade-offs that are made between fidelity and adaptation, and how these impact on sustainability, would help researchers and practitioners better manage the tensions that exist in this area.

That stakeholder engagement and the depth of engagement was perceived to be such a facilitating (and impeding) factor in SRT implementation – and that only one of the theoretical perspectives used in this study explicitly presents stakeholder engagement as an important construct – suggests we need more study on the role of stakeholder engagement in KT/implementation science efforts in health care. Indeed, health care systems are highly professionalized with many distinct cultures and organizations [96, 269], yet are also characterized by high levels of interdependency with individuals operating in health care organizations seldom having enough autonomy on their own to implement and make use of new tools and technologies in practice [18, 56, 58]. The application and use of stakeholder analysis techniques [270, 271], developed and employed in the business and management sectors, would be useful to study in the context of implementing new tools in clinical practice.

Finally, the findings demonstrated that substantial resources (human and fiscal) are often needed to implement complex innovations in practice. Moreover, the

cost of technological innovations involving IT and specifically their physical integration into existing IT infrastructure (e.g., hardware and software) are often high. Thus, as more of these innovations are introduced in health care settings, the cost-effectiveness of new tools and technologies is a needed area of study. Practically, demonstrating health system efficiencies through use of SRTs, when and where they exist, will likely be important to their implementation and expansion locally.

CONCLUSIONS

This study found that factors at multiple levels of the healthcare system influenced the implementation and use of SRTs, with five common factors across three cases. The findings add to our knowledge base on the multi-level factors that influence the implementation and use of complex innovations in healthcare organizations. That multi-level factors influenced the implementation and use of a tool in frontline clinical practice, which is often perceived as removed from the administrative and socio-political components of health care, across three cases is an important finding and demonstrates the interdependency of the system and the need to cultivate and maintain constructive relationships across organizations and professions. The key role that interpersonal level factors played in implementation and use processes across cases, despite differing characteristics and contexts, and their relationships to gaining and maintaining both moral and material support for innovation implementation have significant implications for individuals and teams who are responsible for implementing changes in health care settings. Researchers and practitioners may learn

from this study to help them make sense of their specific contexts and design interventions, or plan for and manage implementation processes, accordingly.

This research also contributes to the growing field of KT/implementation science research. Specifically, this research demonstrates the value of case study methodology for studying the implementation of new knowledge and tools in clinical practice and adds important insight into the application of theoretical knowledge (i.e., organizational and systems theories) and areas for theoretical refinement and potential enhancement. Moreover, few KT/implementation science researchers have specifically focused on the interpersonal and system levels when studying the implementation of new tools in clinical practice; this research clearly shows the impact of these levels and suggests that others studying implementation and use processes adopt perspectives and approaches that enable their investigation. Further study is warranted on the sustainability of innovations, the role of stakeholder engagement in knowledge application and implementation more broadly, and the cost-effectiveness of new tools and technologies in clinical settings.

Table 14. Key factors influencing synoptic reporting tool (SRT) implementation and use and their relationship to the theoretical perspectives (1 = Promoting Action on Research Implementation in Health Services; 2 = Organizational framework of innovation implementation; 3 = Systems thinking / change). Factors that were common to all three cases are shaded grey.

Influencing factors	**Relevant theoretical perspective(s); construct(s)**	**Relationship to theoretical perspective(s)**
Common factors		
Stakeholder involvement	3; local autonomy, (re)negotiation, resources	Key stakeholder involvement influenced SRT implementation and use, with high involvement critical to navigating the healthcare system, building a sense of local ownership, and acquiring moral and material support for implementation.
Managing the change process	2; implementation policies and practices, implementation climate	Employing policies and practices to manage resistance and other barriers to SRT implementation and use, communicate about the SRT and its implementation, and provide training and support were important parts of managing the change process.
Administrative and managerial support*	2; management support	In organizations wherein administrative and managerial support were high, implementation went smoother and the experience tended to be better for end users; where support was low, the reverse occurred.
Champions and respected colleagues	2; innovation champions	Respected colleagues who championed the SRT were instrumental to clinicians' decisions to use the SRTs and to continue using, even in settings wherein ongoing challenges and frustrations were prevalent.
Innovation attributes	2; innovation-values fit	Innovation-values fit is akin to one of the concepts – compatibility – encompassed in the key factor innovation attributes. High compatibility or "fit" existed between SRTs and individual, organizational, and system values, interests, and priorities.

Table 14 continued.

Influencing factors	Relevant theoretical perspective(s); construct(s)	Relationship to theoretical perspective(s)
Innovation attributes	3; nature of knowledge	Implementation and use was influenced by the way in which participants understood the SRTs. Individuals' understandings of the nature and characteristics of the SRTs were depicted as attributes of the innovation, specifically complexity, relative advantage, and compatibility. When individuals believed that the SRT held value and would (at least eventually) be better than the practice it replaced, they were much more apt to support its implementation and use.
Distinct factors		
Implementation approach	*Neither*	In the CCPP and SSRTP cases, SRT implementation and use were influenced by the tool's positioning in the healthcare system (i.e., part of a screening program; pilot project) and the related implementation approach (i.e., top-down, policy driven; ground-up). Neither of the theoretical perspectives specifically addresses how these factors might affect innovation implementation.
Project management	*Neither*	In the CCPP case, SRT implementation was impeded by suboptimal project management, specifically related to the tool's implementation. Neither of the theoretical perspectives specifically addresses project management as an important influence on moving knowledge into practice, though task-based 'facilitation' [110] may include some of the project management practices encompassed in this factor.
Resources	2; financial resource availability	Limited financial resources, including financially dependent resources (e.g., acquiring personnel), was deemed a key constraining factor in the NSBSP and SSRTP cases. Limited resources affected change management practices (NSBSP) as well as information technology work to update/refine the SRT (NSBSP) and adapt the SRT to the Nova Scotia environment (SSRTP).

Table 14 continued.

Influencing factors	**Relevant theoretical perspective(s); construct(s)**	**Relationship to theoretical perspective(s)**
Culture	1; context (culture)	In the NSBSP case, SRT implementation and use were facilitated by the program's strong quality improvement culture.
Leadership	1; context (leadership)	In the NSBSP case, SRT implementation and use were facilitated by consistent and effective leadership; the leaders, who have largely remained stable over two decades, were effective at building a dedicated team and acquiring the resources for SRT implementation.
Monitoring and feedback mechanisms	1; context (evaluation)	SRT implementation and use in the NSBSP were facilitated by ongoing monitoring and feedback mechanisms at multiple levels of the healthcare system (e.g., clinicians, health districts, government).
Components of the healthcare system	3; *no specific construct*	In the CCPP and SSRTP cases, SRT implementation was impeded by structural, infrastructural, and/or socio-historical components of the healthcare system. "Systems" thinking / change views the healthcare system as an interdependent, social system wherein the movement of knowledge into practice is impacted by the larger system's characteristics (e.g., relationships across the system, historical interactions, and so on).

NSBSP = Nova Scotia Breast Screening Program; CCPP = Colon Cancer Prevention Program; SSRTP = Surgical Synoptic Reporting Tools Project.

* In this study, administrators refer to executive officers, directors, and senior management at the Department of Health, health district, and hospital levels and managers to mid-level managers and heads of hospital departments and units.

Table 15. Study findings that are under-developed in the theoretical literature on moving knowledge into healthcare practice.

Finding	Description
Organizational management	• Even without positional authority over SRTs, middle managers and others in mid-level leadership positions (e.g., department or unit heads) facilitated or impeded SRT implementation by demonstrating their support (or lack of) for SRTs and exerting their influence over departmental policies, priorities, and resources. • Reasons for low support from these individuals included a limited understanding of the SRT's utility or value; low involvement in and input on the SRT and its implementation; and the introduction of new roles and tasks with no additional resources to carry out the new work.
Healthcare system components	• SRT implementation was influenced by how the broader healthcare system operated (e.g., its delivery and support structure, information technology infrastructure, policy environment) and the nature of relationships amongst its various players (e.g., weak relationships across organizations).
Interpersonal aspects of implementation	• The interpersonal aspects of implementation and changing practice had considerable influence on SRT implementation and use across all cases studied: e.g., involving key stakeholders in the SRT development and/or implementation process and managing the 'people' aspects of change. • Those with low involvement in the implementation process were, by and large, resistant to SRT implementation – despite speaking highly of SRTs in general – and put forth numerous reasons for opposing the SRT or its implementation.

Table 15 continued.

Finding	Description
Complex nature of implementation	• The implementation processes were characterized by many convergent and divergent activities, often departing from planned activities and timelines. SRT implementation required team members to forge new relationships and work within shaky ones, span organizational boundaries, and develop and re-develop strategies to make implementation happen.

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APPENDIX A: NOVA SCOTIA'S HEALTHCARE SYSTEM

This appendix contains a description of the organization of the healthcare system in Nova Scotia over the time of synoptic reporting tool implementation in the three cases studied.

Organization of health care in Nova Scotia

Health care delivery

The provincial health care delivery system is currently comprised of nine district health authorities (DHA) and the IWK Health Centre (IWK), the province's consolidated women's and children's hospital in Halifax. The health authority structure is legislated under the Health Authorities Act and all DHAs and the IWK are legal entities. Altogether, there are 34 acute care facilities operated by the nine districts and the IWK. Twenty-eight of these facilitates are outside of Capital Health and IWK.

Under the current legislation, the DHAs receive funding from the Department of Health and Wellness (DoHW; formerly Department of Health) but have the authority and autonomy to plan, manage, deliver, monitor, and evaluate health services within their jurisdiction. However, unlike most provinces, the DoHW does not have performance or accountability agreements in place with DHAs (or individual hospitals) to facilitate their participation in provincial transformation initiatives and reporting/monitoring.

Historical context. Prior to 1996, 36 local hospital boards were responsible for health care delivery in the province and governed the day-to-day administration of local hospitals. In 1994, under a Liberal government, the province began a reconfiguring of its health system (this was in response to a 1989 provincial Royal Commission on Health Care). The justification for this reconfiguring was cost containment and greater accountability/citizen participation. By 1996, the 36 hospital boards were amalgamated into four regional health boards (Central, Western, Northern, Eastern).

In 1999, the Conservative government campaigned, in a general provincial election, that it would eliminate the four regional health boards and replace them with nine DHAs. The justification for this proposed expansion was cost containment and greater accountability/citizen participation. In January 2001, under a majority Conservative government, the four regional health boards were expanded into nine DHAs (the current structure) despite recommendations from an expert panel that, while the restructuring had experienced some challenges with implementation, the regional health board structure should not be abandoned and that the system could not afford another major structural change. These DHAs assumed the same responsibilities as the prior regional health boards but with smaller catchment areas. Interestingly, both cost containment and greater accountability were clearly articulated by both governments, yet the strategies to meet these goals were contrary to one another (one government took numerous boards and amalgamated them; the other government took a small number of boards and expanded them).

Provincial program organization

The organization of provincial programs in Nova Scotia and their governance model are directly relevant to the implementation of synoptic reporting in two of the cases studied: the Colon Cancer Prevention Program and the Nova Scotia Breast Screening Program. The DoHW funds nine provincial programs in Nova Scotia. Since 2004, a provincial program model has been in place that outlines the mandate of these programs:

- Act in an advisory capacity to the DoHW
- Recommend service delivery models (i.e., advise care providers)

- Develop draft standards
- Educate and communicate about standards and best practices
- Monitor approve standards
- Work with provider organizations to ensure implementation
- Participate in program evaluation

This mandate is significant in that it underscores the advisory role of the provincial programs. The program model separates policy development and standard setting from care delivery: provincial programs are not directly responsible for providing care (this is the role of DHAs and the IWK) and they generally lack authority for monitoring and non-compliance.

While each program is responsible for managing its day-to-day operations, the programs are not separate legal entities. This means they cannot be direct employers or hold funds in their own right. The DoHW has contracts and/or memoranda of understanding with host organizations, usually academic healthcare centres (the Queen Elizabeth II Health Sciences Centre [QEII HSC] and IWK), wherein these organizations support provincial program operations (e.g., office space/overhead, employee services, and information technology [IT] services). All contracts involving provincial programs are entered into under the authority of the Crown and all assets of provincial programs, including data, are owned by the DoHW.

Information technology organization and infrastructure

There is no single IT platform implemented across Nova Scotia. Eight DHAs have a range of clinical, financial, and administrative software applications hosted on a common

Meditech Client-Server platform. This single vendor solution allows these largely rural DHAs to accommodate more primary and secondary healthcare requirements. The IWK operates on Meditech Magic platform. Capital Health (DHA 9) has adopted a best-of-breed (multi-vendor) approach to its clinical applications, with no Meditech products. This approach was likely due to the fact that Capital Health provides a more complex mix of tertiary and referral care, includes the province's leading academic medical centre (QEII HSC), and engages in much more medical research/clinical trials. Many of Capital Health's clinical solutions were acquired from some of the leading vendors at the time of procurement.

The DoHW established the Health Information Technology Services Program of Nova Scotia (HITS-NS) in 2006 as the centralized provincial service delivery organization for the province's shared IT services. HITS-NS is funded by the DoHW but is a separate entity hosted at the IWK. This decision was based on the fact that HITS-NS holds a great deal of patient and institutional information, and the DoHW felt this information was best held by a quasi-independent organization.

HITS-NS oversees the expanding inventory of clinical, financial, and administrative software applications for DHAs1-8 (all hosted by HITS-NS on a common Meditech Client-Server platform) as well as some applications for both IWK and Capital Health. HITS-NS also has operational oversight of a number of additional IT services, including the province's Picture Archiving and Communications Systems, Primary Healthcare Information Management systems, and TeleHealth video-conferencing.

In essence, HITS-NS provides operations support for provincial IT systems. The organization is not tasked with the role of identifying, developing, and implementing new

IT systems. Rather, the organization is charged with the responsibility of ensuring that existing and proposed IT systems follow defined standards and interface to other systems using acceptable protocols and procedures. HITS-NS' role in 'accepting' any new IT system and helping with the technical work is based on a DHA's approval of implementing the system.

There is no provincial plan on how to best leverage information management/IT systems in Nova Scotia.[1] As explicated by a key informant at the DoHW, the rapidly expansion of technology and the subsequent demands on HITS-NS services has meant that the organization has not grown in an organized or planned way. The lack of a clear provincial plan is a significant barrier in the development of the province's IT infrastructure.

Privacy and data sharing environment

Around the early to mid-1990s, governments at provincial and territorial levels began to enact laws to regulate the collection, use, and disclosure of personal information in the public sector. These laws followed increasing public concern about the privacy of personal information. Thus, in alignment with other jurisdictions, Nova Scotia enacted the *Freedom of Information and Protection of Privacy Act* (*FOIPOP*) in 1993 to regulate access to and privacy of personal information held by public bodies, including government departments, provincial agencies, boards, and commissions, universities,

[1] Corpus Sanchez International (CSI) Consultancy Inc. *Provincial Health Services Operational Review Final Report: System Level Findings & Overall Directions*, December 2007.

DHAs, and hospitals. This "personal information" included an identifiable individual's healthcare history.[2]

However, during implementation of synoptic reporting in the three cases studied, there was no legislation in Nova Scotia to specifically protect the privacy of personal health information. Instead, personal health information was managed according to more than 40 different pieces of legislation, including the *FOIPOP Act*, *Hospitals Act*, *Health Protection Act*, and the Federal *Personal Information Protection and Electronic Documents Act (PIPEDA)*, which falls under the mandate of Industry Canada. The rules for providers, health records, and facilities were not always consistent across Acts.[3] For instance, some of the Acts do not use a consent-based model to collect and use personal information, while others do. *FOIPOP*, for example, authorizes public bodies to collect personal information where authorized by law or where necessary for the operation of the body's programs. These bodies may use or disclose information without specific consent for the purpose(s) for which it was obtained or a similar purpose. *PIPEDA*, however, maintains that, in general, explicit consent should be sought for the collection, use, and disclosure of sensitive information, including secondary uses of identifiable health information.

Moreover, this legislative structure was largely developed in an era of paper-based records and was considerably challenged by electronic personal health information. For example, applying legislation on informed consent to the collection, use, and disclosure of personal health information can be challenging in the context of electronic medical records and other clinical systems. Specifically, it may be next to impossible to

[2] Freedom of Information and Protection of Privacy Act. *1993, c. 5, s. 1.*

obtain truly informed consent for uses and disclosures of personal health information given that all future uses of information in electronic medical records and other clinical care databases cannot be foreseen when the information is initially entered into the system.[4]

Alongside this legislative context, in January 2005, the Nova Scotia Deputy Minister of Health endorsed a *Pan-Canadian Health Information Privacy and Confidentiality Framework*.[5] The *Framework* was meant to be a tool to inform and influence privacy legislation processes within provincial and territorial jurisdictions, and it set out a number of core provisions that attempted to strike a balance between protecting the privacy and confidentiality of individual health information and enabling the flow of information to support effective health care delivery, management of the health system, and an interoperable electronic health record. For instance, the *Framework* advises there are circumstances wherein explicit consent should *not* be required for the use or disclosure of personal health information, as long as certain conditions are met (e.g., legislation authorizing use and disclosure, or a privacy impact assessment subject to review by a Commissioner or Review Officer). Such circumstances include: ensuring quality of standards of care within the trustee/custodian organization (e.g., disclosure for quality of care committees or similar bodies) and planning and management of the health system.

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[3] Nova Scotia Department of Health. *Personal Health Information Legislation for Nova Scotia: Discussion Paper*, 2008.
[4] For further discussion of the consent challenge in the EHR context, see: Work, F. *Issues with respect to the Electronic Patient Record,* Office of the Privacy Commissioner of Alberta, October 2002.
[5] Health Canada. *Pan-Canadian Health Information Privacy and Confidentiality Framework.* January 27, 2005. Available online at: http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2005-pancanad-priv/index-eng.php.

In addition, each health care facility has its own policies and procedures related to privacy, security of personal health information, and data integrity. While they may be similar, the introduction of any new clinical database and the transfer of personal information across databases required that the database be implemented in such a way that it adhered to the policies of the particular institution. Similarly, given that the synoptic report is the legal equivalent to the dictated report, the final report must meet the legal requirements of health records, privacy, and health information management departments/offices at each institution.

In December 2010, Nova Scotia passed legislation, the *Personal Health Information Act*, to protect the privacy of personal health information. This Act is expected to come into effect in Winter 2013.

APPENDIX B: SYNOPTIC REPORTING IN THE NOVA SCOTIA BREAST SCREENING PROGRAM

This appendix contains a case history of synoptic reporting in the Nova Scotia Breast Screening Program.

Context and history of the issue

Synoptic reporting for mammography began in the mid-1980s at the Victoria General (VG) Hospital, the province's only academic hospital. A small team of personnel from the radiology department developed a synoptic reporting-like database for mammography reporting. The impetus for this development was to track patient care/follow-up subsequent to suspicious imaging. Specifically, one radiologist had experienced a situation wherein a patient did not receive further assessment following an abnormal finding. Thus, the radiologist wanted to develop a database that would enable tracking of patients and ensure patients would receive appropriate and timely follow-up care. A synoptic-reporting like database (Diagnostic Reporting System; DRS) for mammography was developed 'in-house' and, within a few years, also used by radiologists at the Halifax Infirmary (HI). At the time, the concept of and terminology around *synoptic reporting* was not developed, and the developers had no knowledge of any other type of system existing nationally or internationally for any medical investigations or procedures.

In 1991, the Department of Health and Wellness (DoHW; formerly Department of Health) established and funded the Nova Scotia Breast Screening Program (NSBSP). Nova Scotia was the fifth province in Canada to provide organized breast screening (British Columbia, Alberta, Saskatchewan, and Ontario had existing programs; all 10 provinces and two territories now have an organized breast screening program). The individual who became head of this program had been using the original synoptic reporting system developed at the VG, and was a strong believer in and promoter of data capture and monitoring for quality assurance and improvement. As a result, the screening program developed and employed a screening database (Mammography Information

System; MIS) to capture data on all screening mammography in the province. The NSBSP also became the host of the DRS, which meant that Nova Scotia was in a unique situation wherein all mammography in the province, screening or diagnostic,[1] could be captured in one single database.[2]

In 1993, the Canadian Breast Cancer Screening Database (CBCSD) was developed through the National Committee for the Canadian Breast Cancer Screening Initiative, a collaboration of the federal, provincial, and territorial governments. The database, operated and maintained by the Public Health Agency of Canada (PHAC), is a national breast screening surveillance system that allows organized breast cancer screening to be monitored and evaluated at a national level. An Evaluation Indicators Working Group was formed in 1999 (following several meetings/workshops that identified the need for a standard method of evaluation for all Canadian breast cancer screening programs[3]) to identify evidence-based performance measures, which are now reported in a biennial report.[4] For Nova Scotia, the establishment of the CBCSD meant that national resources could be leveraged to update/refine the provincial database since work was required to retrieve and assemble the data in a suitable form.

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[1] As defined by the NSBSP, screening mammography is for asymptomatic women aged 40+ (or 50+, depending on jurisdiction) who do not have a personal history of breast cancer; diagnostic mammography is for symptomatic women, women with a personal history of breast cancer, women with breast implants, and for workup of any individual who receives an abnormal screening mammogram. Diagnostic mammograms take longer to perform and longer to interpret by a radiologist than screening mammograms.

[2]

[3] These meetings included the 1990 Interchange meeting, 1993 National Forum on Breast Cancer, and the 1997 Workshop on Organized Breast Screening in Canada. See: Health Canada, Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance, 2002. Available at: http://www.phac-aspc.gc.ca/publicat/eiwg-gtie/index-eng.php#content

[4] Reports are entitled Organized Breast Cancer Screening Programs in Canada. Available at: http://www.phac-aspc.gc.ca/publications-eng.php

As of October 2012, the MIS was implemented and used province-wide for screening mammography; the DRS was implemented in all nine health districts for diagnostic mammography but only used in six of the nine districts. In addition to mammography reporting, in recent years, the NSBSP has collaborated with colleagues to develop synoptic reporting for other breast imaging modalities (i.e., magnetic resonance imaging). Further descriptions of the synoptic reporting systems, their updates, and the timeline for implementation are provided in later sections. Data collection for this study suggested synoptic reporting for mammography does not exist elsewhere in Canada.

Nova Scotia Breast Screening Program

In 1979, a provincial committee was established to consider and plan for organized breast screening in Nova Scotia. Committee leadership and membership changed over the initial years, with limited progress. A restored committee began planning in earnest in the mid/late 1980s; current NSBSP leaders were members of this committee. A program plan was developed based on the growing evidence in breast screening (with a large influence being Dr. Edward Sickles' work at the University of California, San Francisco). In 1991, the DoHW formally established the NSBSP as a pilot program, operating solely in Halifax. Much of its administrative and operational materials were adapted from British Columbia's screening program. The main goal of the NSBSP was, and continues to be, to "standardize the mammography process throughout the entire province."[5] The program's mandate[6] is:

[5] Nova Scotia Breast Screening Program. *Nova Scotia Breast Screening Program Annual Report 2011 (2010 Data)*, March 2012, pg. 10.
[6] As cited in: Corpus Sanchez International (CSI) Consultancy Inc. *Provincial Health Services Operational Review Final Report: System Level Findings & Overall Directions*, December 2007.

- To provide cost effective breast screening for Nova Scotian women aged 50-69;
- To develop standards, guidelines, and policies to support a decentralized model of breast screening at multiple sites throughout Nova Scotia;
- To monitor and evaluate dissemination, uptake, application, and outcome of standards and guidelines;
- To review the delivery of certain clinical services; and
- To provide continuing education for professionals and general education to the public.

Since its inception, the program has been led by a medical director, who is ultimately accountable for the program and reports to the Acute and Tertiary Care Branch of the DoHW, and a program manager, who oversees the operations of the program and reports to the director. For the first six years of operations, the director position (filled by a practicing radiologist) did not have dedicated administrative time. Subsequently, this position increased to one half-day per week and later to one day per week. The program manager position is full-time. The core business functions of the NSBSP include: population health, database surveillance and evaluation, and education to women and health care providers. Some of its key programs and services are:

- Coordination of population-based breast screening
- Centralized booking services
- Mammography examination of breast tissue (screening and diagnostic)
- Maintenance and analysis of provincial program database
- Program evaluation

- Direct and indirect support of radiologists through development of standards, guidelines, and policies
- Patient navigation
- Patient education

As a provincial program, the NSBSP is not a separate, legal entity. The host organization for the NSBSP was initially the HI, but has been the Queen Elizabeth II (QEII) Health Sciences Centre in Halifax since the amalgamation of the VG Hospital and HI in 1995/96. The NSBSP is housed in the Department of Diagnostic Imaging, VG Site, QEII Health Sciences Centre, though most of its staff work at a community-based site on Mumford Road in Halifax. Its staff are employees of Capital Health and its operations are maintained by Capital Health infrastructure. Hosting of the program will move in the near future to the IWK Health Centre as a result of a recent DoHW decision that will align it with the Women's Breast Health Clinic at the IWK.[7] The NSBSP has retained ownership of its database, unlike other provincial programs wherein the DoHW owns their databases/data. Though operational funding comes from the DoHW, the program has acquired funding for much of its innovative work (see below) as well as imaging equipment/information technology (IT) infrastructure from external organizations, including the Canadian Breast Cancer Foundation (CBCF) – Atlantic Region, federal government agencies/departments, and industry.

As part of the provincial program model, the NSBSP is expected to act in an advisory capacity to the DoHW, to monitor adherence to approved standards, and to evaluate how the program is meeting its mandate and objectives (see Appendix A for a description of provincial programs and their mandate). The program's synoptic reporting

systems and resulting database are instrumental to achieving the provincial program mandates. An independent review of provincial health services operations,[8] commissioned by the DoHW and completed in December 2007, found that the NSBSP adheres to all of the provincial program mandates as explicated by the DoHW. Relevant to synoptic reporting implementation and use, the review did note several challenges for the NSBSP:

- Inadequate authority to act on quality of radiologists' performance, with no capacity to enact consequences for consistently poor performance.
- Ongoing engagement of physicians and nursing staff in the community has remained difficult.
- Inadequate research funding to gather the evidence needed to support further financial and resource investments.
- Limited financial resources, dated infrastructure, insufficient program management capacity, and lack of administrative resources, which all impact on operations.

The review also remarked that the NSBSP "provides an extremely good service on a relatively small budget. The participants are very dedicated, highly motivated and passionate about the program."[9]

Like other provincial programs, the NSBSP has no direct authority to enforce changes in practice or provision of care or ensure that radiologists comply with policies and standards, and thus cannot compel radiologists to use the synoptic reporting systems. Nonetheless, the program director has worked closely with the DoHW and other

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[7] Personal communication with NSBSP staff and cancer system administrators.
[8] Corpus Sanchez International (CSI) Consultancy Inc. *Provincial Health Services Operational Review Final Report: System Level Findings & Overall Directions*, December 2007.

organizations to develop and establish policy around radiology practice and care standards (e.g., accreditation requirements; see below), which have been implemented and supported by the District Health Authorities.

Innovations

In addition to synoptic reporting, the NSBSP has developed and/or introduced a number of innovations in the breast screening landscape, many of which have been adopted by organized screening programs across Canada. These innovations include:

- Concerted implementation of stereotactic needle core biopsy since the program's beginning, which has led Nova Scotia to achieve the lowest benign:malignant breast surgery rate in Canada.
- The Pink Rose Project, which provides information and support packages to newly diagnosed women at the time of diagnosis; the project has since been adapted and implemented in most screening programs in Canada.
- A Patient Navigator to navigate women with abnormal reports; this person works closely with women and their physicians prior to diagnosis to ease patients through the diagnostic sector.
- Central Mammography Booking, allowing all mammography in the province, screening or diagnostic, to be booked through one integrated booking system (1-800 number); this innovation has enabled the NSBSP to eliminate opportunistic screening (i.e., screening asymptomatic women in the diagnostic sector) in Nova

[9] Corpus Sanchez International (CSI) Consultancy Inc. *Provincial Health Services Operational Review Final Report: System Level Findings & Overall Directions*, December 2007, pg. 354.

Scotia as well as to track and follow-up all patients with an abnormal or suspicious finding.

- Full field digital mammography, which has been implemented in all fixed sites, screening and diagnostic, and in one mobile screening unit.

Most of these innovations have been funded entirely or in part by external organizations, including the CBCF, PHAC, and Health Canada. The program has also undertaken many projects related to performance monitoring, surveillance, and evaluation of new practices/technologies. These include use of geographic information systems to understand service delivery, evaluation of full field digital mammography, developing empirically-based Breast Imaging Reporting and Data System (BI-RADS) scales from full field digital mammography, and annual report automation. These projects were also funded by external funding organizations.

Organization of initiative: synoptic reporting in the Nova Scotia Breast Screening Program

Positioning in the provincial landscape

Synoptic mammography reporting initially began in the mid-1980s at the VG Hospital. The initiative (database development/implementation) was started as a research project, with funds acquired from the Radiology Research Foundation to purchase computing software and hardware. One individual developed the database without additional expertise and resources. Similarly, the subsequent implementation at the HI was performed without additional expertise/resources.

Following establishment of the NSBSP in 1991, both the MIS and DRS were housed within this program, essentially creating one database designed to capture all mammography (screening and diagnostic) in the province. Given the authority structure of provincial programs, the NSBSP could not mandate implementation and use of these systems. Thus, the NSBSP expanded booking and screening capacity (through use of the mobile vans) throughout the province much earlier than the expansion of the MIS and DRS. Throughout the 2000s, as fixed screening sites were set up at hospitals across the province, implementation of the MIS occurred during, or shortly after, establishment of these sites.

In 2005, the DoHW established a provincial policy that fees for mammography services would not be paid unless an institution was accredited through the Mammography Accreditation Program of the Canadian Association of Radiologists (CAR) and had established processes to maintain this accreditation. This policy received strong support from the Nova Scotia Association of Radiologists (NSAR) and the provincial medical society. Subsequently, all institutions in the province that wanted to conduct screening mammography needed to be CAR accredited. In the years that followed, the DoHW strongly advised all fixed NSBSP sites to implement and use the MIS, in keeping with the accreditation standards. Although the DoHW did not have authority to enforce this policy at the health district/hospital level, the support of NSAR was instrumental in making a medico-legal case for hospital accreditation and use of MIS. As a result, in October 2008, the last hospital in the province implemented the MIS in response to the policy.

DRS implementation occurred later at most hospitals than MIS implementation. By 2010, the DRS had been implemented at all diagnostic imaging departments in the province that perform mammography. However, as of October 2012, radiologists in three health districts continued to refuse to use this system to report diagnostic mammography, regardless of the 2005 provincial policy.

Implementation approach

The implementation of the two synoptic reporting systems initially followed a pilot project approach wherein the systems were implemented, tested/trialed by users, fine-tuned when needed, and subsequently implemented in another hospital or district. The MIS was first implemented in Halifax, followed by the mobile vans, and then fixed hospital sites in Sydney, Cape Breton, and Yarmouth. The DRS was first implemented in Halifax (VG hospital and HI) before being implemented in Sydney, Cape Breton. For both systems, it took approximately one decade to 'spread' them to hospital settings outside of Halifax (see timeline below). Nonetheless, these initial implementations were viewed as opportunities to test the systems and their implementation/use outside of Halifax. It took nearly another decade to fully expand these systems across the province, with expansion undertaken in a gradual, largely unplanned, manner.

Once the MIS or DRS system was implemented at an institution, all radiologists performing mammography within the diagnostic imaging department chose to either use or not use the system. The MIS was implemented province-wide in 2008. While the DRS has been implemented at all institutions with mammography services in the province, radiologists at three institutions have chosen not to use the system. Since their diagnostic

mammography data are not entered into the provincial database, this means that patients in the three health districts served by these institutions cannot be followed and tracked in the program's database, as is the practice in all other districts.

Implementation team

There was no planned or organized team *per se* to oversee the implementation of synoptic reporting. Nonetheless, a small group of people, who have remained fairly consistent over the decades, have led the implementation of the MIS and DRS systems. Initially, implementation and user training were performed by the individual who developed the original DRS system. Since the establishment of the NSBSP, implementation and user training has been primarily carried out by the NSBSP Program Manager (with three people holding this position since 1991) and a technical support person. The latter person, who has changed several times over the past two decades, has not been in the employ of the NSBSP, but rather been paid through contract work. Following establishment of the Health Information Technology Services Program of Nova Scotia (HITS-NS) in 2006, a HITS-NS employee has also been involved in implementation throughout the districts.

User training has also involved a member of the NSBSP clerical staff, who is responsible for training relevant clerical personnel (e.g., health records personnel) at the individual institutions. There have also been several "champion" radiologists, who have supported the implementation throughout the province via advocating for use of the systems with decision-makers and radiologists, and making site visits to support radiologists' training and use.

Synoptic reporting tool

Description of tool

Synoptic reporting in the NSBSP involves two reporting systems/databases: the MIS (screening) and the DRS (diagnostic). Both systems are electronic, use a structured format and drop-down menus to input data, and store data in discrete data fields. However, neither the MIS nor the DRS system uses standardized reporting language or standardized coding terminology, or HL7 messaging (the international health informatics interoperability standards). The systems do incorporate the BI-RADS standards for breast imaging, designed to standardize mammography reporting, yet also allow the radiologist to select non-BI-RADS descriptors that are more granular in nature. These capabilities and functions (or lack thereof) position the systems somewhere in the middle of the evolution of synoptic reporting technology (see Table 1 below).

The MIS is relatively simple; for normal screens, the system input involves only one response and the resulting mammography report is comprised of a one-word radiologist report ("Normal"). In effect, the DRS is considered the more relevant and sophisticated synoptic reporting system, with radiologists expected to input responses related to mammographic findings, degree of suspicion, and recommended management/ follow-up. Both technologists and radiologists input data (the technologist input is reviewed by the radiologist, and superseded when necessary), with all data elements entered via drop-down menus. There are a number of mandatory elements wherein the radiologist cannot complete the report without responding to those particular questions. There is a limited area for free text description. Free text comments are not stored as retrievable data in the database, but are printed on the end mammography report.

With the exception of normal screening reports generated by the MIS, the end report that is generated is narrative in nature, rather than a synoptic 'checklist' format. Specifically, the input generates a series of standardized paragraphs, separated by structured headings (i.e., management recommendations, introduction, findings, additional observations), that reads similar to a traditional dictated report. Since the systems are not interfaced with existing hospital IT systems, once the end report is generated, it must be copied and pasted into the hospital information system (e.g., the radiology information system or the hospital's electronic medical record). NSBSP clerical staff manually enter patient information into the MIS and DRS systems during the booking phase, which occurs over the phone for screening patients and from paper requisitions for diagnostic patients. At the time of registration at the mammography site, a registration clerk will confirm the information in the MIS or DRS database and change if needed. Once registered at the site, the patient becomes available for the technologists' and radiologists' to report the mammography.

Table 1. Continuum of reporting technology. Adapted from Srigley et al.[10]

Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
• Narrative • No standard • Single text field data	• Narrative • Standards • Single text field data	• Synoptic-like • Structured format	• Electronic tools • Use of drop-down menus	• Standardized reporting language • Data stored in discrete data fields	• SNOMED CT, ICD-O or other standardized coding terminology

Development and updates

Although the MIS has not undergone substantial change since 1991, the DRS has undergone several major updates since its original development. When initially

[10] Srigley JR, McGowan T, Maclean A, Raby M, Ross J, Kramer S, et al. Standardized synoptic cancer pathology reporting: a population-based approach. *J Surg Oncol*. 2009;99:517-24.

developed, the DRS consisted of a simple flat file database on a UNIX operating system. The database underwent minor updating/revisions prior to implementation at the HI and again in 1991 once transitioned under the NSBSP. A major revision occurred in 1997, when the system was converted from a UNIX to Windows operating system and redesigned as a relational database. A second major revision occurred in 2002-04, resulting in a single database providing standardized data entry procedures and outcomes for both screening and diagnostic mammography.

Most recently, the NSBSP is developing a new breast imaging information system, which will substantially update the current synoptic reporting systems and allow the program to update and expand its automated reporting and analysis capabilities. This new system will also use HL7 messaging, permitting interfacing with other hospital IT systems. Development of the new system is co-funded by CBCF and PHAC.

Implementation of synoptic reporting: timeline and key milestones

Table 2. Timeline of key milestones.

Timeline	***Milestone***
1985	Development and implementation of the DRS for mammography reporting at the VG Hospital, Halifax
Late 1980s	Implementation of the DRS at the HI, Halifax
1991	Development of the MIS as part of the newly established NSBSP; implementation of MIS at the Halifax Shopping Centre fixed site
1994	Implementation of the MIS in the mobile van, Cape Breton Region
1995	First data transfer to the national screening database; resources obtained for this transfer permitted updating of DRS
1997	Implementation of the MIS in the mobile van, Western Region
1998	Implementation of the DRS at Cape Breton Regional Hospital, Sydney
2000	Implementation of the MIS at Cape Breton Regional Hospital, Sydney
2001	Implementation of the MIS at Yarmouth Regional Hospital, Yarmouth
2002	Implementation of the MIS at Colchester Regional Hospital, Truro

2003	Implementation of the MIS at Dartmouth General Hospital, Dartmouth
	Implementation of the MIS in the mobile van, Northern Region
2004	Implementation of the MIS at Cumberland Regional Health Care Centre, Amherst
2005	Implementation of the MIS at South Shore Regional Hospital, Bridgewater
2006	Establishment of automated reporting
	Implementation of the MIS at Valley Regional Hospital, Kentville
2007	Implementation of the MIS at Aberdeen Hospital, New Glasgow
	Implementation of the MIS at Cobequid, Lower Sackville
2008	Establishment of context sharing capability, meaning that the synoptic reporting system(s) are integrated with the provincial Picture Archiving and Communication System so that when a radiologist selects a patient from the system, it automatically links to the mammogram images, ensuring radiologists report on the correct mammogram/patient (minimizing error)
	Establishment of central mammography booking, providing an impetus (or facilitating factor) to roll out the DRS across the remainder of the province
	Implementation of the MIS at St. Martha's Regional Hospital, Antigonish
	Implementation of the DRS at Dartmouth General Hospital, Dartmouth
2009	Implementation of the DRS at Aberdeen Hospital, New Glasgow
	Implementation of the DRS at South Shore Regional Hospital, Bridgewater
	Implementation of the DRS at Yarmouth Regional Hospital, Yarmouth
2010*	Implementation of the DRS at St. Martha's Regional Hospital, Antigonish
	Implementation of the DRS at Colchester Regional Hospital, Truro
	Implementation of the DRS at Valley Regional Hospital, Kentville
	Implementation of the DRS at Cumberland Regional Health Care Centre, Amherst
Fall 2012	Anticipated implementation of revised DRS with substantial updates, including voice recognition capabilities

*Despite the DRS implemented province-wide by 2010, radiologists at three hospitals have chosen not to use the system.

APPENDIX C: SYNOPTIC REPORTING IN THE COLON CANCER PREVENTION PROGRAM

This appendix contains a case history of synoptic reporting in the Colon Cancer Prevention Program.

Context and history of the issue

Synoptic reporting for colonoscopy commenced in Nova Scotia in 2009 as part of the newly established Colon Cancer Prevention Program (CCPP). The CCPP is administered by Cancer Care Nova Scotia (CCNS), the provincial cancer agency. This population-based screening program sends asymptomatic individuals aged 50-74 a fecal immunochemical test (FIT), which can detect small traces of blood in stool. If the test is abnormal, the individual is advised to undergo a *screening colonoscopy*, a procedure in which a long, flexible scope is guided through the colon. Approximately four percent of those who take the FIT test will be advised to have a colonoscopy, which is arranged through the screening program. In Nova Scotia, gastroenterologists and surgeons perform colonoscopies, with the majority done by general surgeons. This is unlike many provinces in Canada, wherein gastroenterologists perform the majority of colonoscopies.

The impetus for implementing a synoptic reporting tool (SRT) was to enable performance monitoring and quality improvement for colonoscopy, support the appropriate follow-up of participants in the screening pathway, and facilitate overall maintenance of the screening program. The specific SRT implemented by the program was developed by and procured from a U.S.-based research initiative: the endoscopy reporting software and database from the Clinical Outcomes Research Initiative (CORI). CORI was rolled out across the province concurrently with the screening program. All screening colonoscopies in the province are coordinated through the screening program and must be reported using CORI. Refusal to use this tool meant that gastroenterologists and surgeons would not be permitted to perform screening colonoscopies in the province.

Moreover, one health district has issued a district-wide policy that the SRT be used for all endoscopic procedures.

National context

In 2001, the Canadian Task Force on Preventive Health stated there was good evidence to recommend annual or biennial fecal occult blood testing to screen for colorectal cancer in asymptomatic individuals age 50+ years. One year later, Canadian recommendations were published supporting regular screening for individuals 50-74 years of age using a fecal test, with colonoscopy as the follow-up investigation.[1] By 2007, three provinces in Canada (Alberta, Manitoba, and Ontario) had announced organized screening programs. In the same year, the Canadian Partnership Against Cancer established the National Colorectal Cancer Screening Network (NCCSN) to support the creation of evidence-based screening programs and policy. The NCCSN provides a mechanism for program leads/staff to come together to discuss issues of common interest and concern, and to share best practices, related to the implementation of organized colorectal screening programs. Four years following its launch, in late 2011, eight provinces were running full or pilot programs (see Table 1), though only Ontario and Nova Scotia's programs reached 100% of the province.[2] New Brunswick and Newfoundland and Labrador have announced plans to establish screening programs, implemented as pilot projects, but, as of June 2012, these programs have not been launched.

[1] National Committee on Colorectal Cancer Screening. (2002). Technical Report for the National Committee on Colorectal Cancer Screening. Ottawa, ON: Public Health Agency of Canada. Available at: www.phac-aspc.gc.ca/publicat/ncccs-cndcc/.
[2] Cancer View Canada (n.d.). Colorectal Cancer Screening: Program/Strategy Elements. Available at: http://www.cancerview.ca/portal/server.pt/community/screening/456/screening_programs/3961.

Table 1. Organized screening programs in Canada, as of December 2011.

Province	"Go Live" Date	Implementation Approach
British Columbia	January 2009	Pilot
Alberta	March 2007	Phased-in
Saskatchewan	September 2009	Phased-in
Manitoba	April 2007	Province wide
Ontario	April 2008	Province wide
Quebec	November 2010	Pilot
Nova Scotia	March 2009	Phased-in
Prince Edward Island	May 2009	Pilot

One of the first steps taken by the NCCSN was the development of a common set of quality determinants and quality indicators to permit comparisons over time and across jurisdictions. In May 2008, the NCCSN, of which the CCPP has been a member from the beginning, undertook a stakeholder consultation process to identify these elements; a preliminary list was subsequently refined by a smaller working group of NCCSN members. Of the proposed 20 quality indicators that were identified and prioritized through this process, seven are related to the colonoscopy procedure.[3] Measurement of these indicators will require reliable data from each of the programs. The provinces have taken different approaches to information technology (IT)/ information management. As of August 2012, several provinces are exploring the possibility of implementing the same SRT as the CCPP; there is also an ongoing project in Ontario, supported by the Canadian Partnership Against Cancer, to develop a colonoscopy synoptic reporting system for Canada.

Concurrent with the NCCSN work, the Canadian Association of Gastroenterologists (CAG) has led a number of efforts to promote quality in colonoscopy

[3] Canadian Partnership Against Cancer. (2009). Quality Determinants for Colorectal Cancer Screening in Canada. Toronto, ON: Canadian Partnership Against Cancer. Available at:

performance. These include adoption of the Global Rating Scale (GRS),[4] a program that evaluates endoscopy services from a patient-focused perspective, and a national consensus process to define the key elements of endoscopy quality. Several gastroenterologists in Nova Scotia have been highly involved in both endeavours. In 2012, the CAG consensus guidelines on safety and quality indicators in endoscopy[5] were published, which include recommendations for endoscopy reporting standards as well as 18 quality indicators. In a recent position statement, the CAG has also stated its recommendation that all endoscopists in Canada "record and monitor their outcomes and participate in quality assurance programs, regardless of whether colon cancer screening is performed through organized programs or opportunistically."[6]

Provincial context

In 2006, there were 78 gastroenterologists and general surgeons in Nova Scotia who performed colonoscopies. During the time of CORI procurement and pre-implementation planning, there were a number of initiatives happening in Nova Scotia relevant to this project. First, since the late 1990s, a screening program was operating in one of the district health authorities (DHA), initiated and led by one surgeon. Subsequently, the CCPP asked this surgeon to act as a 'champion' for CORI and the DHA was an early implementer of the tool. Second, at the time of planning and implementation, the Surgical

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www.partnershipagainstcancer.ca/wp-content/uploads/QD_for_CRC_Screening_in_Canada_2009-10-05_v16.pdf.

[4] NHS Global Rating Scale. Available at: http://www.grs.nhs.uk.

[5] Armstrong D, Barkun A, Bridges R, et al. (2012). Canadian Association of Gastroenterology consensus guidelines on safety and quality indicators in endoscopy. Can J Gastroenterol 26(1):17-31.

Synoptic Reporting Tools Project (SSRTP) was underway in Nova Scotia and thus many system and organization level stakeholders were aware of SRTs as well as surgeons in several districts who perform colorectal cancer surgery. Indeed, many provincial stakeholders were introduced to electronic SRTs via the SSRTP. Third, several gastroenterologists in the largest provincial health district were leading and implementing the GRS to measure and improve endoscopy unit performance. The district is one of 20 sites in Canada implementing the GRS, under the national leadership of the CAG. Therefore, gastroenterologists and surgeons in this district who perform colonoscopies would have been recently introduced to the idea of measuring colonoscopy performance.

In addition to these efforts, at the time of CORI implementation, the Department of Health and Wellness (DoHW; formerly Department of Health), DHAs, CCNS, and other organizations in the province had begun to place increased emphasis on performance measurement and quality improvement. For example, the development and tracking of key performance indicators was becoming a core organizational concern and subsequently prioritized in organizational and district business and strategic plans.[7] Moreover, work was beginning on developing provincial clinical standards for cancer care, beginning with rectal cancer.[8]

Organizational structure

Cancer Care Nova Scotia

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[6] Leddin DJ, Enns R, Hilsden R, et al. (2010). Canadian Association of Gastroenterology position statement on screening individuals at average risk for developing colorectal cancer: 2010. Can J Gastroenterol 24(12):705-714.
[7] See: IWK Strategic Plan 2007, Capital Health Business Plan 2010/2013.
[8] See: http://www.cancercare.ns.ca/en/home/aboutus/newsroomandevents/ournewsletter/standards2012/fs.aspx

The positioning and role of CCNS in the provincial health system is relevant to the implementation of CORI within the Nova Scotia environment. In 1993, the Metropolitan Hospital Advisory Committee (in Halifax) presented a report to the DoHW that identified serious issues with the provision of cancer services across Nova Scotia. The DoHW responded by establishing a Nova Scotia Cancer Action Committee, which presented, in May 1996, a comprehensive provincial cancer management strategy to the Deputy Minister of Health. The cancer management strategy was called Cancer Care Nova Scotia: A Plan for Action. [9] This strategy recommended that the DoHW establish an independent organization that would be responsible for ensuring the provision of comprehensive, integrated, and accountable cancer services to the people of Nova Scotia. The Government accepted most of the Committee's recommendations and, in 1998, established CCNS as a provincial program.

CCNS reports to the Deputy Minister of the DoHW. Historically, it had a two-person Executive Team: a Commissioner and Chief Operating Officer. The Commissioner resigned in 2006, with the role vacant since then. In 2010, the DoHW recruited a Chief Medical Director to assume executive responsibilities along with the Chief Operating Officer. The program's mandate, explicated by the DoHW, is to coordinate, evaluate, and strengthen cancer programs and services across the cancer continuum. In addition to the CCPP, some of the key programs and services currently provided by CCNS include the Nova Scotia Cancer Registry, Cervical Cancer Prevention Program, cancer patient navigation, cancer site teams, and interprofessional education.

[9] Cancer Action Committee. (May 1996). Cancer Care Nova Scotia: A Plan for Action. The comprehensive, integrated, accountable cancer management strategy.

As a provincial program, CCNS is not considered a separate, legal entity. The host organization for CCNS is the Queen Elizabeth II Health Sciences Centre in Halifax. Its staff are employees of Capital Health and its operations are maintained by Capital Health infrastructure. The DoHW holds all assets of the program, including intellectual property and data. Moreover, due to its positioning as a provincial program, CCNS has no authority to mandate changes in practice and provision of care: the program's ability to support change is limited to persuasion and facilitation, not authority.

An independent review of provincial health services operations,[10] commissioned by the DoHW and completed in December 2007, explicated several challenges for CCNS relevant to synoptic reporting implementation. These include:

- Information management processes and technology are inadequate; its data collection and data registry technology were described as "old and antiquated."
- Lack of an information management strategy and infrastructure; at the time of the report, there was no integrated cancer information management strategy and plan.
- Lack of monitoring authority; while CCNS is expected to set standards, staff are limited in their ability to monitor compliance with standards.
- Perception that CCNS and the QEII Health Sciences Centre are one in the same: i.e., the perception that CCNS is a Halifax organization and not a provincial organization.

Colon Cancer Prevention Program

In November 2006, CCNS issued a report and presented it to the DoHW, recommending

[10] Corpus Sanchez International (CSI) Consultancy Inc. *Provincial Health Services Operational Review Final Report: System Level Findings & Overall Directions*, December 2007.

the development of a population-based colorectal cancer screening for Nova Scotia.[11] Following approval from the DoHW to further explore the feasibility of an organized provincial colorectal cancer screening program, CCNS undertook an environmental scan to review existing provincial screening programs (i.e., Nova Scotia Breast Screening Program, Cervical Cancer Prevention Program), the screening project operating in one DHA, national and international organized colorectal cancer screening programs, scientific literature, provincial colonoscopy utilization (acquired from one year of provincial physicians' billings data), and DHA-level resource utilization and capacity relevant to colorectal cancer screening (acquired from a survey administered in each DHA). CCNS also recruited two individuals (a full-time program manager and a 0.2 full-time equivalent medical director) to develop a proposed screening program structure. In 2007, the proposed program was presented to the DoHW and approved in the ensuing provincial budget. Relevant to synoptic reporting, the approved program structure included the following components:

- Administration of the program would be centralized and coordinated by CCNS and include the development and maintenance of a data registry;
- Colonoscopy would be the follow-up investigation for a positive screen; and
- The program would be phased in over a maximum period of five years or as resources permitted.

Organization of initiative: synoptic reporting in the Colon Cancer Prevention Program

[11] Cook S, MacIsaac M, & Underhill TM. (2006). Population Based Colorectal Cancer Screening: Report and Recommendations. Halifax, NS: Cancer Care Nova Scotia.

Positioning in the provincial landscape

Synoptic reporting for colonoscopy is positioned within the provincial colorectal cancer screening program. The SRT application and associated database was procured and implemented by screening program personnel; the centralized database is maintained by CCNS and thus is hosted on Capital Health IT infrastructure. Implementation of CORI was funded by the DoHW as part of the screening program.

To participate in the CCPP and perform screening colonoscopy in the province, endoscopists (gastroenterologists and surgeons) were required to sign an agreement stating they would use the SRT for all of their colonoscopies (screening and diagnostic), with the goal of having a single database capturing all colonoscopy in the province, and have their colonoscopy performance and outcomes monitored (and reported on) by the program. Refusal to agree to these terms meant the endoscopist would not perform colonoscopies as part of the screening program. By positioning the tool in the screening program, the CCPP had the authority to mandate use of CORI for all screening colonoscopies in the province. Through linkage of CORI with another screening program database (which collects data on all screening participants and their FIT results), the implementation team had the capacity monitor use of CORI for screening colonoscopies and refuse to pay colonoscopy fees if users did not input their data into the CORI system. However, despite endoscopists agreeing to report *all* their colonoscopies using CORI, by Winter 2012, endoscopists in most districts were not using CORI for diagnostic colonoscopy. The reason provided by most endoscopists for not doing this was the lack of integration with existing hospital IT systems, leading to additional work for endoscopists and endoscopy unit staff (see below for more detail).

Project team

The CCPP core team, which included a medical director, program manager, several technical/IT staff, and an implementation coordinator (hired part-way through the roll-out), managed CORI's implementation. The CCPP was led by Steering and Clinical Advisory Committees that provided leadership, expertise, and guidance on all aspects of the screening program's implementation; these committees were comprised of representatives from CCNS, Capital Health, and the three health districts that first implemented the screening program. The CCPP also convened two work groups relevant to synoptic reporting and CORI's implementation: Quality & Standards, and Data Management & Evaluation.

Implementation approach

SRT implementation was phased in over a 2-year period, beginning Spring 2009, across the entire province (nine DHAs). Districts could apply to be an 'early adopter' of the screening program: the criteria for early adoption included having a certain number of endoscopists performing a specific volume of colonoscopies and a willingness to use CORI. In addition, the CCPP performed an assessment of all districts to determine their level of readiness to implement the program. Three districts were eventually selected as the first districts to implement the program (a timeline is provided below). CORI was implemented at the same time as the screening program in every district and endoscopists had to apply to be credentialed by the program in order to perform colonoscopies

following an abnormal FIT test. These endoscopists were required to use CORI once they began performing colonoscopies under the auspices of the screening program.

With respect to CORI, implementation included acquiring and customizing the SRT, carrying out a Privacy Impact Assessment and establishing the system architecture, coordinating and trouble-shooting the province-wide implementation, and endoscopist training and support. In every district, the CCPP established an implementation planning committee to guide the local implementation of the screening program. The team met with each committee 1-2 times in person, with the remaining contact via telephone. Each committee was asked to provide data on a standard worksheet to inform CORI implementation at their hospitals. By and large, the implementation process was structured, with project team members seeking out specific information from each district to ease implementation. As an ongoing incentive, the CCPP has begun to provide skills training (master classes, workshops) for credentialed endoscopists. In Fall 2010, the CCPP also commenced performance monitoring and reporting, with performance reports sent to participating endoscopists, in which their individual performance was compared with their colleagues and the program's standards. Performance reporting began with a small number of endoscopists and has been developed and expanded on a continual basis. The plan is to send these reports annually.

There are a number of avenues that the CCPP received feedback on CORI during implementation. Specifically, feedback was received through participation/representation on the steering and advisory committees, participation on the local implementation planning committees, and several facilitated feedback workshops. Some users also contacted the program directly to provide feedback. There are three mechanisms by

which endoscopists may gain ongoing CORI support, depending on the particular issue: they may contact a CCPP staff person, the Health Information Technology Services Program of Nova Scotia Help Desk, and a IT resource person at the largest health district. All are available during regular working hours.

Synoptic reporting tool

The CCPP selected the endoscopy reporting software and database from the Clinical Outcomes Research Initiative (CORI) for its SRT. CORI was developed at Oregon Health and Science University, in partnership with the National Institutes of Health, AstraZeneca, and Novartis, to support performance reporting and to enable prospective research on quality of endoscopy performance.[12] CORI uses HL7 messaging, the international health informatics interoperability standards, and is compliant with International Classification of Diseases nomenclature, a comprehensive clinical healthcare terminology. These features ensure standardization and IT interoperability to facilitate the exchange, integration, sharing, and retrieval of electronic health information. Along with its data retrieval structure (e.g., use of drop-down menus; see below), these capabilities position CORI at the advanced end of synoptic reporting technology (see Table 2).

Procurement of tool

After hearing about the CORI system, the CCPP arranged a conference call and online demonstration with the CORI developers in Oregon. Subsequently, the CCPP decided to pursue CORI for its colonoscopy reporting tool and database, and sent a small group to

Oregon to meet with development team, learn about the tool, and negotiate procurement. Through that visit, the CCPP worked out an agreement to receive CORI from its developers, free of change. This agreement included obtaining all of the source code and the database, giving the team full capacity to change the system in whatever manner was needed/desired. This provided the opportunity to adapt CORI to the local context, but also meant that the CCPP might not benefit from any new releases or 'fixes' built by the Oregon-based team if the code was modified extensively.

Table 2. Continuum of reporting technology. Adapted from Srigley et al.[13]

Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
• Narrative • No standard • Single text field data	• Narrative • Standards • Single text field data	• Synoptic-like • Structured format	• Electronic tools • Use of drop-down menus	• Standardized reporting language • Data stored in discrete data fields	• SNOMED CT, ICD-O or other standardized coding terminology

Description of tool

CORI was initially implemented to report colonoscopy procedures, though the application itself contains modules for numerous endoscopic procedures, all of which the CCPP received when it acquired the CORI application and database. The CCPP modified the application as little as possible, though some customization was necessary. Upon obtaining CORI from the Oregon team, a business analyst, developer, and two endoscopists (both with high level of involvement in the CCPP) reviewed the colonoscopy module in its entirety to determine what needed to be changed in order to meet the requirements of the screening program. Despite some changes, the application

[12] For more information on CORI, see: http://www.cori.org/?topic=about.

[13] Srigley JR, McGowan T, Maclean A, Raby M, Ross J, Kramer S, et al. Standardized synoptic cancer pathology reporting: a population-based approach. *J Surg Oncol*. 2009;99:517-24.

was modified minimally. However, the tool did require some customization for each hospital: specifically, the values for certain data elements had to be changed to reflect local resources (e.g., medications, endoscope serial numbers, and endoscopy nurses).

To use the reporting tool, the endoscopist must log in to the system and enter data by responding to a series of questions, divided into discrete fields, in a point-and-click manner using drop-down menus, radial buttons, and check boxes. Text boxes are available to document additional information not captured by the questions. All questions considered essential to the colonoscopy report are mandatory. The report is normally completed immediately following the colonoscopy, in the endoscopic suite when the patient is recovering. Upon completion, the end report is available for immediate placement in the patient's chart. The final report is in narrative form: although it is entered synoptically, CORI takes the responses and creates them into standard sentences and paragraphs. Thus, the final report does not appear as a *synoptic* report, or a structured abstract using key words and phrases (not sentences) in 'checklist' format to record clinically relevant elements. The underlying data are still available as individual discrete elements. A patient report, a shortened summary of the full report, is also available immediately upon completion and may be printed for the patient if the endoscopist wishes to do so.

CORI has the functionality to interface with existing IT systems; IT integration has been a priority of the CCPP since the beginning of IT/information management planning. As of Spring 2012, however, the CCPP had not achieved IT integration in most districts in the province. Subsequently, CCPP IT staff created a work-around solution by linking CORI to another of its IT applications (wherein screening participant information

is entered, including results of the FIT test), which allows information on screening participants to be transmitted to CORI with the click of a button. However, the lack of IT integration has meant that different districts have developed different processes to get the final colonoscopy report into the patient's medical record; these include copying and pasting the final report into the electronic medical record, printing the report and physically delivering it to the health records department, and having endoscopists report the colonoscopy twice, once using CORI and once using the hospital's Dictaphone system. In the one district with IT integration, patient data electronically enters CORI via the hospitals' registration systems and the final report is automatically sent to the hospitals' electronic medical record. In this district, an image capture program has also been integrated with CORI to allow endoscopists to take and store photos of the colon during the procedure. Thus, the end report in this district consists of both text and graphics (i.e., photos of the colon).

Implementation of synoptic reporting: timeline and key milestones

Table 3. Timeline of key milestones.

Timeline	***Milestone***
Nov 2006	CCNS presents a report to the DoHW, recommending the development of a population-based colorectal cancer screening for Nova Scotia
Mar 2007	The DoHW announced funding ($300,000) for CCNS to go ahead with developing a business plan for a population-based colorectal cancer screening program
Aug 2007	Two individuals were hired (program manager, medical director) to scope out and plan program requirements
Dec 2007	Business plan submitted to DoHW
Apr 2008	Colorectal cancer screening program approved and presented in Nova Scotia provincial budget
Apr-Jul 2008	Gathering baseline data/research, conducting DHA visits, preparing data model and IT development

Sept 2008	Selection of DHAs for 'Phase 1' implementation
Oct 2008	DHA demonstration of CORI to gain feedback on system and determine if it was a suitable solution
Nov – Dec 2008	Procurement of CORI application and database; site visit with Oregon team
Dec 2008 – Mar 2009	Analysis of reporting requirements for colonoscopy performance monitoring and reporting[14]
Jan 2009 – ongoing*	Customization of CORI
Mar 2009	Official launch of the CCPP
Spring 2009	Phase 1: Implementation of CORI in first three districts (South Shore Health, Guysborough Antigonish Strait Health Authority, and Cape Breton District Health Authority)
Spring 2010	Phase 2: Implementation of CORI in three additional districts (South West Health, Annapolis Valley Health, Colchester East Hants Health Authority)
Oct 2010	Implementation of CORI at Capital District Health Authority**
Nov 2010	Implementation of CORI in Pictou County Health Authority
Dec 2010	Implementation of CORI in Cumberland Health Authority; CORI is now implemented and "live" in all regions of Nova Scotia

*Ongoing as of September 2012.
**In all districts, except Capital District Health Authority, CORI was implemented concurrently with implementation of the screening program in that district; in Capital District Health Authority, CORI was implemented prior to implementation of the screening program (with the latter implemented in March 2011).

[14] Bharathan, S. (2009). Reports Requirement Analysis and Gap Analysis of Colon Cancer Prevention Program and Testing of Colon Cancer Screening Application. Report of Internship for Masters of Health Informatics, Dalhousie University.

APPENDIX D: SURGICAL SYNOPTIC REPORTING TOOLS PROJECT

This appendix contains a case history of the Surgical Synoptic Reporting Tools Project.

Context and history of the issue

National context

Alberta experience. Surgical synoptic reporting began in Alberta more than a decade ago. In the late 1990s, a group of Alberta surgeons established a Cancer Surgery Working Group (CSWG) to address the lack of cancer surgery guidelines and meaningful indicators to measure and monitor surgical performance. In the following years, the group held several province-wide education and consensus workshops to develop a web-based surgical medical record (WebSMR) to synoptically collect surgical data. In 2000, the CSWG contracted a vendor (Softworks Consulting Group) to develop WebSMR. This was subsequently presented to Alberta surgeons and approved for production. During this time, the group employed consensus methodologies (e.g., modified Delphi approach) with academic- and community-based surgeons to define and develop minimum data sets for rectal, colon, liver, and ovarian cancer synoptic templates. These templates were subsequently piloted in a limited number of hospitals, resulting in a peer-reviewed publication[1] documenting the benefits of synoptic versus narrative operative reports in rectal cancer: the WebSMR documented 99% of the data elements considered essential to decision-making/patient care versus 45.9% in a random sample of narrative reports.

In 2006, Cancer Surgery Alberta (CSA; formerly CSWG) and the Alberta Cancer Board received approximately $1.4M from Canada Health Infoway (CHI) to implement WebSMR province-wide for breast, colon, and rectal cancers. This project also allowed CSA to expand on template development to enhance certain components of the synoptic reporting system, including: optimizing the reporting system to include features such as

[1]Edhemovic I, Temple WJ, de Gara CJ, Stuart GC. The computer synoptic operative report--a leap forward in the science of surgery. *Ann Surg Oncol* 2004;11:941-7.

hyperlinks to relevant practice guidelines and automatic calculation of clinical stage; developing an automated mechanism to allow surgeons to have immediate (real-time) access to individual and provincial aggregated performance reports to be able to assess their practice; and mapping data elements to an international clinical standard (SNOMED CT) to facilitate international data comparisons. An evaluation of the CHI-funded project supported prior findings related to improved quality of documentation in the operative note, and demonstrated high user satisfaction and several health system efficiencies. These efficiencies included the time it takes for a verified surgical report to reach the patient's medical record and cost-savings through the elimination of transcription services. Subsequently, numerous peer-reviewed publications from Alberta have demonstrated that WebSMR improves quality of operative reporting for a variety of malignancies.

The impetus for the Alberta initiative was to create a mechanism that could capture surgical data in real-time, feed that information back to the surgeon and other decision-makers in cancer care, and ultimately improve the quality of surgical care. The CSWG/CSA operated on the premise that the operative report is the cornerstone of any quality assessment of surgical outcomes, representing the focal point in which the surgeon's judgment and skills can be captured within the context of the patient's health, values, and disease as well as the health system resources at hand. Their eventual goal is to replace the narrative operative report with a synoptic report for all cancer surgeries in Alberta.

Canadian Partnership Against Cancer. The successful development and implementation of WebSMR in Alberta provided the stimulus for a pan-Canadian collaboration to expand surgical synoptic reporting to other Canadian jurisdictions. Funded by Health Canada, the Canadian Partnership Against Cancer (CPAC) began its work in 2007 with an initial five-year mandate to implement a national cancer control strategy[2] to reduce the impact of the disease on Canadians. CPAC views itself largely as a knowledge transfer and exchange organization: it works to identify examples of innovative and best practices that exist in Canada and to build on those practices and collaborate with partnering organizations to facilitate their widespread adoption and implementation across the country.

In 2007, CPAC consulted with stakeholders across the country to gauge interest and encourage participation in a multi-jurisdictional initiative to expand surgical synoptic reporting, using Alberta's experience as the basis for this larger effort. The organization held a national consensus forum on synoptic surgical and pathology reporting in Toronto in May 2007, at which point there was enthusiastic support for a pan-Canadian project but concerns largely related to its implementability, particularly concerning information technology (IT) issues. The organization also held a meeting in September at the 2007 Canadian Surgery Forum to discuss the possibility of CPAC leading a multi-jurisdictional surgical synoptic reporting effort. In addition to select surgeons, other relevant individuals from across Canada were invited to this meeting. A basic strategy around leadership and advancing a project plan was developed, including establishing surgeon leads as well as a surgical working group to identify/work on synoptic reporting for specific disease sites. In November 2007, the CPAC team submitted a formal project plan

[2] Canadian Strategy for Cancer Control. The Canadian Strategy for Cancer Control: a cancer plan for Canada - Discussion Paper. Ottawa, ON: CSCC Governing Council; 2006.

for a Synoptic Reporting Tools Project (SRTP) that would involve five provinces (Alberta, Manitoba, Ontario, Quebec, and Nova Scotia) and four disease templates (breast, colorectal, ovarian, and head and neck). This plan was approved for funding in February 2008. Three templates (breast, colorectal, head and neck) used the WebSMR platform; the breast and colorectal templates were adapted from the previously existing Alberta templates while the head and neck template had to be created as part of this initiative. The ovarian template used the e-Ovarian platform, previously developed and implemented in London, Ontario. Table 1 demonstrates the provinces and disease sites involved in the pan-Canadian SRTP.

Table 1. SRTP provinces and disease sites.

Alberta	**Manitoba**	**Ontario**	**Quebec**	**Nova Scotia**
• Head and neck • Ovarian	• Head and neck • Colorectal • Breast	• Ovarian • Colorectal	• Colorectal	• Head and neck • Colorectal • Breast

In addition to providing an overall organizing/coordinating structure and funding for this initiative, CPAC's role has included developing national mechanisms to i) support, develop, and maintain surgical reporting standards and ii) ensure data is fully leveraged to support practice and policy improvement. Importantly, there were no existing national or international surgical reporting standards to draw on for template development. As of 2012, this continues to be the case. This differs from concurrent efforts to establish cancer pathology synoptic reporting, wherein pathology standards are developed and well-established for 60 of the most commonly reported forms of cancer.[3]

[3] These U.S.-based checklists were endorsed by the Canadian Association of Pathologists and have been used as the basis of synoptic pathology reporting in Canada.

The CPAC SRTP initiative brought together surgeons, clinicians, health system administrators, and other stakeholders across the country to pursue a pan-Canadian approach to surgical synoptic reporting. Overall, this project demonstrated that the voluntary adoption of a synoptic surgical record can cross disease sites/professional groups, provincial jurisdictions, urban and rural settings, and diverse and fragmented health IT infrastructure. Table 2 highlights CPAC's vision as they move forward with surgical synoptic reporting in Canada.

Table 2. Central components of CPAC's vision for surgical synoptic reporting.

Template (data element) and indicator selection/development using a pragmatic methodology
Content distinct from technology
Best practice evidence informed with links to guidelines
Accessible and consistent nationally
Aligned with national and provincial standards
Supported by appropriate infrastructure and resources nationally and provincially
Common template structure and flow
Supported and endorsed by clinicians and clinical governing bodies
Support standard core data set and process across Canada
Support national reporting on key quality indicators in each disease site
Support flexibility and discretion at provincial and local levels
Maintain agility of current process where possible while scaling up to national level
Clinical First • Leveraging clinical expertise • Focus on surgeon practice and adoption • Administrative requirements are secondary

Local context

In 2006, the lead surgeon of the Alberta synoptic reporting initiative was invited to present in Nova Scotia about their experiences with synoptic reporting (presentations occurred at the Division of General Surgery Rounds and Grand Oncology Rounds). In 2007, several provincial representatives (a surgeon and representatives from the provincial cancer agency) were invited to the CPAC-led May and September meetings. All agreed with the concept of engaging in a pan-Canadian project and piloting synoptic

reporting for cancer surgery in Nova Scotia. At the September meeting, the surgeon became the Clinical Lead for the SRTP in Nova Scotia.

During the time of SRTP adoption and pre-implementation planning, there were a number of efforts underway in Nova Scotia related to synoptic reporting and therefore relevant to this project. The first is the Nova Scotia Breast Screening Program and its synoptic reporting system. In the mid-late 1980s, radiologists at the Victoria General Hospital had developed a synoptic reporting-like database for mammography reporting; this system has been refined over the years and implemented in most districts across the province for diagnostic mammography reporting. Breast surgeons in the province, as well as other individuals in the cancer system, would therefore have been aware of this reporting tool and familiar with its use in Nova Scotia.

The second is that pathologists in Halifax as well as some districts had been using a synoptic approach to dictation for the reporting of breast and colorectal cancer specimens. This involved dictating pathology findings using a paper-based synoptic template, so that the resultant report was in a structured, checklist format with only the important data elements (based on existing national/international standards). While there was no formal initiative to implement this reporting mechanism – and not all pathologists were using the templates developed by their colleagues – breast and colorectal cancer surgeons, and others involved in the downstream care of these patients, would have been familiar with these reports and their synoptic format. Third, concurrent with the SRTP, CPAC was attempting to facilitate a pan-Canadian cancer pathology synoptic reporting project in which management and administration at the provincial cancer agency were involved. In fact, early on, there was consideration that the SRTP and pathology projects

would become one larger project, but the two remained separate projects, funding and supported by different groups within CPAC.

Finally, by the time the SRTP went "live" in 2010, the newly established Colon Cancer Prevention Program had been implementing a synoptic reporting tool (Clinical Outcomes Research Initiative software application; CORI), using a phased-in approach, across the province. Therefore, some surgeons were aware of and may have used the CORI synoptic reporting system by the time of SRTP implementation.

In addition to synoptic reporting efforts, at the time of SRTP implementation, the Department of Health and Wellness (DoHW; formerly Department of Health), district health authorities (DHA), Cancer Care Nova Scotia (CCNS), and other organizations in the province had begun to place increased emphasis on performance measurement and quality improvement. For example, the development and tracking of key performance indicators was becoming a core organizational concern and subsequently prioritized in organizational and district business and strategic plans.[4] Moreover, work was beginning on developing provincial clinical standards for cancer care, beginning with rectal cancer.[5] Despite such initiatives, however, general surgeons in Nova Scotia had limited experience in projects or programs that measured/monitored their surgical performance or provided aggregate data to compare performance (the latter being a major enabler to adoption and use of surgical synoptic reporting nationally). In 2009, a DoHW-led surgical wait times management project was initiated to collect surgical wait time information from hospitals across Nova Scotia to monitor and report on wait time performance. This project uses a management information system (Patient Access

[4] See: IWK Strategic Plan 2007, Capital Health Business Plan 2010/2013.
[5] See: http://www.cancercare.ns.ca/en/home/aboutus/newsroomandevents/ournewsletter/

Registry Nova Scotia) requiring data to be submitted in electronic format. While surgical departments were required to provide information to this project, it received little support from surgeons who felt they gained little (or no) value for their increased effort.

Organization of initiative: the Nova Scotia Surgical Synoptic Reporting Tools Project

The Nova Scotia Surgical Synoptic Reporting Tools Project (SSRTP) included breast and colorectal surgeries performed at two academic hospitals, which serve a population of approximately 400,000, and at one community hospital, serving a population of approximately 50,000. Approximately 50% of all primary breast cancer surgeries in Nova Scotia are performed at one of the academic hospitals, while approximately 40-45% of primary colorectal cancer surgeries in Nova Scotia are performed at the other academic hospital. The community hospital was selected to participate in the SSRTP due to strong interest, support, and commitment at that site.

Originally, the project had also included head and neck cancer surgeries performed at one academic hospital, but, despite initial interest, head and neck cancer surgeons did not use the template once it was implemented. There were several reasons for this. First, the team expressed concerns about data sharing agreements with other provinces, though this concern was alleviated through a conversation with the project coordinator. Following this, several project team members (see below for project team descriptions) met with the head and neck surgeon group and the group chose not to use the synoptic reporting tool due to concerns that the template was not user-friendly and not

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standards2012/fs.aspx

relevant to most of their practice. Subsequently, the project team directed its efforts primarily toward breast and colorectal cancer surgery.

Positioning in provincial landscape

The SSRTP project commenced as a pilot project, organized and funded nationally, but led by a surgeon in Nova Scotia. This surgeon was a breast cancer surgeon who had formal leadership experience in the cancer system. As a pilot project, a small number of surgeons were selected to participate across disease sites and hospitals. The focus of the project was largely around adaptability and implementability of the synoptic reporting tool (previously developed in Alberta) in Nova Scotia. While the SSRTP was directly funded by CPAC, it received significant in-kind contribution from DHAs and other provincial health organizations in terms of staff time and resource support. CCNS provided additional in-kind support by housing the project's coordinator, providing office space and covering basic operating expenses (e.g., telephone, fax).

Given the project's positioning, use of the synoptic reporting tool was voluntary. The project team had no authority to mandate use nor the capacity to influence use through organizational or provincial policies. As a pilot project, the SSRTP did not have a formal governance structure. Rather, the team went through a process wherein it attained formal approval for the project from all relevant organizations, specifically representatives from DoHW, Health Information Technology Services Program of Nova Scotia (HITS-NS), CCNS, and all participating hospitals. The DoHW became the de facto Project Sponsor, signing most documentation and contracts. The software application and database was (and continues to be) housed and maintained by HITS-NS.

This latter decision came out of discussion with all partners and was viewed as the most feasible solution since the database was to be integrated with existing district-level IT applications and HITS-NS provides operational support for most of these systems. The data, however, are owned by the corresponding district wherein the data are captured.

Project structure

Project team. The project team consisted of the Clinical Lead (surgeon), a full-time coordinator, and part-time administrative assistance, on an as needed basis, until December 2009. A part-time (0.5 full time equivalent) IT lead was hired in October 2009 and continued with the team until November 2010. The team was responsible for the day-to-day management of the project and the overall coordination and administrative activities for implementation. This included communicating about the project and its progress with all stakeholders, developing and maintaining all the necessary documentation (e.g., Privacy Impact Assessment, Threat Risk Assessment) for implementation, coordinating development of software upgrades and interfaces for IT integration, coordinating and trouble-shooting the implementation at all three institutions, training users (surgeons as well as other end-users of the report, such as coders and health records staff), providing telephone and in-person support for users, and managing the project budget.

The project has a designated Tier II support person, who is the main contact for users when experiencing system issues. This person is a HITS-NS employee, funded partially by HITS-NS and partially by the provincial programs. The SSRTP (through CCNS) pays a percentage of the salary.

Committees and working groups. The project team established a number of groups to provide leadership, expertise, and guidance on SSRTP implementation:

- Senior Leadership (Oversight) Committee. This committee was created to ensure all key partners were informed of the SRTP and its progress, and to engage and build support from key decision makers. Committee members included representatives from the DoHW, senior leadership from all nine DHAs and the IWK Health Centre, and senior provincial officials. This committee met quarterly, or as required if/when a particular issue arose.
- Project Management Committee. This committee was created to provide overall guidance on the project, from development of the project plan through all the steps necessary to fully implement the synoptic reporting tool in the selected institutions. Members included representatives from all of the key organizations (CCNS, HITS-NS, and the three participating hospitals).
- Provincial Working Groups. The project team established three working groups to provide direction and expertise on specific areas relevant to implementation: Privacy Working Group, IT Working Group, and Information Management and Quality Working Group. The Privacy Work Group supported the development of the Privacy Impact Assessment and Threat Risk Assessment. The IT Working Group assisted in identifying and mapping the IT integration/interfacing requirements for all three institutions, undertaking an IT Needs Assessment for implementation, and in defining/delineating IT processes for the Threat Risk Assessment. The Information

Management and Quality Working Group provided guidance on ensuring the integrity and quality of the data and identifying medical records solutions.

Terms of Reference for the Project Management Committee and each of the Working Groups were developed and approved by members. The provincial project team also had support from two additional groups: CPAC's Cancer Guidelines Action Group and an Interprovincial Working Group. Nationally, the SRTP was positioned under the Cancer Guidelines Action Group, with this group providing overall resource and strategic support for the provincial project as well as direction and guidance as required. The clinical leads and project coordinators of each province met with this group regularly (via tele/videoconferencing and in-person meetings) to keep all groups informed of progress and to ensure that each province could learn from other province's activities. The Interprovincial Working Group provided expertise and guidance on the development and refinement of the interprovincial breast cancer template and accompanying data dictionary. This group was led by Nova Scotia's Clinical Lead, with members comprised of surgeons from all provinces implementing the breast cancer template. Similar Interprovincial Working Groups were established for the other cancer disease sites (colorectal, ovarian, and head and neck).

Synoptic reporting tool

A synoptic report is essentially a structured, standardized abstract using key words to record clinically relevant elements. The SSRTP implemented WebSMR, the synoptic software application developed in Alberta through collaboration with Softworks Consulting Group (now Softworks Group Inc). WebSMR uses HL7 messaging, the

international health informatics interoperability standards, and is fully compliant with SNOWMED CT, a comprehensive, international clinical healthcare terminology. These features ensure standardization and IT interoperability to facilitate the exchange, integration, sharing, and retrieval of electronic health information. Along with its data retrieval structure (e.g., use of drop-down menus and so on; see below), these features place WebSMR at the cutting edge of synoptic reporting technology (Level 6; see Table 3).

Table 3. Continuum of reporting technology. Adapted from Srigley et al.[6]

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
• Narrative • No standard • Single text field data	• Narrative • Standards • Single text field data	• Synoptic-like • Structured format	• Electronic tools • Use of drop-down menus	• Standardized reporting language • Data stored in discrete data fields	• SNOMED CT, ICD-O or other standardized coding terminology

Procurement

Given its implementability and acceptability in Alberta, CPAC made the decision to implement WebSMR as the synoptic reporting tool for breast, colorectal, and head and neck cancer surgery. WebSMR is jointly owned by the Alberta Cancer Board (now Alberta Health Services) and Softworks Group Inc. A trademark has not been registered for WebSMR, but Alberta Health Services has copyright on the original Alberta templates/intellectual property.

Nova Scotia obtained a license to use the software, which was funded out of the Nova Scotia budget. Alberta provided permission for all provinces to freely use the Alberta templates. This was coordinated and agreed upon through CPAC.

Description of tool

Although the software application can be web-based, accessible on a secure server via unique username and password, for the pilot project, access to WebSMR was restricted to the institution's secure network. Once the surgeon logs on to WebSMR and selects the correct template and patient, the patient's identifying information/demographics and the requisite institutional data are automatically pre-filled. This is made possible by integration with the institution's Admission, Discharge, and Transfer system. The software then takes the surgeon through a series of questions related to the patient's presentation, preoperative period, operative procedure, and follow-up planning. These questions are divided into discrete fields and data are entered using drop-down menus, radial buttons, and check boxes. The questions and predefined values (responses) are often based on practice guidelines, allowing evidence to be assimilated into the template itself. Some sections contain text boxes to document additional information not captured in the individual fields. All details considered essential to the operative report are mandatory. Software characteristics include branching logic, smart navigation, and automated clinical staging calculations. The software can also profile a surgeon's most common responses and pre-fill values to some questions.

Upon completion of all sections, the surgeon is asked to review the report and confirm that all responses are accurate. After clicking the 'submit' button to indicate the report is complete, an electronic signature is added, and the final synoptic operative report, presented in a "checklist" format, is automatically sent to the patient's medical

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[6] Srigley JR, McGowan T, Maclean A, Raby M, Ross J, Kramer S, et al. Standardized synoptic cancer pathology reporting: a population-based approach. *J Surg Oncol*. 2009;99:517-24.

record (with transcription and subsequent surgeon review and sign-off no longer required). This "outflow" is made possible via integration with the institution's electronic medical record system. The final report is also automatically faxed to all involved in the patient's care (e.g., the referring physician, surgeon's office, cancer centre, and family physician). This WebSMR report was accepted as the legal equivalent to a narrative operative report by the participating hospitals' health records, privacy, and health information management departments/offices. The project team worked with each of these groups (in each of the hospitals) to ensure the report would meet their legal requirements. The participating surgeons also had to acknowledge that WebSMR would replace their dictated note, becoming the legal document.

Implementation: timeline and key milestones

Table 4 presents a timeline of key milestones, both in terms of the pan-Canadian initiative (national efforts) and provincial project. The pilot project officially ended March 2011. Since then, the provinces have received funding from CHI to expand surgical synoptic reporting across disease sites and health regions within the participating provinces. CPAC continues to lead the project nationally. In Nova Scotia, the current plan (as of October 2012) is to expand surgical synoptic reporting to another hospital, and for lung cancer surgery and a surgical discharge summary.

Table 4. Timeline of key milestones.

Timeline	*Milestone*
May 2007	National consensus forum on synoptic surgical and pathology reporting
Sept 2007	National meeting on surgical synoptic reporting; agreement to move forward with pan-Canadian surgical synoptic reporting project; disease site leads

	identified
Nov 2007	Submission of pan-Canadian project plan
Feb 2008	Funding approval for pan-Canadian surgical synoptic reporting project
Mar-May 2008	Provincial project coordinator recruited
	Kick-off meeting for project, with Alberta surgical synoptic reporting team and Nova Scotia partners
	National forum in Montreal, QC, with key decision-makers from participating provinces, specifically to identify and discuss IT issues
May–Nov 2008	Development of provincial project plan
	Engagement of partners through small-group meetings
	Establishment of 3 working groups [IT, information management/quality, privacy]
Feb–Dec 2009	IT "gap" analysis with visiting software vendor
	Funding delays
	Completion of privacy impact assessment and threat risk assessment
	Formal request for funding proposals to conduct the IT work identified by the gap analysis
	Hiring of part-time IT lead (October)
	Work to integrate provincial IT systems starts by end of year
Jan–Jun 2010	Continuation of IT integration work
	Intensive change-management focus as project nears "go-live" date
Jul–Aug 2010	System goes "live" at two sites (July)
	Training and initiation of a small number of surgeons
	Testing period and resolution of identified issues
Sep–Dec 2010	Training of all surgeons at two sites, initial adoption, and use
	Nationally-funded evaluation
Jan 2011	National stakeholder forum to present evaluation results and discuss future work/expansion
Jul 2011	System goes "live" at remaining site

APPENDIX E: DATA COLLECTION INSTRUMENTS

This appendix contains data collection instruments for this study: interview guides and non-participant observation form. Examples of interview guides from the four units of analysis are provided. Note the interview guides (questions and probes) were adapted for each key informant, depending on the case and his/her specific role in the implementation. Thus, these examples represent the basic guides that were modified for each interview.

Unit of Analysis: Implementation Team

Project Leads (Clinical, administrative)
Interview Guide

Implementation experience

1. Tell me about how you became involved in this project.
   Describe your specific role [in the program / in terms of synoptic reporting].

2. [For NSBSP / CCPP] Why did you choose to adopt and implement a synoptic reporting tool within the program?

3. How did you introduce this project to the various players?
   Departments, hospitals, and physicians/surgeons?

   What was the general reaction of these folks? Was it difficult [or easy] to get some people's support behind the project? If so, why do you think so?

4. Tell me about the implementation process. What did it entail? How long did it last?
   Probes:
   Tool development / procurement / adaptation
   Communications
   Education
   Stakeholder involvement and input [clinicians, others in organizations]
   Training / support processes
   Incentives (CME credits, financial)

5. Who, specifically, supported you and your team before and during the implementation (who did you have to get "onside")? Tell me about how you engaged these people/ groups.
   Probes:
   Prior or new relationships
   Negotiations
   Incentives

6. What specific resources and/or "supports" did you get with respect to synoptic reporting (e.g., from Department of Health and Wellness, physicians/physician groups)?
   Human and material resources
   Clinical, implementation, IT expertise

Specific challenges/drivers

7. Given your perspective, what are your thoughts on the main drivers to successfully implementing this project? These may be at the physician or the broader health system level. *[Ask interviewee to identify and discuss at least 2-3]*
   Probes:
   Timing

Buy-in, perceived value (e.g., QI or quality of care, performance feedback)
Leadership / management support
Facilitation of implementation process
Training / support / incentives for use
Champions supporting the project
Stakeholder involvement / relationships
Political or organizational "climate"
What folks are doing in other provinces or in other clinical areas
Dedicated funding

8. Again, given your perspective, what would you consider were the main **challenges** to implementing this project? *[Ask interviewee to identify and discuss at least 2-3]*

Probes:
Buy-in (surgeon, administrative level), perceived value
"Usual" practice
Characteristics of the tool
Information technology
Resources (human, material, fiscal)
Political or organizational "climate"
Governance

9. In your opinion, what was the main reason that physicians/surgeons decided to use synoptic reporting (versus the dictated report)?

What specifically did your team do, if anything, to facilitate this decision and then ease the transition from dictated to synoptic reporting?

Sustainability

10. In your opinion, what have been/are the main challenges to sustainability?

Probes:
Physician resistance
Infrastructure / resource support
Leadership support
Governance / regulatory issues

11. In your opinion, what are the critical elements that need to be in place to support this project's sustainability?

Probes:
Physician demand
Infrastructure / resource support
Leadership support
Monitoring / feedback mechanisms

Other

12. Are there any aspects of the implementation and how it unfolded that you would have changed? If so, which are they?

What could have been done better?

13. Have you received any specific feedback from physicians/surgeons involved in the project? If so, what type of feedback? *[Ask interviewee to provide examples]*

14. Have you provided performance feedback reports to physicians yet? If so, how did that go? If not, what are the plans around providing feedback?

15. Are there any other issues related to your implementation experiences that you would like to comment on? If so, what are they?

Implementation Team Members
Interview Guide

Implementation experiences

1. Tell me about how you became involved with this project.

2. Describe your specific role in this project.

3. Tell me about the implementation process. What did it entail? How long did it last?
   Probes:
   Tool development / procurement / adaptation
   Communications
   Education
   Stakeholder involvement and input [clinicians, others in organizations]
   Training / support processes
   Opinion leaders / trusted colleagues / champions
   Incentives (CME credits, financial)

4. How did you train folks to use the system? *[Query for specifics]*
   What was the general reaction of physicians/surgeons during training? Was it difficult [or easy] to get some people's support behind the project? If so, why do you think so?

   Was a clinician involved in training as well? If not, were there many clinical questions and how did you respond?

5. Who – specifically, people and organizations – helped you before and during the implementation?
   What did they do?

   How did you work with these people/groups?

Specific challenges/drivers

6. What were the main <u>drivers</u> to successfully implementing synoptic reporting? *[Ask interviewee to identify and discuss at least 2-3]*
   Probes:
   Timing
   Buy-in, perceived value
   Leadership / management support
   Facilitation of implementation process
   Training / support / incentives for use
   Champions supporting the project
   Stakeholder involvement / relationships
   Political or organizational "climate"
   What folks are doing in other provinces or in other clinical areas
   Dedicated funding

7. From your perspective, shat were the main challenges to implementing synoptic reporting? *[Ask interviewee to identify and discuss at least 2-3]*

Probes:
Buy-in (physician/surgeon, managerial or administrative level), perceived value
"Usual" practice
Specific barriers related to the tool
Specific disincentives for use
Information technology
Resources (human, material, fiscal)
Political or organizational "climate"
Governance / regulatory issues

Sustainability

8. In your opinion, what have been/are the main challenges to sustainability?

Probes:
Physician resistance
Infrastructure / resource support
Leadership support
Governance / regulatory issues

9. In your opinion, what are the critical elements that need to be in place to support this project's sustainability?

Probes:
Physician demand
Infrastructure / resource support
Leadership support
Monitoring / feedback mechanisms

Other

10. In your opinion, what was the main reason that physicians/surgeons decided to use synoptic reporting (vs the dictated report)?

11. What type of feedback have you received from physicians/surgeons (and other users in the hospital) about synoptic reporting?

12. Are there any aspects of the implementation period and how it unfolded that you would change if you could? If so, which are they?

In your opinion, what was done particularly well? What could have been done better?

13. Are there any other issues related to your implementation experiences that you would like to comment on? If so, what are they?

Unit of Analysis: Clinician Users

Interview Guide

General practice

1. What do you think about changing the way you practice?
   What are some things that influence whether and how you change your practice?

Introduction to synoptic reporting and the tool

2. When / how was the synoptic reporting introduced to you?
   What did he/she/they do?

3. What did you think of this new type of report at that time? Now?

Were you aware of others using synoptic reporting? If so, who/where, and what were their attitudes?

What did you think about being asked to use it yourself?

4. Was there reluctance on your part to change from dictated to synoptic reports? Why / why not?
   Promise of new technology doesn't always pan out …
   Why change something that works well now …?

5. [If using] What specific things convinced you to use the new reporting tool?
   [If not using] Why have you chosen not to use the tool?
   Probes:
   Perceived value of synoptic reporting
   Heard about it from physicians/surgeons in other hospitals/provinces
   Evidence (synoptic reporting, poor reporting practices, improved patient care)
   Education (CME sessions, rounds)
   Training
   Colleague
   Promise of performance feedback
   Incentives (CME credits, financial), disincentives
   Specific barriers to use

Implementation

6. From your end, what did the "implementation" process involve?
   Probes:
   Communications (meetings, emails, chats with colleagues)
   Education (CME, rounds)
   Training, support processes
   Involvement in project (tool development/adaptation, implementation at hospital)

7. Who, if anyone, talked to you about this project and what was being asked of you?
   [*Query about project lead and local colleagues identified as 'champions'*]
   What did he/she say?

8. Were you given the opportunity to have input into the tool, how you would use it, and/or to be involved in tool development or acquisition? If so, how?

Use

9. What has been/was your experience using the new tool?
    Probes:
    Transition period
    Times of frustration
    "Level" of use – changes over time
    Speed of completion

10. What did you have to do specifically to change your practice?
    What specific things, if any, made the transition easier/more difficult for you?

11. What, if any, were some of the challenges you experienced in using the synoptic reporting tool?
    Technology (accessing computers, using computers)
    Complex cases
    Time / efficiency

12. What, if any, are some of the benefits you see with synoptic reports?
    Reporting quality, efficiency
    Surgical practice
    Communication with oncologists

Other

13. Have you received performance feedback? What are your thoughts on receiving this? Do you think they make a difference to your own practice?

14. Are there any other topics related to the implementation period or synoptic reporting in general that you would like to comment on? If so, what are they?

Unit of Analysis: Organization

Organizational managers, department/unit heads, and similar individuals Interview Guide

1. Tell me about your overall, general views on synoptic reporting tools.

2. Tell me about how you became involved with this synoptic reporting project.
   How were you introduced to it?
   What was your role?
   What was your initial reaction (positive, negative, indifferent) to [the specific synoptic reporting tool]?

3. Was your [department/unit] given the opportunity to have input into the tool (e.g., its development or adaptation) and/or its implementation in your organization? If so, how?

4. Why did your [department/unit] decide to support this project?
[If not supporting implementation, change question to query about why the lack of support]
   Probes:
   Perceived value of tool ("seemed like a good thing to do")
   "Fit" with department/program/organization interests
   Prior relationship with project lead/members
   Heard about it from other jurisdictions
   "Push" from above
   Had no choice (policy)

5. Was there any reluctance within your [department/unit] to get involved and/or implement [the specific tool]? If so, why? If not, why not?
   Probes:
   Perceived value of tool ("seemed like a good thing to do")
   "Fit" with departmental/organizational interests
   (Dis)incentives
   Workload / other priorities
   Governance / regulatory / privacy issues
   Accountability issues

6. What types of supports, if any, did your [department/unit] provide the implementation team or people within your [department/unit/organization] who use the new tool?
   Probes:
   Resources (human, time, fiscal)
   Infrastructure
   Incentives (fiscal, time, otherwise)

7. Can you identify "champions" for synoptic reporting in your organization? What about provincially?

Tell me about them. What makes them "champions"?

8. What has been your experience working with the implementation team?
   Probes:
   Communications
   Relationships and negotiations
   Receptive to feedback / meeting needs and expectations

   Had you worked with any of the team members, or their organizations, previously? [*If yes, query about prior working relationships*]

9. What are your views on this specific synoptic reporting tool?
   What challenges and benefits have you experienced in terms of implementing this new tool?

   From your experience, what are the general views of [radiologists, endoscopists, surgeons] and other folks in the department on the new tool?

10. Are there any other topics related to synoptic reporting or the implementation experience you would like to comment on?

Clinician end-users of the report
Interview Guide

1. Tell me about your initial reaction, positive or negative, the first time you recall seeing a [mammography/endoscopy/cancer surgery] synoptic report.
   Were you aware that this new type of reporting was being implemented? If so, can you recall how you became aware of it?

2. Since then, what has been your experience reviewing synoptic reports? How does this compare to traditional dictated reports?
   Probes:
   Efficiency (time spent reviewing, timeliness of receiving reports)
   Comprehensiveness of reports
   Length/format of synoptic reporting

3. Compared to receiving the dictated reports, what is the effect of using synoptic reports in your practice, specifically on your clinical decision-making?
   Probes:
   Important clinical information
   Ambiguity vs discrete data

4. In your opinion, what are the main benefits of implementing a synoptic reporting system for [mammography/endoscopy/cancer surgery]?
   What are the main challenges/drawbacks to implementing synoptic reporting?

5. Do you believe this type of report should become the 'standard' or best practice in [mammography/endoscopy/cancer surgery] reporting? Why or why not?

6. Are there any other topics related to this project or synoptic reporting in general that you would like to comment on? If so, what are they?

Administrative end-users of the report
Interview Guide

1. Tell me about your initial reaction, positive or negative, the first time you recall seeing a [mammography/endoscopy/cancer surgery] synoptic report.
   Were you aware that this new type of reporting was being implemented? If so, can you recall how you became aware of it?

2. What types of supports did you get to help you use this new report (either from the implementation team or from your department/institution)?
   Probes:
   Education sessions
   Training – in person or manuals
   Meetings to discuss the new report
   Help/assistance in using report
   Ongoing support mechanisms/procedures

3. In general, what has been your experience reviewing/using synoptic reports? How does this compare to traditional dictated reports?
   Probes:
   Efficiency (time spent reviewing, timeliness of receiving reports)
   Comprehensiveness of reports, data availability
   Length/format of synoptic reporting

4. What are some of the benefits you have experienced in using synoptic reports?

5. What challenges, if any, have you experienced in terms of using the synoptic report?
   Does more familiarity and use help?

6. Are there any other topics related to this project or synoptic reporting in general that you would like to comment on? If so, what are they?

Unit of Analysis: System

Interview Guide

1. Tell me about your overall views on synoptic reporting tools in cancer care.

2. How were you introduced to this synoptic reporting project?
    What is your role in this project? What is your overall 'level' or 'depth' of involvement?

3. Tell me about why you decided to support this project [or support the implementation of synoptic reporting in the screening program]?
    Probes:
    Perceived value of tool ("seemed like a good thing to do")
    "Fit" with interests, current / planned projects, perceived responsibilities
    Prior relationship with project lead/members
    Heard about it from other jurisdictions
    Policy "push"

4. Was there anything about this synoptic reporting project that made it seem particularly worthwhile to support?
    Probes:
    Timing of initiative
    Evidence of use/value (e.g., in other jurisdictions)
    "Fit" with directions, interests, priority areas
    Relationship/prior work with project lead
    Other provincial or national initiatives

5. Was there any reluctance within your organization/agency to support this work? If so, why? If not, why not?
    Governance / regulatory / policy issues (e.g., privacy legislation)
    Competing demands
    Timing not good
    Resources
    IT infrastructure concerns

6. What has been your experience working with the implementation team?
    Probes:
    Communications
    Relationships / negotiations

7. [If/where relevant] From your perspective, has synoptic reporting been able to demonstrate "value" to the cancer care system? If so, how? If not, why not?

8. From your unique perspective, what are some of the critical elements that need to be in place to support to the sustainability and expansion of this tool in Nova Scotia – for example, to other jurisdictions and/or areas of care?

Probes:
Physician demand
Leadership
Infrastructure / resource support
Monitoring and feedback mechanisms
Demonstration of value

9. From your unique perspective, what are some of the challenges in terms of sustaining (or expanding) this tool in Nova Scotia – for example, across health districts or across areas of care?

Probes:
Physician resistance
Infrastructure / resource support
Health IT infrastructure
Leadership support (clinical, administrative)
Governance / regulatory issues

Data collection form: non-participant observation

Activity:_____	
Location: _____	Length (min): _____
Descriptive notes	Reflective notes
Time & space	*Time & space*
Training Environment/Methods	*Training Environment/Methods*
User reaction/initial use	*User reaction/initial use*

Other observations	*Other observations*
Physical layout (where relevant):	

APPENDIX F: CODES

This appendix contains the final coding structure used in the analyses.

Coding structure/framework

Background/ contextual information	*Decision to implement* • Passages related to decisions about / reasons for implementing a synoptic reporting tool (NSBSP, CCPP) or becoming involved in the national pilot project (SSRTP)
	Structure of initiative • Passages related to existence and formation of project/program, how synoptic reporting fits into overall program (where relevant)
	Organization of initiative • Passages related to implementation plans and activities, implementation team, timeline, and support mechanisms (e.g., management committees, working groups, and so on)
	Role in case • Passages related to key informant's role in organization/system, role in SRT implementation
	Tool description • Passages related to the descriptive and technical aspects of the software (e.g., HL7 messaging), the user interface, the final report structure/content, and related elements
	Timing • Passages related to timing of initiative, timing in relation to other contextual factors
Stakeholder involvement	*Engagement* • Passages related to breadth, depth, and/or timing of stakeholder involvement
	Needs, preferences, expectations • Passages related to stakeholders' needs, preferences, and expectations, and/or whether and how the implementation team listened to and met these issues in the context of tool development, adaptation, and/or implementation
	Receptivity to feedback • Passages related to the implementation team's receptivity and responsiveness to stakeholder feedback
	Local context • Passages related to using (or not) stakeholders' local expertise and knowledge • Passages related to understanding (or not) local contexts and adapting implementation accordingly
	Relationships with team • Passages related to stakeholders' relationships with implementation team
	Sense of ownership • Passages related to stakeholders' sense of ownership concerning the tool
Managing the change process	*Selling* • Passages related to 'making the case' for synoptic reporting tools

	and their implementation
	Resistance, other barriers to implementation • Passages related to resistance and other barriers (e.g., physician autonomy, practice 'inertia', technical/IT barriers, and organizational autonomy) • Passages related to managing resistance and other barriers
	Communication/contact • Passages related to formal and informal communications with relevant individuals and groups about the implementation (including communication about the reasons for, and details and benefits of, implementation) • Passages related to personal contact between implementation team and relevant individuals and groups
	Understanding policies and processes • Passages related to understanding and/or managing different departmental and organizational cultures, policies, and procedures (e.g., policies and procedures related to data sharing, legal medical records, and so on)
	Implementation policies and practices • Passages related to strategies and actions that the implementation team employed to increase skill level for use (e.g., education, training), remove barriers to use (e.g., support processes, increasing accessibility), and/or provide incentives for use (e.g., CME credits, 'master' classes, medico-legal reasons)
	Articulating value • Passages related to conveying the value of the tool • Passages related to limited understanding of tool and its potential benefits/value, and thus the need to convey value of tool
Champions and respected colleagues	*Clinical champion* • Passages related to existence, activities, and/or impact of clinical champions (these individuals may or may not have been directly involved in the implementation)
	Administrative champion • Passages related to existence, activities, and/or impact of administrative champions
	Colleague influence • Passages related to the influence of departmental colleagues on tool use
Administrative and managerial support	*Top-level support* • Passages that demonstrated moral and material support, or lack of, from the Department of Health and Wellness as well as senior administrators/executives/managers in districts and hospitals
	Mid-level support • Passages that demonstrated moral and material support, or lack of, from managers and others in positions of authority at the middle level of the organizations
	New roles/tasks

	• Passages related to new tasks and roles as a result of tool implementation that influenced support
	Competing demands • Passages related to organizational and departmental competing demands and priorities, how competing demands and priorities impacted support for implementation
Innovation attributes	*Alignment* • Passages related to the tool and its alignment with individuals' and organizations' values, needs, interests, and/or priorities: e.g., clinical value and utility (e.g., quality and timeliness of report, communication with care providers, enabling best practices, educational tool for community surgeons and residents), organizational efficiencies (e.g., elimination of transcription), potential for quality improvement (e.g., performance monitoring and reporting, evaluation activities)
	Experience/familiarity • Passages related to users' familiarity and experiences with synoptic reporting or other similar tools (e.g., in other disciplines, jurisdictions, and so on)
	Ease of use • Passages related to how easy (or complicated) the tool was to learn and use, including issues such as the tool's accessibility and use for complex cases
	Relative advantage • Passages related to whether and how the tool represented a relative advantage in practice over existing reporting methods
	Adaptation • Passages related to customizing and tailoring the tool and end report (or not) for local hospitals
	Content • Passages related to the content of the tool (e.g., mandatory data fields, suggestions for additional fields, uncertainty around specific elements)
	Technical barriers • Passages related to technical/IT barriers to tool use (e.g., lack of IT integration, lost passwords, getting "locked out" of system, and so on)
	Final report • Passages related to the final synoptic report, including format and content of end report, completing amendments to the end report, and using the end report (e.g., for coding purposes, to retrieve information, and so on)
	Optimizing design • Passages related to ways to optimize the tool's design (user interface, templates, end report, and so on)
	Evidence • Passages related to evidence for synoptic reporting tools;

	evidence could relate to research, clinical experience, patient experience, or local data (e.g., data on quality of narrative reports)
Monitoring and feedback mechanisms	*Monitoring/feedback* • Passages related to processes and mechanisms to provide regular monitoring and feedback (e.g., to clinicians, hospitals/district health authorities, and/or government)
	Demonstrating value • Passages related to using monitoring and feedback mechanisms to demonstrate the beneficial impact of the tool
Culture	*Way things are done* • Passages related to the routines, habits, and usual 'ways of working' of professions, departments, and/or organizations within the healthcare system
	Cultural characteristics • Passages related to the existence and/or impact of particular cultural characteristics: e.g., a 'quality' culture that views data collection, monitoring, and use as critical to improving quality of care and services; an 'innovative' culture that views innovation in a positive light and/or leads in innovative practices; a 'paternalistic' culture that attempts to provide for needs without asking individuals' and groups' what their needs/preferences are, limits individuals' and groups' autonomy, and/or conveys an attitude of superiority
	Language • Passages wherein the language used illustrated cultural differences across the various groups in the healthcare system
Leadership	*Vision* • Passages related to leaders' visions and goals, ability to articulate these to team and others
	Leadership behaviours • Passages related to leaders' actions and expectations • Passages related to integrity (i.e., consistency of principles, actions, and expectations)
	Building a team • Passages related to leaders' abilities to build an effective team, support effective teamwork and interactions, and clarify roles amongst team members
	Leadership history • Passages related to leaders' history and experience
Resources	*Financial resources* • Passages related to the availability and acquisition of financial resources (and financially-dependent resources) needed for tool development and implementation
	Expertise – IT • Passages related to the availability and acquisition of IT expertise needed for tool development and implementation

	Expertise – clinical • Passages related to the clinical expertise needed for tool development and implementation
	Time • Passages related to the time it takes (on the part of implementers and others in the organizations and healthcare system) to successfully implement synoptic reporting tools and similar projects
Implementation positioning/approach	*Positioning* • Passages related to how the tool was 'positioned' in the province (e.g., positioned in a provincial program or as a pilot project), how positioning impacted implementation • Passages related to a 'screening-centered' implementation, how this impacted implementation
	Implementation Approach • Passages related to how the implementation was approached by the implementation team and/or perceived by relevant stakeholders (i.e., "top-down" or "bottom-up"/"grassroots"), how the team's approach impacted implementation • Passages related to a 'phased-in' implementation, how this played out/impacted implementation
	IT integration • Passages related to decisions to implement tool with (or without) IT integration, how this decision impacted implementation
Project management	*Project management techniques* • Passages related to project management techniques, specifically concerning the tool and its implementation (e.g., developing and communicating a project plan, involving the right people at the right time, conducting de-briefing sessions)
	Seeing the big picture • Passages related to implementation team's ability to see the 'big picture' in regards to synoptic reporting and how the tool fits into overall program/healthcare landscape
	Coordination • Passages related to coordinating and implementing project plans
Healthcare system components	*System structures* • Passages related to how the structure and organization of the provincial healthcare delivery and support system impacted implementation • Passages related to how structures impacted governance and ownership issues relevant to synoptic reporting tools and their implementation
	Infrastructure/legacy infrastructure • Passages related to the healthcare system's infrastructure (e.g., IT/information management infrastructure), how this impacted implementation • Passages related to the healthcare system's aging technology

	(including computing systems and applications), how this impacted implementation
	Policy • Passages related to healthcare system policies (e.g., policies related to collection and sharing of health information, data integrity) that impacted tool implementation; these included "big P" (formal laws and regulations enacted by elected officials) and "small p" (organizational policies, procedures, and guidelines) policies
	Silos • Passages related to 'siloing' within the healthcare system, difficulty crossing silos/boundaries, how silos impacted implementation
	Relationships within system • Passages related to prior and existing relationships/interactions amongst individuals and organizations in the healthcare system, how these impacted implementation
	Roles/role clarity • Passages related to the roles of various organizations in the healthcare system, clarity (or lack thereof) of these roles, and/or how unclear roles impacted implementation
Others	*External enablers* • Passages related to 'external' enablers of tool implementation and use (e.g., professional associations and colleges, national and international groups and organizations, inter-provincial relationships)
	Sustainability and expansion • Passages related to the sustainability and expansion of these tools in Nova Scotia (including both barriers to and enablers of sustainability/expansion)
	Vendors • Passages related to working with software vendors (or software developers) relevant to the tools