THE INFLUENCES ON PHYSICIAN ATTITUDES TOWARD THE USE OF TELEMEDICINE FOR THE DELIVERY OF PATIENT CARE

by

Donna Marie Bain

A thesis submitted in conformity with the requirements

For the degree of Doctor of Philosophy

Institute of Medical Science

University of Toronto

Your file Votre référence
ISBN: 978-0-494-15867-8
Our file Notre référence
ISBN: 978-0-494-15867-8

THE INFLUENCES ON PHYSICIAN ATTITUDES TOWARD THE USE OF TELEMEDICINE FOR THE DELIVERY OF PATIENT CARE

Donna Marie Bain

Doctor of Philosophy (2006)
Institute of Medical Science
University of Toronto

Abstract

The expectation of telemedicine as a health care delivery system that will address systemic problems confronting traditional health care delivery has largely been unrealized. For telemedicine to achieve the system change that is believed possible by its proponents, physicians must be willing to use it. In addition to commonly confronted user issues where technology is introduced such as mastering technical use of the technology itself, telemedicine requires a fundamental shift from local, familiar and traditional methods of patient referral and physician practice to distant, unfamiliar and new ways of practicing. These non-technological characteristics of telemedicine that may have a significant impact on physician attitudes toward the use of telemedicine for patient care must be studied with methodological rigour. The purpose of the teledermatology study is to explore the influence of innovation attributes as these have been defined by innovation diffusion theory, and social and organizational factors on physician attitudes toward use of telemedicine. Using three underserviced northern Ontario communities as case studies, in this practice-based study family physicians are interviewed before and after their participation in interactive continuing education teledermatology sessions where patients from their own practice have been referred and receive a dermatology consultation. Study results suggest that from the physician perspective, innovation attributes such as relative advantage and compatibility function as prerequisites to further consideration of telemedicine. The importance of trial use absent a commitment to ongoing telemedicine use is confirmed. Consistent with the uncertainty reduction process as described in theory, once physician knowledge of

innovation attributes is satisfied, social and organizational and contextual factors appear to influence physician attitudes. A key finding of this study is the identification of 'value for time' as an influence on attitudes toward telemedicine. This suggests that exploration of the dimensions of 'value for time' from a physician perspective could be instructive to further understanding of telemedicine diffusion among family physicians for the delivery of patient care. Study findings also suggest that further investigation of the simultaneous use of telemedicine for the delivery of patient care and continuing education could elucidate the benefits of this model for the delivery of continuing education in medicine.

Acknowledgements

The success of a journey that begins with a blank university application form and concludes with completion of a doctoral research study reflects the thoughtful participation of many individuals. As my journey was initiated with encouragement from colleagues, supervisors and friends, I was similarly sustained throughout by the support of many individuals who generously contributed their knowledge and time.

As my doctoral supervisor, Dr. Linn Holness contributed the finest in intellectual rigour and reasoning. Her demonstration of clarity of thought and integrating logic contributed greatly to my intellectual development. Dr. Janice Stein and Dr. Dave Davis enhanced my analytical thought through the wisdom that they shared with me. Their participation on my doctoral committee helped to transform formative ideas into research concepts and modelled the integration of theory into research. Dr. Pascale Lehoux taught me the subtleties of qualitative methods and I could rely on her intellectual challenges to me to be accompanied by strong encouragement and support. The examiners during my oral defense, Dr. Kendall Ho and Dr. Elizabeth Peter, provided additional creative ideas that will facilitate my future research development.

The teledermatology study would not have been completed with Dr. R. Gary Sibbald's dedication to patient care and professional education. Dr. Sibbald tirelessly provided dermatology services across the study communities using each patient consultation as an opportunity to share his knowledge with their physicians.

My gratitude is extended to all of the physicians who kindly participated in the teledermatology study without remuneration. I admire their dedication to resolving their patients' needs and there is not a teledermatology session that did not highlight their commitment to excellence in patient care and continuous learning.

My gratitude is also extended to the patients in the case study communities who were willing to use telemedicine for the delivery of their care. Accepting on faith that the

teledermatology consultation would be a beneficial experience, thank you to all of the patients who participated in a long distance dermatology consultation.

The staff of NORTH Network deserves special appreciation. The teledermatology sessions created new challenges for patient scheduling and inter-organizational coordination. Thank you for meeting the challenges with such enthusiasm and patience.

The support of the Workplace Safety and Insurance Board as I ventured into academia is greatly appreciated. I am extremely fortunate to have had this opportunity to expand my knowledge and broaden my experience.

Finally, thank you to a supportive and indulgent family, Frank, Blake and Andrea, whose personal sacrifices allowed me to complete this journey.

Table of Contents

List of Tables

List of Figures

List of Appendices

Table of Contents

Chapter 1

Introduction

Chapter 1

Introduction

Getting a new idea adopted, even when it has obvious advantages, is difficult.
E. M. Rogers, Diffusion of Innovations, (2003)

Sustainability of Canada's health care system relies upon the accessibility of health care services and adaptation to meet changing needs of Canadians. (Commission on the Future of Health Care in Canada, 2002) Governments are challenging those who deliver health care, particularly physicians, to implement changes in delivery methods as a way to promote sustainability of health care services. (Ministry of Health and Long Term Care, 2005) Despite an international emphasis on change in health care delivery, change itself has been slow and innovations that were introduced more than two decades ago continue to be viewed with skepticism and resistance by many health care professionals: "Whilst many new technologies.... have been gradually accepted and used by doctors over the last few decades, the average doctor still works in a way that has changed remarkably little over the past thirty years." (Yellowlees, 1999)

Innovation designed to improve efficiency and quality of care is presenting itself in many ways in health care. There are technological innovations such as electronic patient records and non-technological innovations such as clinical practice guidelines that have been introduced within the past decade. Accompanying these innovations is a growing acknowledgement that many are not integrated into the practice of the health care professionals for whom they were designed. (Berwick, 1999; Finch, May, Mair, Mort & Gask, 2003; Grol & Wensing, 2004) The adoption of health informatics has been shown to be subject to a number of influences that surpass technological considerations. (Kaplan, 2001) Understanding innovation adoption within the health care system and the factors that influence physician attitudes toward innovations is the overall purpose of this research.

To achieve that purpose, one innovation has been selected for in-depth study with the intention that it may function as an exemplar with relevance to other innovations. This innovation is the use of telemedicine for the delivery of patient care. Telemedicine has been selected for in-depth examination since integral to its adoption are issues that similarly arise in the introduction of other technological innovations. While typically considered as a purely technological innovation, it has recently been shown that consideration of factors much broader than its technological specifications is necessary to understand telemedicine adoption by physicians. (Wootton, 2001)

An innovation is a practice that is perceived as new by an individual or an organization. (Rogers, 2003) It is purported to be able to address existing problems in a new way. However, the preference of this new practice over the status quo is unknown to its potential adopters who must obtain information about the innovation to make that determination, the uncertainty reduction process. (Rogers, 2003) Telemedicine has also been selected as an innovation for study given that it is a technology that was introduced more than forty years ago, but continues to provoke uncertainty about the breadth of its future adoption. (Sicotte & Lehoux, 2003) Prediction of its integration into mainstream health care delivery is also compounded by the view that physicians are historically a conservative group with respect to the implementation of change. (Guitterez, 2001) Although some telemedicine programs have shown the technology can be effective, the longevity of programs is unclear. (Agency of Healthcare Research and Quality, 2003). In contrast, telemedicine network funders such as governments are appear convinced that telemedicine will solve some of the systemic problems confronting the health care system such as improving access to non-urban patients and reducing system costs. (Ministry of Northern Development and Mines of Ontario, 2003) While it is challenging to ascertain the total amount allocated specifically to telemedicine by Canadian provincial and federal governments, as an illustration of magnitude, a two year $80 million shared-cost incentive program was implemented by the federal government for telehealth and electronic health records model projects from 2000-2002. (Health Canada, 2004)

With better knowledge of the factors that influence physician attitudes toward telemedicine, it is possible that telemedicine networks will be better able to address physician uncertainties about telemedicine. Once addressed, it is also possible that physicians may evaluate telemedicine as an innovation that could be useful to their practice. Until that uncertainty reduction has been accomplished, it is likely that telemedicine will continue to have restricted application within the health care delivery system. If, as stated by Rogers, innovation adoption is challenging even where the advantages are obvious, then the challenges of telemedicine adoption where the advantages from a physician perspective are not yet evident will be even greater. Technology adoption requires integration into routine practice: "These new applications for communications technologies are established in everyday clinical work by as (sic) set of practical negotiations, in part because they are as yet, profoundly unstable. That is they have not yet been translated into unremarkable, 'normal' sets of practices, but instead require the invention of forms of normative conduct that will effect that stabilization." (May & Gask, 2001, p.1893)

The definition of telemedicine can be as varied as the number of studies that are reported. One recognized definition is "...rapid access to shared and remote medical expertise by means of telecommunications and information technologies, no matter where the patient or relevant information is located. (European Commission, 1993) For the teledermatology study that is described in this work, the investigator defined telemedicine as the provision of real time medical care to diagnose and/or treat a patient where the physician and patient are separated by a distance, and technology is used as a substitute for an in person consultation. Activities that are excluded from this definition are telephone/fax services and internet exchanges. Also excluded is the use of 'store and forward' technology where images of the patient are gathered and forwarded to a specialist for examination at a later time. In this work, telemedicine refers to a specialist consultation where the patient, primary care or referring physician and specialist are in a real time interaction facilitated by telemedicine technology because the specialist is at a geographic distance from the other two participants.

Telemedicine as an innovation

Health care delivery must be considered within the context of space and time. (Shannon, 1997) Health care is arranged both geographically, perhaps in a hospital-based clinic or private office, and temporally, for example, at an appointment time. To address the lack of access to health care in rural communities, common strategies are to restructure the physical environment, for example, by building additional hospitals in these communities. It is thought that increasing physical space will lead to a concomitant increase in service provision. Other strategies include providing economic incentives for increased care delivery, for example, by paying urban physicians to travel to remote areas to deliver care.

In contrast, telemedicine is an innovation strategy that addresses rural resource inadequacy through a virtual rather than physical restructuring. (Shannon, 1997) By restructuring space and time through non-physical means, telemedicine brings specialists to a remote community. Time can be restructured through store and forward technology and space can be restructured through the use of a telemedicine studio for videoconferencing. In this manner, telemedicine benefits are most often considered within the context of addressing longstanding systemic problems that have been identified in many jurisdictions. It is purported that telemedicine can address the unequal access to subspecialty consultation experienced in rural communities. (Davis et al., 2001)

Telemedicine may also be a more efficient way to deliver care to remotely located patients than patient travel. The "virtual travel" of the physician may be more efficient than the actual travel of the patient. This efficiency benefit is supplemented by a potential quality of care benefit. Telemedicine has the potential to support the patient, the primary care physician and the specialist by enabling live interaction amongst these three participants in the health care encounter. An opportunity to jointly discuss the patient's clinical need, whether diagnostic or treatment planning, has the potential to improve clinical care:

> Studies in the Netherlands have shown that involvement of general practitioners in joint consultations can lead to better patient management, reductions in hospital follow up appointments, fewer tests and investigations, improvements in health status one year after referral and fewer subsequent referrals to hospital.
>
> (Jacklin & Roberts, 2003)

Through its reengineering of care delivery, telemedicine can provide innovative opportunities to improve health care delivery. This reengineering of care delivery itself exemplifies the notion that telemedicine must be considered as more than the mere application of a technology to a health care interaction. The nature of the health care interaction is also changed, a repercussion of the technology that must be considered where one attempts to understand the introduction of telemedicine from the physician perspective.

Telemedicine has also been shown to be an innovation that has the potential to improve the quality of care through its educational opportunities. A comparison of face-to-face and teleconsultations with dermatologists across the United Kingdom showed that the general practitioners found that 75% of teleconsultations were of educational benefit and rated the teleconsultations as a valuable experience. (Gilmour, 1998) A Canadian telemedicine feasibility study showed that the referring physician regarded the telemedicine consultation as a valuable continuing medical education experience not only in terms of clinical skills but also with respect to knowledge, attitude and judgement. (Davis et al., 2001) However, these positive initial telemedicine experiences have not translated into physician adoption of this technology. Understanding the chasm between a positive telemedicine experience and subsequent integration of telemedicine into clinical practice is limited.

Influences on telemedicine adoption

Before one considers the many factors that may influence physician use of telemedicine, there is a threshold question related to the technology itself. Does the image delivered

through telemedicine provide sufficient clarity to enable an accurate diagnosis and development of a treatment plan? Studies of the technological sufficiency to provide an image that enables accurate diagnosis often use concurrence between a diagnosis determined through an in person visit and a diagnosis made through a telemedicine consultation as measure of clarity. (Perednia, 2002) The technical reliability and diagnostic concordance of teledermatology to in person consultations has been shown. (Gilmour et al., 1998)

In the context of opthamology, it has been reported that digital images transmitted through telemedicine are effective for the detection and grading of diabetic retinopathy. (Gomez-Ulla, Fernandez, Gonzalez, Rey, Rodriguez, et al., 2002) Within dermatology, it has been reported that when challenged in a court of law, images used by a teledermatologist were found to be valid for diagnostic purposes and identification of child abuse: "Clarity of the digital image through all of the peripheral cameras used in the network has been excellent, with clear pictures, observed and captured, of dermatological marks measuring less than 5 mm." (Whitworth & Wood, 2002, p.148) Other studies report that physicians are satisfied with the images provided through teledermatology for the purpose of diagnoses. (Lowitt , Kessler, Kauffman, Hooper & et al., 1998)

In the evolution of telemedicine research, studies are increasingly focusing on the influences on physician adoption of telemedicine. Some researchers have studied whether telemedicine use is a factor related to physician characteristics such as age, gender. These demographic characteristics have not been shown to be related to telemedicine adoption. (Spaulding, 2005) Despite explanations offered through empirical study and applied study of the factors that impact telemedicine use by physicians, a comprehensive understanding of the influences on telemedicine adoption remain elusive.

Attitudinal variables such as level of comfort with new technology have been suggested as explanations of telemedicine adoption. (Brauer, 1992) One study found that physicians were resistant to telemedicine because they were unfamiliar with the equipment. (Birch, Rigby & Roberts, 2000) The time commitment to participate in real-

time consultations has also been shown to engender reluctance to participate in telemedicine. (Larsen, Gjerdum, Obstfelder & Lundvoll, 2003) Also, referring physicians across medical specialties believe that teleconsultation should respect existing referral patterns. (Sicotte & Lehoux, 2003) Many professionals who deliver health care services maintain a belief that these services should be delivered personally and locally. (Gustke, Balch, Rogers, & West, 2000)

Researchers recognize that as an innovation, telemedicine includes organizational and social dimensions. (Bashshur, 2000) While knowledge of the impact of different technological specifications, such as the effect of bandwidth has been developed, much less is known about these non-technological factors that will influence telemedicine use with sufficient frequency to impact the delivery of care across communities. (Eedy & Wootton, 2001)

Purpose

Although the proponents of telemedicine may have anticipated its widespread adoption across physicians and regional communities, it is increasingly evident that delineating where telemedicine can be implemented as an alternative to in person care delivery is critical to achieving successful implementation in any setting:

> "Researchers need to replace the approach of asking whether a telemedicine application is acceptable with an approach that explores why, in what ways and under what circumstances telemedicine applications are favourably received."
>
> (Whitten & Richardson, 2002, p.247)

Therefore, the purpose of this research is to explore the influences on physicians' attitudes toward telemedicine as a patient care delivery system. "Telemedicine will not prosper simply because it is a good idea. Like any revolutionary force, telemedicine will encounter considerable resistance as it moves from the fringe to the mainstream of

healthcare over the coming years." (Bauer & Ringel, 1999, p.157) Through a deeper understanding of the influences on physician attitudes toward the use of telemedicine in the context of specialist care, identification of factors influencing physician adoption of other health care innovations may be discovered.

To contribute to the understanding of the influences on physician attitudes toward telemedicine use, a practice-based qualitative research study is conducted. Dermatology is selected as the specialty to be used for this study since dermatology is known to be well suited to telemedicine. (Grigsby & Brown, 2002; Wootton, 2001) Dermatology is also a specialty that is frequently delivered through telemedicine where these applications have been successfully introduced. (Wootton, 2001)

The teledermatology study is positioned within the framework of substantial established knowledge about innovation diffusion generally, and the less established knowledge of telemedicine adoption specifically. While there has been empirical study of telemedicine applications from the perspective of patients and outcome evaluation such as impact on costs, there is less study with respect to physicians as the end users of telemedicine and how this technology may be perceived as satisfying or aggravating their clinical practice needs. The teledermatology research study is designed to increase understanding of physician perceptions of telemedicine as a technology and the influence of these perceptions on attitude toward telemedicine use. Well-established theoretical models for innovation adoption have been used as a framework for this qualitative study. In contrast to other study designs such as mailed surveys that have explored physician perspectives about temporally and spatially distant care delivery, a unique aspect of the teledermatology study is its delivery of teledermatology specialist care to patients where the referring physicians, as study subjects, are interactive and real time participants in patients' consultations.

Research questions

To obtain the benefits that are typically attributed to the use of telemedicine such as quicker patient access to specialist care, better quality of care and reduced travel costs, family physicians must refer their patients for specialist care provided by distant physicians using telemedicine as a substitute for an in-person visit. The referring physician is pivotal to the utilization of telemedicine systems. However, the referring physician, confronted with a patient who has a clinical need that cannot be met through local resources, has autonomy to decide from amongst a number of options to obtain specialist care. For example, the local physician can decide to refer the patient to a specialist where patient travel will be required or to wait for a visiting specialist clinic within the patient's geographic location. Potential benefits of telemedicine will remain unrealized where primary care physicians choose these in-person options.

Enhanced understanding of the influences on physician decision-making with respect to telemedicine as an alternate health care delivery system is essential to its adoption. Within the three case studies of the teledermatology study, the first step is to establish whether a context for change exists. Thus, all case studies begin with exploration of the necessity for improvement to the access to care that currently exists in the local community. The context for change from a physician perspective in each of the study communities is explored during individual interviews before the first teledermatology session as follows:

> *What is the primary care physician's description of the need for specialty dermatological services? Do physicians describe their need for increased access to this care as an issue of significance for their practice/community? What are current referral patterns and under what circumstances are dermatology referrals made?*

Assuming the identification of a need for improved access to dermatological services is established, then the study explores physicians' perceptions of innovation attributes

ascribed to telemedicine before and after personal participation in teledermatology sessions:

> *How do physicians describe the innovation attributes of relative advantage, compatibility, complexity, trialability, and observability, perceived ease of use, perceived usefulness, image and voluntariness? How do these attributes impact the social and organizational dimensions of primary care practice? How do these attributes influence physicians' attitudes toward telemedicine use? What other influences on physician attitudes are identified? How do study incentives affect attitudes?*

Outline of Dissertation

Although the delivery of medical care facilitated by technology is popularly thought to be an obvious way to provide health care to patients whose access to care is limited by geography or ability to travel, widespread utilization has not occurred. (Larsen et al., 2003). What affects physician attitudes toward telemedicine as an accepted delivery method for health care where the technology is perceived to be adequate and patient demand for health care services is growing?

In Chapter Two, a theoretical framework for exploring physician attitudes during the teledermatology study is developed. It begins with the diffusion of innovations theory described by E. M. Rogers as its foundation, focusing on innovation attributes since these are purported to explain 49-87% of the variance in innovation adoption rate. (Rogers, 2003) Then, theoretical concepts derived from the literature on technology innovation adoption and, more specifically, telemedicine are discussed. This provides additional theoretical considerations for study design and data collection which subsequently structure the discussion of the teledermatology study findings.

Within the backdrop of this theoretical framework, the telemedicine literature is reviewed in Chapter Three. Within only two peer-reviewed journals specific to telemedicine and indexed in MEDLINE, there were more than 1,300 articles at October 2004. (Demiris & Tao, 2005) Given the wide breadth of the telemedicine literature as compared to the narrower focus of the research questions, the literature review encompasses telemedicine applications rather than other topics such as telemedicine outcome evaluation.

In Chapters Four and Five, the teledermatology study is described. The participants of interest in the teledermatology study are primary care physicians in northern Ontario communities identified as underserviced for specialist services. The methods, data collection, data analysis and findings are described in these chapters. Chapter Six provides a discussion of these findings with respect to the influences on physician attitudes. In this chapter, the limitations of the teledermatology study are also presented. The dissertation concludes in Chapter Seven with a discussion of innovation adoption and future research in telemedicine that could contribute to theory development.

This dissertation has been completed to increase understanding of factors that influence physician attitudes toward adoption of innovations and, in particular, telemedicine utilization for the delivery of care to patients in a real time interaction. It is premised on the perspective that the conceptualization of telemedicine as merely a technological innovation has limited capacity to increase understanding of the influences on its adoption. It hypothesizes that telemedicine must be considered within a broader framework that includes social and organizational influences that are far more encompassing than factors commonly cited in the literature such as physician comfortability with technology or physician reimbursement. Through the teledermatology study, an in depth examination of physician perceptions is completed that will make a contribution to existing knowledge about the influences on the adoption of telemedicine.

It is also important to acknowledge considerations that the teledermatology study will not include. Foremost, it must be noted that the study is not designed to be *predictive* of

physician adoption of telemedicine or other health care innovations. While Rogers' innovation attributes are described as having predictive ability with respect to innovation adoption rates (Rogers, 2003), the teledermatology study uses these attributes as a first step in understanding physician attitudes. Using a case study design, the teledermatology study does not include a quantitative analysis that matches attitudes to subsequent telemedicine use. The significance of the language of physician attitudes *toward* telemedicine use should thus be understood.

Table of Contents

Chapter 2

Selected Theoretical Models with Relevance to the Teledermatology Study

Chapter 2

Selected Theoretical Models with Relevance to the Teledermatology Study

Understanding the adoption of innovation has been the subject of scientific inquiry and theory development for decades. (Rogers, 2003) Theorists such as E.M. Rogers have developed theoretical models to understand innovation adoption and behavioural change that are recognized internationally and have been applied to a wide range of topics. (Sanson-Fisher, 2004) To first understand and then to develop strategies to influence individual and organizational change, researchers have applied theories of innovation diffusion across many kinds of settings. Further to the resurgence of interest in telemedicine in the 1990's, it has become increasingly recognized that the process of telemedicine diffusion has technical, organizational and social dimensions that must be considered as one attempts to understand physician attitudes. (Bashshur, Reardon & Shannon, 2000)

Recognizing that the potential benefits from new technologies are often limited by user unwillingness to use available technology, researchers such F.D. Davis have developed scales to measure theoretical constructs that have been thought to be able to explain technology use. (Davis, 1989) Though originally applied to technology in educational or commercial and corporate settings, Davis' research and theory development has more recently been applied to use of technology in the health care sector. (Hu, Chau, Liu Sheng, & Tam, 1999) In addressing how user attitudes are formed, the technology acceptance model proposed by Davis suggests that there is a causal relationship between the characteristics of the technology itself and users' perceptions of these characteristics or key attributes. (Davis, 1993) The applicability of the technology acceptance model, as developed by Davis in his effort to understand causal relationships between attributes and actual technology usage, has been tested within the context of physician use of telemedicine. (Hu et al., 1999)

Theories to explain diffusion of technology innovations have also been developed specifically for the adoption of telemedicine. (Tanriverdi & Iacono, 1999) Given the low use of telemedicine for patient care deliver as compared to funder expectations, researchers have employed empirical methods to construct theoretical models to explain telemedicine use by physicians. A theoretical model built on the concept of knowledge barriers has been developed to explain the diffusion of hospital-based telemedicine programs. (Tanriverdi & Iacono, 1999)

Irrespective of the theoretical framework that is applied in empirical research designed to delineate the mechanisms that influence physician adoption of the innovation of telemedicine, a comprehensive understanding of the physicians as users of telemedicine continues to be elusive. (Helitzer, Heath, Maltrud, Sullivan, & Averson, 2003) Thus, new theory development or refinement of existing theoretical models to understand the influences on innovation adoption continues to be a relevant and important dimension of telemedicine research. Theoretical modeling with regard to the influences on physician adoption of this technology is a research topic with practical application. Technology implementation strategies, based on empirically validated theory, are essential to the introduction of innovations such as telemedicine since it has been shown that implementation of change absent an empirically-based adoption plan that recognizes unique contextual factors will not lead to changes in professional practice change. (Ashford, 1999)

The breadth of disciplines and the number of theories that have been proposed to explain innovation adoption is daunting. For example, it has been suggested that discussion of telemedicine should include anthropological perspectives. (Sinha, 2000) In this chapter, the theoretical models that were selected from the social science, information technology and telemedicine literature, further to a determination that they were well-established with demonstrated credibility and provided a strong fit and relevance to telemedicine diffusion in the Ontario, are summarized. These theoretical models were subsequently used to facilitate the design and data collection methods used in the teledermatology study. This description begins with a comprehensive innovation diffusion theory that has

been applied to innovations across settings and disciplines. This is E.M. Rogers' diffusion of innovations theory. (Rogers, 1995, 2003) Included within this description is a summary of the development of an instrument to measure user perceptions of the innovation attributes as these are depicted by Rogers. (Moore & Benbasat, 1991) While the instrument itself is not used within the teledermatology study, the description of the process of instrument validation elucidates the subtleties and weaknesses of Rogers' innovation attributes.

Then, an exploration of three user adoption theories, as these have been tested by researchers within the specific application of telemedicine, is presented. To understand how these theoretical models influenced the development of the principal study data collection tool in the teledermatology study, which is the individual interview with physician participants, the guide for semi-structured physician interviews is presented in Appendix 1 and includes references to the constructs within these theoretical models.

Rogers' Diffusion of Innovations Theory

Rogers' diffusion of innovations theory includes many dimensions that explain rate of innovation adoption. It has been widely applied to change initiatives in the health care sector. Rogers defines an innovation as:

> "...an idea, practice, or object that is perceived as new by an individual or another unit of adoption. An innovation presents an individual or an organization with a new alternative or alternatives, with new means of solving problems. But the probabilities of the new alternatives being superior to previous practice are not exactly known by the individual problem solver. Thus, they are motivated to seek further information about the innovation to cope with the uncertainty that it creates."
>
> (Rogers, 1995, p.xvi)

The existence of uncertainty about the preferability of an innovation is a significant dimension in Rogers' theory. An innovation offers a new way of doing an activity or

task, but those who could use the innovation do not know whether it will be preferable in comparison to existing activities or practices. Therefore, the decision whether to adopt or reject an innovation is influenced through the individual's ability to reduce this uncertainty about how well the innovation will meet their needs by collecting information that will help to evaluate the innovation superiority over existing practice.

Based on a survey of thousands of innovation studies, Rogers has identified variables that influence the rate of innovation adoption. Rate of adoption is defined as the "...relative speed with which an innovation is adopted by member of a social system." (Rogers, 1995, p.221) One variable is the personal characteristics of the population of persons who are presented with an innovation. What are the characteristics of people who adopt innovations more easily and quickly? A second variable describes the characteristics of the innovation itself. What are the attributes of innovations that are adopted more easily and quickly? Also, the rate of innovation adoption is influenced by the manner in which the innovation is communicated and promoted to potential adopters and the nature and norms of the social system into which the innovation is introduced. What communication channels create awareness or knowledge of an innovation more easily and quickly? The overarching theoretical principle is that "...subjective evaluations of an innovation, derived from individuals' personal experiences and perceptions and conveyed by interpersonal networks, drives the diffusion process." (Rogers, 1995, p.208)

Rogers' diffusion of innovations theory recognizes that each of these variables will have an impact on the rate of innovation adoption and will be influential during the stages of the innovation decision process that are common to all innovation adoption decisions. I will begin with an overview of the innovation-decision process as articulated by Rogers to establish the context for an examination of the influences on that process. Then, characteristics of the individual and characteristics of the innovation itself and their influence on innovation adoption decisions and adoption rates will be summarized. Rogers' discussion of social systems and communication channels will also be summarized.

Innovation-Decision Process

The innovation-decision process is described by Rogers as "...a series of actions and choices over time through which an individual (or an organization) evaluates a new idea and decides whether or not to incorporate the innovation into ongoing practice". (Rogers, 1995, p.161) A period of time to allow for a series of smaller choices and gaining information that supports the final decision is required. There are five stages that individuals complete in the decision-making process reflecting Rogers' premise that a decision about an innovation is rarely immediate.

The first stage occurs when the individual remembers information about the innovation. Labelled the *knowledge stage*, this occurs when the person realizes that an innovation is available and begins to understand how it works. This knowledge of the innovation can include recognition of its existence, understanding how it functions, and also why it works or the principles that underlie its operation. Knowing that a new way of doing things, or an innovation, exists is a prerequisite for a decision about utilization.

The second stage in the decision process leads the individual to form an attitude about the innovation. In this stage, the individual asks questions related to the advantages and disadvantages of the innovation. Based on the answers, the individual develops a positive or negative attitude about the innovation and the individual's perception of the characteristics of the innovation itself becomes critical to the decision whether to adopt the innovation. Labelled as the *persuasion stage*, the person develops a view of the innovation based on its characteristics that either persuade or dissuade adoption. This attitude toward the innovation may result from information gained from first hand experience with the innovation as well as from peers who themselves have some experience with the innovation. However, positive or negative attitudes formed at this stage do not necessarily lead to a parallel change in behaviour. Rogers' suggests that further stages must still be completed before the decision process is complete.

It is in the third stage of the innovation-decision process that the individual participates in activities that will lead to an adopt or reject decision. Trial use plays an important role in this stage referred to as the *decision making stage*. Even where the individual does not try the innovation, the trial use by others can be informative to the individual's decision making. Referring to this as a vicarious trial, Rogers notes that for some persons, the reported experience of others can be influential in decision making. Where the assessment of the relative advantage of the innovation over the status quo has been achieved either directly or indirectly, the decision about adoption becomes much clearer to the individual. Accordingly, those who seek to influence innovation adoption may hold demonstrations based on Rogers' theory that innovations are adopted more quickly when the adopter has an opportunity to try the innovation prior to making a commitment to ongoing use. The completion of the third stage of the innovation decision process results in an intention or decision to try the innovation.

In cases where an intention to use the innovation has been achieved, an *implementation stage* follows as the individual begins to use the innovation. In the first three stages in this innovation decision making process, the activities are largely intellectual and evaluative rather than action based. At this fourth implementation stage, the individual makes a behavioural change and uses the innovation. At this point, the individual will require more detailed information related to the logistics of the innovation such as how to use it, where to obtain assistance etc. The duration of the implementation stage depends on the nature and complexity of the innovation. More complex innovations require longer time for acquisition of necessary information to enable use. This stage of the innovation decision process is complete when the innovation no longer has the status of a new idea and is integrated into routine practice. Rogers suggests that the duration of the implementation stage is also a function of where the innovation occurs. In a complex organizational setting, where there are many participants and perhaps systemic resistance to changed behaviour, the implementation may be longer than in a setting largely in the control of an individual adopter. Thus, inherent to the innovation adoption process is the influence of contextual factors such as organizational and social structures that can facilitate or impede adoption.

Recognizing that the implementation of an innovation may not be the conclusion of the innovation decision process, Rogers suggests that in some circumstances a final *confirmation stage* may be necessary. This stage provides an opportunity to confirm that the innovation decision has been the correct decision through recognition of its benefits. However, it is also possible that the individual reconsiders benefits and decides to discontinue utilization of the innovation. Where this occurs, it may be a reflection of an absence of true innovation integration, as described in stage four, into routine practice.

Rogers addresses the issue of the empirical basis for the innovation decision process as he has described it. While noting that most diffusion of innovation research is focussed on the quantitative study of variance among a set of variables that influence innovation adoption, Rogers states that process research studies have empirically demonstrated the existence of the stages in the innovation decision process as he has theorized.

Innovation adopter categories

One of the most studied aspects in diffusion is innovativeness or the "...degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system..." (Rogers, 1995, p.252) Implicit in the concept of innovativeness is the actual use of the innovation rather than an attitude or perception with respect to the innovation. Noting that there is variation in the timing and pace of innovation adoption across populations in any particular context, Rogers' diffusion theory includes an empirically based method to categorize adopters. Individuals within a population adopt innovation in a pattern distributed over time that is sufficiently common that it permits classification of adopters based on the commencement of innovation use. Analysis of the timing of the adoption process has led to the specification of adoption rates across populations that have been statistically standardized, irrespective of the specific innovation. When the cumulative number of adopters is plotted on a graph over time, an S-shaped cumulative curve results. The consistency with which this curve can

be applied to different situations reflects that not only is there a common distribution related to innovativeness, but that as more people in a social system try the innovation, there is a stronger effect on others to be persuaded to try the innovation themselves. Additionally, adoption of an innovation follows a normal, bell-shaped curve when plotted over time based on the number of new adopters suggesting that innovation adoption follows a normal distribution.

Given that people adopt innovation at different rates over time that reflect a normal curve, Rogers has used the statistical properties of the normal curve, to categorize innovativeness or the use of an innovation based on standard deviations from the mean time of adoption. It has been shown that there is heterogeneity amongst those who are more innovative. Within the group of people who adopt an innovation in advance of the average time of adoption, there are differences. Rogers has highlighted these differences through the identification of three separate adopter categories within 2 standard deviations to the left of the mean. These categories of early users have been labelled by Rogers as innovators, early adopters and early majority. Since there is more homogeneity amongst those who are later than average in adopting innovation, there are only two categories of adopters within 2 standard deviations to the right of the mean. These are labelled by Rogers as the late majority and laggards. These adopter categories are considered by Rogers to be "ideal types" that enable comparison. (Rogers, 2003) Rogers has described the main characteristics for each adopter category and explained its role within innovation adoption. Adopters in the first category, *innovators*, have been characterized by Rogers as venturesome with tolerance for uncertainty. Their function in an innovation situation is to perform a gatekeeping role with respect to new ideas entering into a system.

The second category of adopters is known as *early adopters*. These are individuals who are opinion leaders and are respected by peers. Their positive influence on innovation adoption is that they can decrease individual uncertainty about the innovation because they are trusted to make well-informed decisions. Because they are closer to the average

adoption time than innovators, they are more trusted by the mainstream of adopters in a system.

Between the very early and relatively late adopter categories, Rogers has identified a category of adopters whose adoption timing is just before the average rate of adoption in a system. Rarely including an opinion leader, this category is labelled as *early majority*. As described by Rogers, it represents people who are very willing to follow those who have already adopted the innovation.

Rogers also describes those people whose rate of innovativeness is slower than average. The first of the two categories of adopters to the right of the mean adoption time on the normal adoption curve is the *late majority*. Requiring pressure from others in their system before they will use the innovation, those in the late majority have addressed most of the uncertainty related to the innovation and are comfortable that the innovation does not constitute a risk.

Farthest from the mean of innovation adoption are those labelled by Rogers as *laggards*. These are individuals who are likely suspicious of change and those persons who introduce change into a system. Rogers suggests that those who are identified as laggards may feel compelled by their circumstance to be cautious and thus warns against judgement of laggards. Their adherence to tradition may reflect the system within which they operate rather than a failure of the person.

How can knowledge of the normal curve of the rate of innovation adoption and its separation into adopter categories assist those who wish to influence innovation adoption? Based on this rate of adoption curve, there are two alternatives. One alternative is based on the view that the most effective timing of an implementation strategy to increase adoption is when it will influence the largest number of users, those found within one standard deviation on both sides of the mean. Using telemedicine adoption as an example, these statistical distributions would suggest that implementation strategies would be most effective once the telemedicine network has been introduced

into a community and used by opinion leaders who will influence the adoption decision of others. A second alternative is to use resources to influence the innovators and the early adopters, since increasing their adoption may hasten their impact on the larger system of users.

These adopter categories have been widely applied and are now integrated into diffusion of innovation discussions. (Berwick, 2003) Adopter categories as described by Rogers have been verified within the context of telemedicine. (Moore & Benbasat, 1999) Within the telemedicine adoption literature, there has been significant study of the characteristics of the innovation adopter and the impact of early adopters on telemedicine utilization. (McIntosh, Booher, Alston, Sykes et al., 2001)

Innovation attributes

The innovation adopter categories provide insight into the timing of innovation adoption, but do not provide insight into the characteristics of the innovation itself that will influence adoption. However, the diffusion of innovations theory also includes five characteristics or attributes that describe innovations identified as having predictive power with respect to the rate of innovation adoption. Rogers notes that the analysis of these attributes has been understudied in the innovation diffusion literature and suggests that the lesser interest in research regarding the properties of innovation and their impact on adoption may be reflective of a tendency to consider all innovations in a similar manner or as "equivalent units". (Rogers, 1995, p.204) Rogers cautions that the consideration of innovations as generally similar with respect to adoption is an erroneous simplification that may obfuscate the importance of innovation attributes on the rate of innovation adoption. Critical to Rogers' theory is consideration of the characteristics of innovations that predict their rate of adoption.

The adopters' perceptions of the attributes of an innovation make a significant contribution to the rate of adoption. Citing that 49-87% of the variance in rate of

adoption can be explained by the five innovation attributes, Rogers states that each of these attributes is related to the others. (Rogers, 2003) The five attributes of innovation as described by Rogers are: relative advantage, compatibility, complexity, trialability and observability. While these attributes of innovation can explain variance in the rate of adoption of innovations, their impact on adoption is contingent on assessment by the individual. Even where the individual's perception is contradictory to expert or technical opinion or even empirical demonstration, it is the individual adopter's perception of these attributes that influences the innovation adoption decision. Thus the influence of innovation attributes is dependent on the unique perspective of the potential adopter. While the actual, objective attributes of an innovation will undoubtedly have an impact on how well it functions, the decisions made by individuals with respect to the adoption of the innovation will be determined by their own perceptions of these attributes. (Moore & Benbasat, 1991) This is a foundation of the teledermatology study and the explanation of each of the innovation attributes will include a description of its incorporation in the teledermatology study data collection.

The first innovation attribute described by Rogers, *relative advantage*, has been shown by diffusion researchers to be a good predictor of rate of innovation adoption. (Rogers, 1995, p.216) It is defined as the "...degree to which an innovation is perceived as being better than the idea it supersedes." The degree of relative advantage or perceived benefits can be expressed from many perspectives. For some adopters, perceived benefits may be reflected in financial success, social prestige or other advantages that may be as varied as the population and the innovation. Consistent with Rogers' description of the innovation decision making process as one that seeks to reduce uncertainty, potential adopters seek to understand the degree to which the innovation is better than an existing practice. The innovation attribute of relative advantage is the result of an evaluation of the benefits as compared to the costs that could accrue from using the innovation.

In the context of telemedicine, it has been noted that physicians are less enthused than patients about it use. (Moore, 2000) The relative advantage to patients such as reduced travel time are not perceived as relative advantages by physicians who may instead

perceive the advantages of teledermatology to be insignificant. (Wootton & Oakley, 2002) Further it has been shown that relative advantage is not a unidimensional attribute. The dimensions of relative advantage in the context of telemedicine can include degree of economic profitability, initial cost, social prestige, time and effort savings and the immediacy of the reward for utilization. (Wootton & Oakley, 2002)

The evaluation of telemedicine as described in the research literature suggests some of the implicit assumptions about the relative advantages of telemedicine over traditional face to face health care. Studies that evaluate the "success" of telemedicine typically describe its relative advantage over current health care delivery. For example, where telemedicine outcome studies report on patient travel costs, quicker patient access to necessary care or reduced professional isolation for remote physicians, these are indicators of relative advantage of telemedicine over current practice as defined by the evaluator or those directing the evaluation.

The second innovation attribute described by Rogers is *compatibility*. It is defined as the "...degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters." That is, compatibility is applied within the context of one's values and beliefs, previous experience with similar ideas and the perceived need for change. The extent to which an innovation is consistent with one or all of these compatibility factors can lead to reduced uncertainty about the benefit of the innovation. The compatibility attribute captures the individual's belief that a change is needed, and that this particular innovation could satisfy that need. For example, within the context of telemedicine, where it is a physician's belief that effective health care delivery requires a face to face encounter, then the use of telemedicine as replacement for an in person contact is incompatible with beliefs and telemedicine use is unlikely. It has been noted that failed telemedicine programs can often be the result of a failure to establish that a deficiency or need existed for which telemedicine would be the solution. (Doolittle & Cook, 1999)

There are several dimensions of compatibility that are key to understanding how this attribute affects innovation adoption. For example, technological innovations are often interrelated. People may consider a specific technological innovation within the context of what Rogers considers to be a broader 'technology cluster' that includes previously introduced technologies similar in nature. Thus, previous experience with similar innovations may encourage adoption of another similar innovation. Where opinions about previous successful innovations are compatible with a new innovation, these can be leveraged at the time of its introduction to maximize consideration of the innovation as compatible with the positive previous experience. For example, where there has been successful use of telemedicine for continuing medical education physicians may be more amenable to the use telemedicine for other purposes such as the delivery of health care to their patients. Telemedicine embraces a cluster of technological uses that may be compatible and thereby influence its adoption. Experience with telemedicine in the 1960's and 1970's was often characterized by failure of technology which had a negative effect on telemedicine initiatives in the 1980's. (Yellowlees, 1999) It has been stated that "One project failing in a high profile area can destroy the reputation of telemedicine as a potential health care delivery system over a much wider area." (Yellowlees, 1999)

As adopters consider an innovation within the context of its compatibility with existing practice, they reflect on their previous experience. Referred to as an *indigenous knowledge system* by Rogers, this aspect of compatibility highlights the local nature of an innovation adoption decision and compatibility as a locally defined attribute. Those who introduce innovation often bring their own perceptions that the relative advantage of the innovation is overwhelming. The importance of the indigenous knowledge system can be overlooked. This may partly explain the recognized failure of telemedicine projects where a single champion or telemedicine adopter leaves and the telemedicine program fails. Perhaps the indigenous knowledge system was insufficiently engaged in the discussion of the compatibility of telemedicine with local practices.

Complexity is the third Rogers' innovation attribute. It is defined as the "...degree to which an innovation is perceived as relatively difficult to understand and use."

Innovations can be placed on a continuum from simple to complex. An innovation thought to be simple in its use may persuade the individual to adopt the innovation since uncertainty about one's ability to use the innovation is less.

Rogers refers to the introduction of home computers in the 1980's to explain the impact of this attribute on technological innovation adoption. When first introduced into the home market, home computer users were commonly individuals who already had experience with main frame computers, most often through their occupation. However, for those unfamiliar with computer use, the perception that home computers were complex to use inhibited the adoption of home computers. The attribute of complexity first served as a barrier to adoption. Lack of knowledge led potential users to assess home computers as complex. In response to technological changes that served to make home computers "user friendly", the complexity attribute acted as a facilitator of adoption as individuals changed their beliefs about home computer complexity.

It has been shown in the telemedicine literature that where the technologies are inaccessible or inconvenient, such as those that require travel to another building, they will not be used. Similarly, where the technology is complicated to use and requires revision to user instructions, use is unlikely. (Yellowlees, 1999) Telemedicine can be perceived as complex for physicians not only in terms of the technology itself, but the infrastructure demands that may surround it.

Trialability is the fourth innovation attribute and is defined by Rogers as the "...degree to which an innovation may be experimented with on a limited basis." An opportunity to try an innovation in a modest way, in conditions within the individual's control, can reduce some of the uncertainty at the core of the innovation decision process. Where the individual has colleagues who have previously used the innovation, the individual may consider their experience in the manner of a vicarious trial. Thus, previous experience of others in the individual's milieu can influence the individual's own innovation adoption decision. Some innovations are more amenable to a trial experience than others. For example, where the trial is predicated on a significant financial investment, the

opportunity for a trial without commitment to sustained use of the innovation is impracticable and thus may hinder adoption.

A review of the telemedicine implementation literature reveals that trialability can also occur at a system-wide level. Reluctant to make an expensive investment in the face of uncertainty about success, some health care organizations have preferred telemedicine trials or demonstration projects prior to committing to an ongoing telemedicine program. While this reliance on trials may reassure funders' who are uncertain about the success of this telemedicine investment, a ramification has been that the outcome research literature has had difficulty showing the result of longer-term cost/benefit analysis particularly where the research may reflect only a few weeks of operation. (Whitten, Kingsley & Grigsby, 2000)

Rogers' fifth innovation attribute is labelled *observability*. It is defined as the "...degree to which the results of an innovation are visible to others." While the benefits of some innovations are clearly observable or describable to others, there are some innovations that can be difficult to demonstrate in the absence of first hand experience. Where an individual is able to observe others using the innovation and its subsequent effect, uncertainty about the innovation can be reduced and the innovation decision process is thereby facilitated. Rogers' example of strong observability is the use of cellular phones in public places. As a technological innovation, others easily observe the use of cellular phones and its impact on users is clear. Observability is an important aspect of the teledermatology study as physicians and nurses are able to observe the impact of the telemedicine session not only on their colleagues but also on the patients who receive health care during the session.

Observation of a telemedicine program in rural New Mexico revealed that Rogers' theory of the diffusion of innovations most accurately explained their observations. (Helitzer et al., 2003) Noting that its strength is its specificity and comprehensiveness, these researchers conclude that Rogers' theory is a viable framework for understanding the diffusion of telemedicine. "Future research in this field may benefit from the diffusion of

innovations theory. Data collection instruments may be designed to elicit systematic information on all elements of the theory..." (Helitzer et al., 2003, p.186)

Incentives

Rogers' diffusion of innovations theory also considers the impact of incentives on innovation adoption. Incentives can increase the rate of adoption and increase the number of individuals who adopt the innovation. The use of incentives may affect innovation attribute perception and Rogers states that the purpose of an incentive is to increase the relative advantage of the innovation. The provision of a monetary or even non-monetary incentive will increase the attractiveness of using the new idea. Incentives can be administered at the individual, organizational or system-wide level. Incentives can also affect trialability where the provision of an incentive as recompense for trying a new idea may lead to a successful trial that persuades the user that full adoption is appropriate.

Elucidation of innovation attributes

With the purpose of developing an instrument that could be used to predict the adoption of information technology by end users, researchers have studied the adoption of information technologies based on Rogers' diffusion of innovations theory, with specific focus on the innovation attributes aspect of his theory. (Moore & Benbasat, 1991, 1995) Through intensive analysis of the five innovation attributes, efforts were made to develop a predictive measurement tool that could be administered to new users. The instrument itself was developed specific to the circumstance of an individual presented with a voluntary, initial adoption decision regarding a new technology. The result was a 38-item instrument to measure users' perceptions of a new technology based on Rogers' five innovation attributes. In their efforts to establish the convergent and discriminant validity of the scales within their instrument, the investigators completed an in-depth analysis of each of the innovation attributes. While not their stated purpose, this work served to clarify definitions of Rogers' innovation attributes and to highlight where weaknesses in

definition led to confusion about what was encompassed with a specific innovation attribute.

This research suggests that observability, defined by Rogers as "...the degree to which the results of an innovation are visible to others" has subtle, and distinct, dimensions. Observability may include the demonstrability of the result from using the technology. Where using the innovation showed a tangible result that could be objectively observed, then *result demonstrability* existed and was thought to have a positive relationship to adoption. A second, separate dimension of observability was labelled as *visibility*. This refers to the extent of exposure of individual adopters to the innovation. Using Rogers' example of cellular phones as reflective of observability, it can be said that cellular phones are highly visible to potential adopters. A software change in a physician's office billing system, however, could be considered as low in visibility although its result demonstrability may be very high.

Final instrument development included two scales that measure factors that are not descriptive of the innovation, but rather reflective of the individual and the context in which the technological innovation is introduced. (Moore & Benbasat, 1995) The first of these is *perceived voluntariness*. It is defined as "...the degree to which use of the innovation is perceived as being voluntary, or of free will." The second is called *image* and is defined as "...the degree to which use of an innovation is perceived to enhance one's image or status in one's social system. These two factors, perceived voluntariness and image, were included in the teledermatology study data collection tools.

This analysis of Rogers' innovation attributes proved instructive to both the development of the data collection tool for the teledermatology study and consideration of its findings since it provides added richness to the description of the innovation attribute. An implication of this instrument development research that examines the nuances of Rogers' innovation attribute definitions, when applied to the views of participants during this research, is that while these definitions may be effective at establishing a theoretical framework from a macro perspective, they may be insufficiently robust to accommodate

more in-depth examination when applied to specific situations. This potential restriction of applicability is acknowledged within the design and discussion of the teledermatology study findings.

Beyond Rogers: Other Theoretical Models and their Application to Telemedicine Research

Based on the hypothesis that attitude toward using a new technology is a function of two key beliefs that determine technology use, a technology acceptance model (TAM) was developed by F.D. Davis. (Davis, 1989) The first belief or innovation attribute within the model is perceived usefulness, defined as the "...the degree to which a person believes that using a particular system would enhance his or her job performance." Where a positive use-performance relationship is envisioned, a positive attitude toward use is created and technology is adopted. Davis found that perceived usefulness is correlated to user acceptance.(Davis, 1993) It has been stated that the breakthrough in the use of technology will occur when end users are convinced that it is useful. (Mairinger & Ferrer-Roca, 1998)

The second variable is perceived ease of use which is defined as "...the degree to which a person believes that using a particular system would be free of effort." Where a technology is perceived as easy to use, attitude toward use is positively influenced and technology acceptance is more likely. Davis' subsequent research found that perceived ease of use may be an antecedent to perceived usefulness rather than a direct determinant of attitude and adoption.

The technology acceptance model was proposed as an explanation of the determinants of computer-related technology use. Characterized as an 'intention-based' model, TAM attempts to explain and predict user acceptance of computer related technology. With respect to these two variables that model states that "...although ease of use is clearly important, the usefulness of the system is even more important..." (Davis, 1993, p.484)

The application of the TAM to the specific case of physician use of telemedicine has been investigated and results provide additional considerations for the theoretical underpinning of the teledermatology study. (Hu et al., 1999) Three influences on intention to use the telemedicine technology were found. These were *ease of use* which is defined as understandability and operability, *usefulness* which is defined in terms of productivity, effectiveness and efficiency and *attitude* which is characterized by beliefs about the benefits of the technology being introduced. Study participants were physicians in public tertiary hospitals in Hong Kong who were currently or likely to be telemedicine users. Consistent with the TAM, study results showed that perceived usefulness had a significant influence on physicians' intention to use telemedicine. Attitude toward telemedicine was also found to be a significant predictor of subsequent use. In contrast to the premise of the TAM, study results showed that perceived ease of use did not have a significant effect on perceived usefulness or attitude toward telemedicine.

Study findings led the researchers to conclude that TAM may not, in itself, be appropriate for understanding physician acceptance of technology. They suggest that physicians may be significantly different from other user populations in terms of general competence, intellectual capacity and adaptability to new technologies, all of which could influence the suitability of the TAM as an explanatory or predictive model. The relevance of these findings to the teledermatology study is the conclusions that are drawn suggesting that theoretical models such as the TAM must be adapted to specific user groups such as physicians.

Other researchers striving to develop a conceptual model of the determinants of telemedicine acceptance, specifically adapted to physicians, have used the Theory of Interpersonal Behavior, as described by H.C. Triandis. (Triandis, 1989) The Theory of Interpersonal Behavior suggests that behaviour is determined by intention, facilitating conditions and habit or routinization of behaviour. Intention is developed through attitudinal, normative and identity beliefs. Predictors of physician intention to use

telemedicine for clinical care were evaluated using mailed surveys to physicians and specialists who were enrolled in a telemedicine network in Quebec. (Gagnon et al., 2003)

There were seven predictors of physician intention to use telemedicine tested in this study based on an adaptation of the Triandis theory. The first predictor was *perceived consequences* of telemedicine use including access to expertise, new knowledge, and time demands. *Social normative beliefs* were assessed in the questionnaire with respect to perceptions of others including colleagues and hospital managers since these were purported to predict intention to use telemedicine. The third predictor, *role beliefs*, was measured by items specific to specialty, region and age and the appropriateness of telemedicine use. *Personal normative beliefs* were measured by consistency with personal principles. Beliefs about the characteristics of telemedicine users in contrast to their self-evaluation provided a measure of *self-identity*. Asking respondents about factors such as time, technology quality and remuneration provided data with respect to *facilitating conditions*. The final determinant, *habit*, was assessed through questions related to frequency of telemedicine use.

In this study affect, as it relates to the use of telemedicine in practice and described as stressful-relaxing and satisfying-dissatisfying, was postulated to have a mediating effect on the relation between habit and use.

Findings showed that social and personal factors were the best predictors of physician intention to use telemedicine. Overall, however, the researchers concluded that many of the constructs within the Triandis model were not predictive of physician intention to use telemedicine. The researchers concluded that qualitative research to enable a more in-depth examination of physician acceptance of telemedicine could contribute to the development of a theoretical model.

Other researchers have also sought a theoretical understanding for low telemedicine utilization using different theoretical models. (Tanriverdi & Iacono, 1999) A longitudinal, multiple case study of three hospital-based telemedicine programs that had been

operational for at least one year at the time of the study used knowledge barriers as proposed by P. Attewell to understand their findings. (Attewell, 1992) In this model, diffusion is considered to be a learning process. Knowledge barriers regarding technical methods inhibit diffusion. This multiple case study research showed that Attewell's model required expansion from a unidimensional construct of technical barriers to include other categories of knowledge barriers; economic, organizational and behavioural barriers. Findings suggest that all of these must be addressed for telemedicine diffusion to occur.

This research provided explanations of these four categories of knowledge barriers from the physician perspective. The technical knowledge barrier is the need for physicians to be convinced that the telemedicine technology can deliver what is claimed. Perhaps unique to clinician use of technology, this study showed that the demonstration of clinical effectiveness must accompany demonstration of the technical methods.

The economic knowledge barrier found in this study is not only with regard to reimbursement for telemedicine services, but understanding how telemedicine may provide new market opportunities for physicians. It is proposed that this finding may be specific to this case study where data was collected in a competitive, managed care health care market. Nonetheless, it underscores the importance of economic factors in telemedicine diffusion that have been found in other studies.

The organizational knowledge barrier was demonstrated by organizations within the study that were unsuccessful in creating a new workflow and organizational support for physician use of telemedicine. These organizations experienced physician unwillingness to use telemedicine. "Lack of know-how in integrating telemedicine into extant organizational workflow and supporting its regular usage constitutes knowledge barriers to the further diffusion of applications." (Tanriverdi & Iacono, 1999, p.239) The case studies revealed that where new workflows were instituted, telemedicine was more likely to become routine.

The final barrier, behavioural knowledge, is described "...learning how to change behavior of potential adopters and manage issues of resistance, power and politics around telemedicine..." (Tanriverdi & Iacono, 1999, p. 239) A temporal pattern was used to address physician resistance; once technical barriers were addressed, then economic barriers had to be resolved. Subsequent to that step, physicians had to observe the provision of organizational supports to minimize disruption. Where the first two barriers were not satisfactorily addressed, then behavioural barriers were not overcome. However, as the initial barriers are lowered, then the need for systematic organizational support services increases. (Tanriverdi & Iacono, 1999, p.241)

This research proposes that a new theoretical model is required to understand diffusion of information technologies among physicians. It is suggested that diffusion is a social learning process that is facilitated by local champions that address knowledge barriers implicit to the new technology. As noted by the researchers: "Physicians want to see proof of technical feasibility, clinical effectiveness, cost effectiveness, and organizational support before using these systems consistently, frequently, and assiduously." (Tanriverdi & Iacono, 1999, p.243)

Despite the contribution of the theoretical models described above, none has shown a capacity to explain physician use of telemedicine. While some theoretical models focus on the individual as others focus on the technology itself or the manner and methods through which telemedicine is communicated, none of these theories also encompass other underlying factors that may influence telemedicine adoption as these have been investigated within the sociological analyses of medical technologies. One sociological perspective on technology diffusion that has been developed into a theoretical model is labelled as technology in practice. This approach to understanding the diffusion of medical technology is premised on the notion while technology can achieve specific functions, what activities the technology actually will deliver and how those activities will be accomplished is a function of a multiplicity of social and technical factors. (Timmermans & Berg, 2003)

The technology in practice model is summarized as follows:

> This approach allows an observer to see how subtle political shifts in the autonomy of patients, the professionalism of healthcare professionals, or the goals of government regulators might be implemented technologically, but also resisted, or simply ignored.
>
> (Timmermans & Berg, 2003, p.107)

An innovation such as the electronic patient record is an example of an infrastructural technology. "It is often in the seemingly 'technical' matters that deeply relevant, social issues are 'hidden' – such as inclusion/exclusions of certain groups or voices, or the subtle restructuring of patients' or professionals' identities." (Timmermans & Berg, 2003, p.108) Expanding disciplinary boundaries in terms of the methods and focus of scientific inquiry would be beneficial to understanding the use of medical technology. Recognizing that technological use within the health care sector is a complex and multidimensional phenomenon leads to the examination of social and political factors that influence the purpose and ultimate use of medical technologies. (Timmermans & Berg, 2003)

What then is the application of a technology in practice theoretical framework to understanding the influences on physician use of telemedicine? First, this approach would suggest that while telemedicine may be able to accomplish many tangible activities, such as sending patient images over a distance, how its potential is actualized during the delivery of health care is a question that needs to be answered through examination of social and organizational factors. Telemedicine is a technology embedded in a complex network of human systems that include health professionals, funders, policy makers, technologists and patients. A physician confronting the potential use of telemedicine for patient care is unlikely to include the perspectives of funders, policy makers and those remote from the physician/patient encounter. Nonetheless, based on the technology in practice theory, social processes both at the local level and

more broadly, are theoretically important considerations to the formulation of understanding of the influences on attitudes toward the use of telemedicine.

Telemedicine is expected to solve the structural problems in the delivery of health care by eliminating barriers to patient access to quality care, typically specialist care, through technology. (McIntosh, Alston, Booher, Sykes & Segura, 2000) However, if telemedicine fundamentally changes the concepts of space and time in terms of health care delivery then, from a technology in practice perspective, this power to modify traditionally-based concepts such as where health care is delivered will have social and political ramifications for diffusion. These concepts must be included in examination of the influences on physician attitudes toward the use of this technology interpolated into the delivery of care. For example, as telemedicine shapes the delivery of health care through the use of urban, academically based physicians, the equilibrium between remote and urban physicians is modified. Accordingly, one of the outcomes that telemedicine is expected to achieve, the realignment of physician resources to improve equity of access across geographic regions, may be a subtle and even negative influence on physician attitudes about telemedicine. The deterritorialization of location from function thus enables the concentration of resources in urban centres. (Sinha, 2000) Therefore, the technology in practice perspective may illuminate the physician resistance and slow uptake of telemedicine described in the literature.

Application of the theoretical models to the teledermatology study

Telemedicine is an innovation that has not achieved diffusion. (Williams, May, Mair, Mort & Gask, 2003) While the advantages of telemedicine as a technological health care innovation seem obvious and perhaps even overwhelming to its proponents, it is possible that these advantages are either not as significant as believed or have been insufficient to lead to widespread use by physicians. Alternatively, it is possible that other factors are

influencing physician attitudes toward telemedicine use and ultimately their adoption decision than those advantages perceived by its funders and networks.

What theoretical model provides the best foundation to fulfill the purpose of the teledermatology study, which is to understand the influences on physician attitudes about the use of telemedicine for the delivery of patient care? The preceding discussion of innovation adoption theories and theories related to professionals' use of technology and their application to health technologies, and telemedicine in particular, demonstrates that no single theory encompasses all of the dimensions that have been variously shown in the research literature to have an impact on innovation adoption.

A theoretical model or conceptual framework can be used to support the purpose and research questions of a study. It can lead to specification of study participants. It also assumes relationships among factors that thereby help to define the parameters of a study. "A conceptual framework explains, either graphically or in narrative form, the main things to be studied – the key factors, constructs or variables- and the presumed relationships among them." (Miles & Huberman, 1994, p.18) The theories that have been reviewed in this chapter have been used to function as a theoretical foundation from which the exploration of influences on physician attitudes in the teledermatology study is completed.

Rogers' diffusion of innovations theory is the most comprehensive of the theories reviewed regarding innovation adoption, but the least specific to the context of the teledermatology study. Within the telemedicine literature, Rogers' theory is commonly applied to the description of the characteristics of individual adopters and innovation adopter categorization that affect telemedicine use. (Doolittle, 2001; Spaulding, Russo, Cook, & Doolittle, 2005) The influence of the perceptions of the attributes of the innovation itself on physician attitudes toward telemedicine has been less frequently used as a theoretical cornerstone for research into telemedicine use. Understanding how physicians perceive the innovation attributes of telemedicine, as these were originally generically delineated in Rogers' theory and then expanded by others, may advance

understanding of the influences on physician attitudes toward innovation in health care. The teledermatology case studies use the innovation attributes as a focus for the initiation of exploration into physician attitudes.

But, the proposed importance of social normative factors (Gagnon, Godin, Gagne, Fortin, et al., 2003) and the broader political concepts within the technology in practice model (Timmermans & Berg, 2003) makes evident that a hybrid theoretical model that recognizes the contribution of the multiple theories that have been described in this chapter would provide the strongest theoretical foundation for the teledermatology study. An illustration of how this theoretical model review has influenced study design is the application of the technology acceptance model to sampling strategies. It has been shown that not only does the technology acceptance model include constructs with relevance to physicians, empirical study has also demonstrated that physicians are significantly different from other users, even within the health care population, and must be studied separately. (Hu et al., 1999) Therefore, since it can not be assumed that what has been learned about telemedicine users generally based on this theoretical model is applicable specifically to physicians, the teledermatology study participant sample is restricted to physicians. Interviews with other key participants in telemedicine systems such as nurses who refer and participate in patient telemedicine consultations are informative to the teledermatology study but these populations are not included as study participants.

Conclusion

Telemedicine is an innovation for which diffusion remains limited. The theoretical models that have been described from the literature, both generic to innovation adoption and specific to technological innovation, are useful in demonstrating the many ways that researchers have attempted to understand the factors that influence potential adopters. These models also provide a foundation for the development of data collection tools in the teledermatology study.

The analyses of the capacity for the theoretical models included in this review to explain physician use of telemedicine consistently demonstrate that in the context of physician use of telemedicine for patient care, these models are inadequate to explain physician attitude development. While adaptations of well established theories are likely to capture many influences on physician use of telemedicine, it can also be concluded that a blend of constructs across many theoretical models will likely be required to understand physician attitudes.

From a methodological perspective, it can also be concluded that qualitative research to enable an in-depth examination of physician attitudes about telemedicine could contribute to the refinement of theoretical models. Through qualitative methods such as case studies and ethnographic studies, more detailed information could be obtained to improve understanding of the influences on physician attitudes toward the use of telemedicine.

Table of Contents

Chapter 3

Literature Review

Telemedicine for Health Care Delivery

Chapter 3

Literature Review

Telemedicine for Health Care Delivery

Within the health technology literature, the terms health telematics, telehealth and telemedicine are used to distinguish a variety of health related activities whose commonality is reliance on technology for their delivery. While usage of these terms is not completely consistent, generally within the health technology literature there is a common utilization of each term. Health telematics is the most encompassing term and represents all health activities and services that occur over a distance through the use of information and communications technology. (World Health Organization, 1998) An example of health telematics is a Web-based physician database with profiles of physicians including specialty, area of expertise and location designed to facilitate information sharing amongst physicians.

Telehealth includes health care provided directly to people who are ill, as well as public health activities such as education, but excludes health technology applications such as electronic patient records. (Bashshur, Reardon, & Shannon, 2000; Craig, 1999; Noorani, & Picot, 2001) An example of telehealth is a telephone service that enables direct communication between ill or healthy people with a health professional such as a nurse.

Telemedicine refers to physician delivery of health care and is the use of telecommunications technology to provide medical information and care across a distance. (Perednia & Allen 1995; Roine, Ohinmaa, & Hailey, 2001). In this definition, telemedicine does not include the delivery of purely physician education, such as videoconferenced lectures. Telemedicine does encompass applications irrespective of a live interaction. Common to definitions of telemedicine is the geographic separation of patient and health professional and the use of technology to facilitate the provision of clinical care and health related information. (Hersh, Wallace & Patterson, 2001; Robinson, Savage & Shannon, 2003)

This literature review is specific to telemedicine where it is defined as the provision of medical care to diagnose and/or treat a patient, where the physician and patient are separated by a distance and, technology is used to enable the clinical interaction to occur as a substitute for an in-person visit. Some technological applications that are thus excluded from the scope of this literature review are telephone/fax communication and the use of the Internet as an educational resource for physicians and the public. In the literature, telemedicine terminology generally adapts to match the specialty service or diagnostic procedure in a particular circumstance. (Bashshur et al., 2000) For example, telepsychiatry, teleradiology and teledermatology are commonplace terms that reflect the clinically specific application of the technology to the delivery of health care.

Scope and literature search strategy

The telemedicine literature grew rapidly in the mid-1990's, 5,911 citations in Medline from 1964-2004, with continued expansion until 2000 when the number of publications in telemedicine plateaued. (Moser, Hauffe, & Lorenz, 2003) Despite its volume, the telemedicine literature has been characterized as 'immature' with inconsistent methodological rigour. (Yellowlees, 1997) The percentage of articles published in two North American telemedicine specific journals that report clinical trials is estimated at less than five percent. (Demiris & Tao, 2005) Restricting this literature review to studies conducted according to quantitative methodologies would severely limit the scope of the review and, in particular, eliminate some practice-based information about the factors influencing telemedicine diffuison gleaned from the implementation of telemedicine projects. Given the goal to provide a broad understanding of the factors affecting telemedicine use from the physician perspective, experience-based articles and essays have been included with qualitative studies.

Within the telemedicine literature there are two distinct foci, telemedicine systems and telemedicine services. (Taylor, 1998) Telemedicine systems studies examine the

technology itself and technological requirements. Studies of the impact of bandwidth are examples of telemedicine systems research. This subject is excluded from the literature search since it is not germane to the research questions that explore how and why telemedicine may be diffused. Investigations of technological issues are common in the telemedicine literature (Robinson et al., 2003) and have been reviewed and are available elsewhere. (Taylor, 1998; Wootton & Oakley, 2002)

Telemedicine services research includes health care delivery networks, diagnostic accuracy, contextual factors that influence telemedicine use and cost comparisons between care delivered through telemedicine and in person visits. Although telemedicine evaluation first began with a focus on satisfaction and economic impacts, the non-technology issues identified as barriers to widespread use are gaining research attention. (Stumpf, Zalunardo & Chen, 2002) The focus for this literature review is the presentation of factors that have been identified in the literature as affecting telemedicine from the perspective of the physician as the end user.

There is variability in the appropriateness of the use of telemedicine for health care delivery and some clinical services are not adaptive to telemedicine. (Doolittle & Cook, 1999; Larsen, Gjerdum, Obstfelder, Lundvoll, 2003; Wallace, Haines, Harrison, Barber et al., 2002) For example, clinical applications in radiology and psychiatry have been frequently studied (Moser et al., 2003) but findings cannot be generalized to dermatology since each application has unique technical and human challenges. Thus, the scope of the literature review was established within this recognition that the suitability of telemedicine as a delivery system must be independently assessed for each clinical specialty application. Findings from the literature on teleradiology have undetermined relevance to other specialty services. Dermatology was selected for research study because it has been identified as a specialty well suited to telemedicine, in part because visual inspection predominates. (Lim, Egerton & Shumack, 2000; Phillips, Burke, Bergamo & Mofrad, 2000; Whited, 2001) The clinical setting for the research study described in Chapter Four is dermatology and this literature review does not focus on other specialty applications of telemedicine.

The literature search began with peer-reviewed journals using electronic searches through MEDLINE, EMBASE, CINAHL and HealthSTAR dating from 1990. Additionally, electronic resources such as the Telemedicine Information Exchange (TIE) and the Cochrane Central Register of Controlled Trials Library were searched. English-language only publications were included. The Journal of Telemedicine and was hand searched Telecare from 1996 to 2005. The bibliographies of all retrieved articles were reviewed for further relevant references, which were subsequently obtained. As key telemedicine texts were identified from peer reviewed publications, these were also obtained. Consistent with the research study questions, this literature review has a physician rather than patient focus. Therefore, studies specific to patient satisfaction or patient home use of telemedicine for the management of chronic disease such as diabetes were excluded from the search strategy.

This literature review commences with contextual information about telemedicine including a brief explanation of the predominant technological methods, absent technical specifications, that are commonly used to deliver patient care through telemedicine. This is followed by a summary of the history of telemedicine in North America and its current use. This historical overview is relevant since it establishes the issues related to telemedicine adoption that underlie the research study of telemedicine. The telemedicine literature is then presented according to the topics of telemedicine as an innovation and the influences on physician use of telemedicine that have been shown to be facilitators or barriers to telemedicine adoption. Finally, to set the stage for understanding why the issue of telemedicine diffusion is considered to be important from a variety of perspectives including telemedicine network funders, a brief overview of telemedicine outcome definition and evaluation research is described.

The technology of telemedicine

Telemedicine utilizes two main technical methods. (Craig, 1999; Lim et al., 2000; Whited, 2001) These methods are 'store and forward' and videoconferencing. In the asynchronous store and forward method, an image such as a radiological image is transmitted to a distantly located physician who may review the image at any time without the live participation of the patient or the referring physician. Resolution requirements for digital teleradiology is one of the most studied aspects of telemedicine systems. (Taylor, 1998) A store and forward method is most often used for a specialty consultation where interaction between physician and patient is not required to complete the clinical activity. (Hersh et al., 2001) For example, store and forward technology has been used in dermatological applications where images obtained through the use of a digital camera are sent to a dermatologist for examination. (Pak, Welch, & Poropatich, 1999)

Diagnostic accuracy of store and forward as compared to face to face examination has been demonstrated to be high. (Hersh et al., 2001) Store and forward technology was used in a blinded comparison trial for the delivery of cardiology, dermatology, endocrinology and orthopedic care. (Houston, Myers, Levens, McEvoy et al., 1999) The store and forward technology was selected rather than videoconferencing because equipment costs were less, images and diagnostic information could be sent to the remote consultant at a time of day when transmission costs were lower, and the consultant could review the images and information at a convenient time regardless of the availability of the referring physician or the patient.

In contrast to store and forward methods, videoconferencing enables the patient and physician to be connected by telemedicine technology in a real time interaction. The physician can see and hear the patient through a video link and the patient can interact with the physician through a digital camera on the videoconferencing unit. Another person, often the telemedicine network staff conducting the videoconferencing, is present with the patient and assists with the use of the technology such as camera positioning or

image magnification for closer examination. While referring physicians may also participate in videoconferenced consultations, rural physicians rarely participate in the telemedicine consultation between specialist and patient. (Campbell, Harris & Hodge, 2001)

Telemedicine applications must be tailored to the specifics of the situation. (Loane, Bloomer, Corbett, Eedy et al., 2000) Services most suitable to videoconferencing are those typically delivered through in-office visits. (Hersh et al., 2001) Where family physicians were willing to complete minor procedures such as cryotherapy in their offices, a live videoconferenced consultation with the patient, referring physician and specialist enabled the family physician to complete the specialist recommendation without the need for a further visit. (Loane et al., 2000) Store and forward technology has been found to be a suitable method where a patient visit to the hospital would be required for the delivery of a specialist recommended procedure. In this scenario, a real time interaction between family physician and specialist is unnecessary and thus the less expensive and administratively cumbersome store and forward technology is considered more suitable. (Loane et al., 2000) However, a study of asynchronous teledermatology showed that after one year of use less than twenty-five percent of participating general practitioners would consider using telemedicine in this format again. (Collins, Bowns & Walters, 2004)

History and use of telemedicine in North America

Telemedicine was introduced in North America in the 1960's. (Craig, 1999) Its precursor was closed circuit television-video monitors used in Nebraska where patients were examined by psychiatrists within the same building, but located in a different room. (Lim et al., 2000) The use of television-video monitors was then expanded into other settings such as prisons and schools once their ability to facilitate interactive consultations between two different psychiatric facilities had been demonstrated. (Craig, 1999) In the United States, telemedicine development was largely influenced by American aerospace

programs where ways to deliver health care to astronauts while in flight were investigated. (Craig, 1999) NASA developed 'space age technology' to provide health care to American astronauts. (Lim, 2000)

Much of the telemedicine literature dating to the 1960's describes telemedicine projects within educational, veteran and correctional settings where its use was predominately for radiology and psychiatric care. After this initial popularity, enthusiasm for telemedicine waned until a resurgence of interest in the 1990's. (Hakansoon & Gavelin, 2000; Mair, Haycox, May, & Williams, 2000; Shannon 1997) The burgeoning development of telemedicine during the last decade was the result of many factors, including improved, simpler and less costly technology. (Currell, Urquhart, Wainwright & Lewis, 2002; IOM, 1996; Mair & Whitten, 2000) The number of programs and patient services delivered through teledermatology in the 1990's attests to its increasing popularity. (Grigsby & Brown, 2002) As technology has become more commonplace in daily life and expectations for immediate and global access to information proliferate, telemedicine has become a more mainstream technological activity. (Heterington, 1998; Lim, 2000) In some regions of the United States, the use of telemedicine for radiological services has been an accepted practice for many years. (Craig, 1999)

Patient demand for access to health care services, particularly specialty services, has been increasing and telemedicine has been promoted as a way to address access to care issues. (Gustke, Balch, Rogers, & West, 2000; Mair & Whitten, 2000) Telemedicine has been identified as a potential solution for many systemic issues that confront current health care systems including access to specialist care and unequal distribution of health care resources across a geographic area. (Dick, Filler, & Pavan, 1999; Garfield & Watson, 2003) Despite the increased interest in telemedicine programs expressed by governments, the acceptance of technology witnessed in daily life such as the proliferation of home computers has not been matched by physician delivery of health care using long distance technologies. Many patients have accepted telemedicine as an alternate health care delivery system, even though health care providers remain skeptical. (Bashshur, 1997) Traditions of local and in-person service have been shown to impede

physician use of technology. (Birch, Rigby & Roberts, 2000) Additionally, physicians have been identified as a conservative population for whom it is difficult to predict acceptance of telemedicine. (Guiterrez, 2001)

A comparison of two rural telemedicine projects showed that telemedicine is considered by physicians as only one of a number of resources available to rural physicians. (Whitten & Adams, 2003)

Telemedicine initiatives have often been based on the efforts of a 'clinician driver' or individual who championed telemedicine program development. Peers and opinion leaders can influence acceptance of a new technology. (IOM, 1996) In a study of factors influencing telemedicine use for dermatological care it was shown that a champion was key to adoption. (Al-Qirim, 2003) The importance of a local champion to stimulate acceptance by others has been reported. (Garfield & Watson, 2003) The literature suggests that telemedicine will continue to be encouraged by its proponents notwithstanding physician reluctance to adopt an innovation that requires a change to their practice pattern.

As public policy makers increasingly consider telemedicine as a solution to widespread problems in health care delivery, telemedicine projects are gaining support and resources from governments. (Yellowlees, 1997) Consequently, many feasibility projects and demonstration projects have been undertaken. However, demonstration projects are often small, time-limited and their evaluation does not always meet the rigour of scientific evaluation. (Whitten, Mair, Haycox, May, Williams & Hellmich, 2002) The literature is replete with descriptions of demonstration studies and feasibility projects but the number of programs that survive initial funding is unclear. (Doolittle & Cook, 1999; Hersh et al., 2001; May, Gask, Atkinson, Ellis et al., 2001) There is little evidence that telemedicine has been diffused as a routine, sustained health care delivery method. (Barlow, Bayer & Curry, 2003; Hakansoon & Gavelin, 2000; Hersh et al., 2001; Doolittle & Cook, 1999; May et al., 2001; Wootton & Hebert, 2001) Given the evolution of telemedicine, it is

premature to assess whether it will be widely adopted and integrated into routine health care delivery. (Sicotte & Lehoux, 2003)

Quantifying the current utilization of telemedicine is difficult, although it is known that the number of telemedicine programs is increasing. (Doolittle & Cook, 1999) Overestimating telemedicine use is likely, however, since the recent proliferation of telemedicine programs belies the actual number of health care services that were delivered. Regardless of the description of program success, the number of services delivered through telemedicine is less than anticipated. (IOM, 1996; Wallace, Haines, Harrison, Barber et al., 2002) Thus, utilization statistics should not be extrapolated from the program statistics. Consultations conducted with physicians and patients in a real time interaction are uncommon as most teleconsultations are restricted to physician participants. (Jaatinen, Firsstron, & Loula, 2002) Even where physicians report positive attitudes toward telemedicine use is limited. (Larsen, Gjerdum, Obstfelder & Lundvoll, 2003) It has even been suggested that "sustainable telehealth" can be likened to an oxymoron. (Cradduck, 2002)

Organizational and social influences on telemedicine adoption

Organizational factors have a significant impact on the use of telemedicine programs. (Picot, 2000) Since more than one organization are required to cooperate for the achievement of care delivered through telemedicine, collaboration and interdependence of people who are employed at two or more different organizations is required. (Aas, 2002) Organizational communication even in terms of activities such as appointment scheduling is required. (Whitten & Allen, 1995) Scheduling interactive consultations can be challenging and time intensive. (Helitzer, Heath, Maltrud, Sullivan & Averson, 2003) Organizations must agree to the use of technology to facilitate the distant interaction and individual control over work methods is reduced. (Aas, 2002) This requirement for inter-organizational collaboration adds complexity to the introduction of telemedicine as an innovation. (Robinson et al., 2003) It has been shown that the requirement for

coordination across disciplines and organizational units slows the diffusion process. (Bradley, Webster, Bala, Schlesinger, Inouye et al., 2004) Also, in highly competitive health care marketplaces, the extent to which health care organizations are willing to collaborate may be limited. (Garfield & Watson, 2003)

At the individual rather than organizational level, health professionals using telemedicine must be prepared to practice in an environment where communication and interdependence are essential to success. (Doolittle, 2001) It is known that physicians have established networks of social relationships and these can influence referral choices. (Campbell et al., 2001) Telemedicine, however, can interfere with usual referral patterns and physicians may lose autonomy respecting referral decisions because the telemedicine network may schedule consultations based on specialist availability rather than referring physician preferences. This suggests that the influences on telemedicine must be considered both at the personal level and within a broader context of health care delivery in a community. (Sjorgren, Tornqvist, Schwieler & Karlsson, 2001) These organizational requirements for collaboration and reduced autonomy can change embedded roles and practices and, where this occurs, there may be physician resistance to telemedicine. (Walker & Whetton, 2002)

It has been suggested that a way to increase acceptance of telemedicine is to implement according to formal and informal communication patterns that already exist within the community for whom the network is intended. (Lehoux, Sicotte, Denis, Berg, & Lacroix, 2002) A study of the impact of telemedicine on rural physician retention showed one reason for lack of use of available telemedicine services was physicians' preferred use of local resources. (Sargeant, Allen & Langille, 2004) Telemedicine networks, however, are typically organized in a "hub and spoke" model. (Sinha, 2000) Urban centers where resources are most abundant form the hub and deliver services to spokes or rural or remote areas where resource availability and specialist diversity is limited. This delivery model has been shown to support increasing centralization of resources. (Sinha, 2000) It may thus be conjectured that the centralization of resources implicit to the configuration of telemedicine networks may have a negative influence on physician willingness to refer

patients for telemedicine specialty care. Providing physicians with a choice about participation in teleconsultations will impact their satisfaction with telemedicine. (Wakefield, Buresh, Flanagan & Kienzle, 2004)

Administrative task support such as letter writing and clinical documentation has also been suggested as an organizational way to facilitate the use of telemedicine. Even store and forward applications which require less coordination across organizations benefit from the integration of existing administrative practices such as physician reporting to minimize additional work for physicians when is used. (Houston et al., 1999) Further to the underutilization of an extensive telemedicine network in Queensland, researchers tested the hypothesis that where responsibility for the administrative tasks such as appointment scheduling was assigned to the telemedicine network provider, rather than the referring physician, utilization would increase. Regional physicians were given direct access to a telemedicine coordinator who arranged the referral, including the completion of any necessary diagnostic procedures prior to the telemedicine consultation. Study results showed that by addressing barriers arising from the point of referral, the number of referrals for telemedicine increased. (Smith, Isles, McCrossin, Van der Westhuyzen et al., 2001) Complex referral processes have also been shown in other studies to be a deterrent for physicians use of telemedicine. (Collins et al., 2004) Even uncertainty about the referral process can act as a negative influence on physician attitudes toward telemedicine. (Sargeant et al., 2004)

Telemedicine consultations are most often an additional time demand that is added to existing physician workloads. (Yellowlees, 1997) Telemedicine consultations require the specialist and, in some settings, the referring primary care physician to leave the office and travel to the telemedicine studio. Where physicians must travel for the delivery of a specialty consultation, these changes to the time and space of health care delivery result in a different set of costs as compared to in-office care. Even where that travel to the telemedicine studio is minimal, such as within the same or nearby building to the physician's office, it can act as a barrier that will limit telemedicine use. (Aas, 2002; Yellowlees, 1997) One study quotes a rural physician who reported that if the

telemedicine studio is not conveniently located within the hospital where consultations usually occur, then the "...time and effort just isn't worth it". (Helitzer et al., 2003)

Therefore, in contrast to traditional health care delivery, telemedicine health care delivery requires physicians as well as patients to bear some inconvenience of travel. The time taken to participate in a telemedicine consultation will be evaluated by each physician in terms of the negative effect on other activities such as the number of patients treated in the office. (McIntosh, Booher, Alson, Sykes, Segura, et al., 2001; Shannon, 1997; Yellowlees, 1999) The time commitment to participate in real-time consultations has been shown to act as a deterrent for physician telemedicine use. (Jones & Crichton, 1996) Lost practice time for physicians is compounded where any of the participants does not arrive at the scheduled time.

Restructuring health care delivery through the use of telemedicine, therefore, creates new costs for physicians while resolving some barriers to care for patients. (Shannon, 1997) Studies in teledermatology have shown that benefits in terms of cost and time savings mainly accrue to patients. (Burdick & Berman, 1997; Ingvarsson & Moseng, 2002) Physicians' use of telemedicine will be reflective of their evaluation of the opportunity costs for example, missed office billings, as these are compared to the benefits during a telemedicine consultation (Grigsby & Brown, 2002)

A Cochrane Collaboration Review describes telemedicine as an innovation that will have repercussions beyond the health outcome for an individual patient. (Currell et al., 2002) The reviewers state:

> Telemedicine therefore raises questions of transfer of resources from hospitals to primary care settings, accessibility and acceptability of services for patients, and major issues of education, substitution and re-skilling for health care staff.
>
> (Currell et al., 2002, p.10)

The Cochrane Collaboration Review suggests that telemedicine research must include analysis of variables specific to the fundamental change in relationships among physicians and health care delivery networks that result from its use. Social, contextual

and organizational factors must be studied separately from technology assessment. (Currell et al., 2002) Telemedicine challenges traditional views about the expectation that local capacities to deliver services should match urban centres as it supports concentrated clinical expertise most often located in urban academic health centres. A physician commenting on the notion that rural hospitals are unable to deliver appropriate care without access to urban specialists stated: "This implication insults the staff of rural hospitals without access to telemedicine, who competently handle a variety of serious conditions with outcomes equal to or better than those achieved by their tertiary care counterparts." (MacLellan, 2005)

Where patient care is delivered through telemedicine, it is often considered within a chain of care and is expected to achieve improved quality, efficiency and accessibility. (Roine et al., 2001) Thus, the integration of telemedicine services with ongoing traditional care delivery in terms of practice patterns is necessary to achieve its benefits since it is most often only one encounter within a series of health care interventions. (Hakansoon & Gavelin, 2000; Sjorgren et al., 2001) The conceptualization of telemedicine as an integral component of existing health care delivery requires understanding of existing patterns of communication and interaction so that compatible routines can be developed to encourage telemedicine use. Telemedicine can support the patient, the family physician and the specialist by providing an opportunity for all parties to communicate in a live interaction dedicated to managing the patient's health problem. (Dunn, 1998) Telemedicine project evaluations have shown that key to sustainability of telemedicine is its design as a support to existing services rather than the creation of a new, parallel system. (Barlow et al., 2003)

A re-analysis of data from qualitative studies identified organizational factors that influence the success of telemedicine to be embedded in routine health care delivery. (May, Harrison, MacFarlane, William, Mair & Wallace, 2003) Four factors were found to be necessary: a link to an agency that can direct resources and develop infrastructure; integration of telemedicine within existing structures; cohesive networks of people who can organize delivery and; integration of telemedicine clinical practice requirements into

existing practice patterns. (May et al., 2003) It has also been suggested that for the purpose of effective implementation strategies, each site must be considered as a unique system deploying its own strategies. (Stumpf et al., 2002)

Influences extrinsic to patient care but intrinsic to the practice of medicine have been identified as barriers to widespread adoption of telemedicine. (Norton, Burdick, Phillips, & Berman, 1997) One of these barriers particularly relevant to physicians is medical liability which can act as a deterrent to telemedicine use. (Lim et al., 2000) Concerns respecting licensure have been identified as a barrier to telemedicine use. (Pong & Hogenbirk, 1999) Medical liability and licensing concerns can be significant where services to patients cross regulatory borders, that is where the patient receiving the long distance service is not within the same licensing boundary as that where the consultant physician is licensed to practice. (Birch et al., 2000; Massman, Dodge, Fortman, Schwartz & Solem, 1999; Rooney, 1999) Telemedicine challenges traditional licensing models particularly where health care is delivered in an international marketplace. (Sinha, 2000) Additionally, there may be questions about whether the consulting physician has privileges at the primary care hospital where the patient receives the care that sometimes go unanswered. (Smits & Baum, 1995) How telemedicine may change physician hospital privileges and at which location the patient is registered are policy questions with particular relevance to medico-legal liability. (Smits & Baum, 1995)

Physician reimbursement is frequently identified in the telemedicine literature as one of the most significant barriers to telemedicine use. (Perednia & Allen, 1995; Grigsby & Brown, 2002; Guiterrez, 2001; Massman et al., 1999) Neither private nor public payers have customarily recognized health care delivered through telemedicine as a physician service to be reimbursed and fear of non-payment for services has been shown to inhibit physician use of telemedicine. (Bauer & Ringel, 1999) Reimbursement practices are unique to payer streams. In 2001, the American public health plan, Medicare, extended coverage to telemedicine where care was delivered through a live interaction while services delivered through store and forward technology are only paid on an exception basis. (Guiterrez, 2001)

Although this may not arise as an issue in telemedicine demonstration projects where project funding includes physician fees, this has been shown to be a barrier to telemedicine use in many instances. From a physician's economic perspective, where telemedicine consultations are not reimbursed, its advantage over an in-person visit cannot be established. (Robinson et al., 2003) Reimbursement and licensing are not reported as barriers to use in telemedicine studies completed in Norway where telemedicine as a health care delivery system is more common than in North America. In Norway, where physician licensing covers all jurisdictions within the country and physicians are paid by salary rather than fee for service, reimbursement and liability issues that can inhibit telemedicine use in North America are not evident. (Hakansoon & Gavelin, 2000)

The influence of individual characteristics on telemedicine adoption

Telemedicine is subject to influences that similarly exist within traditional health care delivery systems. (Grigsby & Brown, 2002) Human, rather than technological, factors are being recognized as having a significant impact on responses to technology. (IOM, 1996) Clinician reluctance to participate in telemedicine has been identified in many studies. (Currell et al., 2002) However, the influences on rural physician acceptance of telemedicine have not been widely studied. (Aas, 2002; IOM, 1996) Physician perceptions of telemedicine have been reported as ranging from an opportunity to improve health care delivery, a nonessential technology, and, a threat." (Campbell et al., 2001) It has been stated that change management is more important to utilization than technology. (Cradduck, 2002)

Professional resistance to the introduction of telemedicine is evident. (Eedy & Wootton, 2001; Yellowlees, 1999)

Telemedicine requires health care professionals willing to use it. (McIntosh et al., 2001) This dependence on physician attitudes has led to the study of physician demographics that may influence willingness to use telemedicine. It has been shown in some studies that physician age and years since graduation are significant predictors of continued use of telemedicine by primary care physicians. (McIntosh et al., 2001) Younger primary care physicians typically have less developed referral networks and thus use of the telemedicine organized consultant does not create an interpersonal or organizational conflict. (McIntosh et al., 2001) Additionally, younger physicians may perceive greater benefit from the educational opportunity provided in a telemedicine consultation. (McIntosh et al., 2001)

However, other studies have shown different results with respect to the influence of individual characteristics. For example, a study that assessed the characteristics of physicians who made referrals to a telemedicine program in North Carolina showed that referring physicians could not be distinguished from the general physician population on the basis of age or sex. (Gustke et al., 2000) A Norwegian study found that age was not correlated with perceived usefulness or attitude toward telemedicine. (Aas, 2000)

Some of the resistance to telemedicine use is attributable to physician comfort with new technology. (Burdick & Berman, 1997; Campbell et al., 2001) One study found that physicians were resistant to telemedicine because they were unfamiliar with the equipment. (Brauer, 1992) It has been shown that even where general physicians are positive about telemedicine, use is limited by lack of confidence using the technology even where it is not considered to be complex. (Larsen et al., 2003)

Of particular relevance to the teledermatology study, a mailed survey was used to evaluate whether those physicians who agree to participate in telemedicine trials are representative of all physicians in terms of exposure and attitude towards information technology. (Snowden, Harrison, & Wallace, 2001) Data on two groups of family physicians were collected. The first group was comprised of physicians who positively responded to an invitation to participate in a telemedicine trial. The second group of

physicians was identified through a random number table and acted as a control group. Similarities between groups in terms of demographic characteristics and attitude toward computer use were stronger than identified differences, and it was noted that differences were specific to the location of practice rather than an individual characteristic. Those physicians in the telemedicine trial group were found, however, to be more positively biased towards the use of computers for research and training and the investigators conclude that physician attitude toward research and training may be a better predictor of telemedicine use than attitude toward technology itself. (Snowden et al., 2001) and a belief that face-to-face consultations are preferable. (Sargeant et al., 2004)

Incentives for telemedicine adoption from a physician perspective

Sustaining telemedicine may require compelling incentives for rural physician participants who are most often the gatekeepers to telemedicine use. (Grigsby & Brown, 2002) Incentives for primary care physicians may include learning from specialists and the availability of continuing medical education opportunities. (Grigsby & Brown, 2002) Telemedicine sessions have been shown to have a positive educational impact for family physicians. (Burdick & Berman, 1997; Ingvarsson & Moseng, 2002) Relationships with consultants through telemedicine have also been shown to reduce a remote physicians' sense of isolation. (Burdick & Berman, 1997)

Studies that have surveyed physician attitude after participation in telemedicine have shown that physicians generally hold positive views. A comparison of face-to-face and teleconsultations with dermatologists in the United Kingdom showed that general practitioners found that 75% of teleconsultations were of educational benefit and rated the teleconsultation as a valuable experience. (Gilmour, Campbell, Loane, Esmail et al., 1998) Similarly, results of a survey of referring physicians in an American military telemedicine program showed that the dermatological store and forward consultations had led to an improvement in their dermatological knowledge. (Pak et al., 1999) A Canadian telemedicine feasibility study showed that the referring physician regarded the interactive telemedicine consultation as a valuable continuing medical education

experience not only in terms of clinical skills but knowledge, attitude and judgement. ((Davis, Howard & Brockway, 2001) Further research specific to the impact of physician learning on telemedicine adoption has been recommended. (Robinson et al., 2003)

There is a widespread erroneous belief that the mere availability of telemedicine will lead to its acceptance and successful use. (Yellowlees, 1997) Others have recognized that telemedicine networks need to create incentives for use. (Sjorgren et al., 2001) Although telemedicine locations are typically selected based on service need, it has been suggested that site selection should reflect local physician interest in using telemedicine. (Yellowlees, 1997)

Evaluation of telemedicine outcomes

There is increasing research focus on the evaluation of telemedicine outcomes. Evaluation studies each uniquely define the indicators of telemedicine success but costs and quality of care are commonly used as measures of positive outcomes. Other indicators of success include acceptance by clinicians, sustainability of the telemedicine network and, routine and frequent use for the delivery of health care. (Wootton & Hebert, 2001)

A study of the comparative costs between conventional outpatient consultations and live teleconsultations in the British National Health Service was undertaken. (Jacklin, Roberts, Wallace, Haines et al., 2003) The results showed that the mean cost per patient was higher where consultations were delivered through telemedicine. Anticipated savings such as reduced costs of additional health care were not demonstrated, although there were costs savings for patients. An American study at a regional burn centre that used telemedicine for follow up visits showed that while patients saved on travel costs, the cost of telemedicine was high particularly given the lost billings for health professionals who were not reimbursed by a third party payer. (Nguyen, Massman, Franzen, Ahrenholz et al., 2004) Although the authors suggest that the lack of cost savings may reflect the

initial cost of the technology installed for the study, their results suggest that economic benefits for payers of health care likely do not exist. (Nguyen et al., 2004)

Despite this interest in cost and quality, research-based conclusions about the effectiveness and cost effectiveness of telemedicine are difficult to make. (Roine et al., 2001; Whitten, Kingsley & Grigsby, 2000) As noted earlier, telemedicine research suffers from weak methodologies that make empirically supported statements difficult to achieve. (Hersh et al., 2001; Mair et al., 2000) Instead, the telemedicine literature often reports opinion rather than scientific evidence. (Yellowlees, 1999) One critic has described telemedicine evaluation literature as "...an expansionist and evangelical body of literature aimed at stabilising and normalising a field to techniques and technologies of clinical practice in the face of substantial political and methodological problems." (Williams, May, Mair, Mort & Gask, 2003) It is suggested that telemedicine evaluation has failed to meet methodological standards both with respect to clinical outcomes and technical evidence. Nonetheless, there is a push to extend telemedicine services and physician payment for services delivered through telemedicine even in this absence of certainty with respect to the costs and benefits. (Hersh, et al., 2001) Concern has been expressed that commercial motivation may influence the development of telemedicine prior to the availability of evidence about its cost effectiveness. (Guiterrez, 2001)

The lack of well-designed outcome trials in telemedicine results from many factors. Many studies have been limited by the small number of patients treated through telemedicine. (Currell et al., 2002) Telemedicine initiatives often proceed based on the influence of a committed leader rather than an a priori establishment of a clinical need thereby rendering pre-established outcomes expectations impossible. (Hersh et al., 2001) A clinical need for telemedicine services should be a prerequisite to implementation. (Doolittle, 2001) However, reliance of telemedicine implementation plans on individuals who are already committed to telemedicine can restrict its use more broadly as other physicians do not perceive a need for this service. (Currell et al., 2002)

In the Cochrane Collaboration Review, the literature regarding the impact of telemedicine is summarized. (Currell et al., 2002) The reviewers' objective was to assess the effectiveness of telemedicine as compared to face-to-face patient care with respect to the patient health outcomes, differences in professional practice during the delivery of care, economic measures, acceptability of care from the patient perspective and, the transfer of skills between clinicians. Although more than 200 studies were identified and 24 met the inclusion criteria, only 7 randomized controlled trials were eventually included and 5 of those trials were specific to the use of technology by patients who were receiving care in their homes. Most of the excluded studies were purely descriptive or feasibility studies.

The reviewers conclude that there is very little evidence of clinical benefits and inconclusive results with respect to the other outcome measures within the scope of their review. They state:

> The implementation of telemedicine systems could have a major impact on the organization of health services and service delivery and administration, but these factors, together with the cost implications, have been largely ignored.
>
> (Currell et al., 2002)

It is suggested that the criteria used to evaluate telemedicine should thus be reconsidered in recognition of telemedicine as system-wide intervention with implications for the health care delivery beyond the individual clinical encounter. (Currell et al., 2002)

Other systematic reviews of telemedicine have declared similar findings. For example, studies of the cost-effectiveness of telemedicine are accused by their reviewers as being poorly designed and with such serious methodological weakness that conclusions cannot be drawn. (Mair et al., 2000; Roine et al., 2001; Whitten et al.,2000) Similarly, systematic reviews of patient satisfaction studies identify methodological weaknesses that limit the generalizability of findings, notwithstanding that almost all studies report that patients are satisfied with their telemedicine experience. (Allen & Hayes, 1996; Mair & Whitten, 2000) Differences in telemedicine technique and equipment, patient diagnostic groups, and outcomes across studies make it very difficulty to combine the data to enable the completion of a meta-analysis. (Hersh et al., 2001) One attempt at a meta-analysis of

cost-benefit research concluded that few well-designed studies, in combination with problems in design and methods, rendered meta-analysis impossible despite the existence of more than 500 relevant citations. (Whitten et al., 2000) In many studies it can be difficult to discern what service is described. (Doolittle & Cook, 1999) Conclusions across reviews repeatedly identify that further study is required specific to cost effectiveness, patient outcomes, patient satisfaction and acceptance by physicians. (Whited, 2001)

Telemedicine studies that have achieved reasonable methodological standards have been able to evaluate whether the particular application being tested results in the delivery of effective health care. For example, randomized controlled trials have demonstrated that some patients can be managed wholly by the primary care setting further to a telemedicine consultation. (Loane et al., 2000) Telemedicine consultations can accelerate specialist decision making and improve continuity of care. (Sjorgren et al., 2001) In comparison to the early telemedicine literature where technological failures were commonly cited, based on the literature published within the last five years, it is reasonable to conclude that telemedicine technology is sufficiently effective to enable the delivery of care. (Hersh et al., 2001) However, this is both theoretically and practically different from demonstrating the effectiveness of telemedicine as a health care delivery system. A patient can receive effective care through a telemedicine consultation that enables the local physician to continue to care for the patient in the community. But, there is uncertain evidence of effectiveness of telemedicine networks as compared to care delivered through face to face interactions. (Hersh et al., 2001)

Recently, there have been more randomized controlled trials in telemedicine. (Gilmour et al., 1998) However, the methodological weakness of telemedicine research will have an impact on its integration into health care delivery. Given the international movement toward evidence-based health policy decision making, methodological rigour is required or telemedicine will continue to be limited by the weakness of its research and outcome evaluation. (Williams et al., 2003) Telemedicine outcome evaluation needs to include

measurement of cost-effectiveness and physician willingness to integrate this technology into their practice.

Conclusions

The telemedicine literature review yields four key conclusions. First, telemedicine can enable an alternative to a face-to-face health care visit that provides effective health care. While there is scientific debate about the indicators of effectiveness and how these should be measured, there is general agreement that the technology can enable a successful clinical intervention at a distance.

The second conclusion is that telemedicine is not a mainstream method for delivering health care, even where sophisticated networks have existed for some years. In North America, telemedicine typically continues to hold the status of an innovation. Telemedicine networks, though increasing in number, do not always deliver the number of services that are expected or imagined by its funders.

The third conclusion is that the barriers and facilitators of utilization are not well understood, with the downstream impact that strategies to increase its acceptance and use are poorly developed. The capability of the technology to exchange information more quickly and with greater accuracy is developing, but this is insufficient to address the social, organizational and individual factors that appear to be inhibiting its successful integration into health care practice. While much knowledge has been acquired with respect to the technology itself, such as the effect of bandwidth, much less is known about the human dimensions that will enable telemedicine to have a positive impact on the delivery of effective care. (Eedy & Wootton, 2001; Mair & Whitten, 2000) Understanding the human influences on telemedicine adoption is required to promote more widespread use. (IOM, 1996) Human factors, organizational and social system issues must be addressed before telemedicine can become integral to health care delivery. (Grigsby & Brown, 2002)

The fourth conclusion is that telemedicine literature is its infancy in terms of methodological standards. The telemedicine literature has been widely criticized for its lack of methodological rigour. A repercussion of this absence of well-designed scientific studies is the conflict between a wealth of practice-based knowledge and a dearth of scientific-based knowledge about the adoption of telemedicine.

Table of Contents

Chapter 4

Teledermatology Study Methods

Chapter 4

Teledermatology Study Methods

The purpose of the teledermatology study is to understand the influences on physician attitudes toward the use of telemedicine. How do physicians perceive telemedicine and how do these perceptions influence their attitudes toward the use of telemedicine for the delivery of patient care? The teledermatology study uses a practice-based approach where teledermatology sessions combine the delivery of patient care and physician participation in patient consultations as a physician education experience. This integration of health care delivery with a physician education session as implemented specifically by the teledermatology study reflects the scientific evidence that interactivity between family physician and specialist during telemedicine can be of educational benefit. (Gilmour et al., 1998) The combination of these two physician-based purposes, dermatological care delivery to one's own patients and dermatological education regarding self-identified topics is a unique approach to telemedicine instituted by the teledermatology study for the purpose of this research. To study the influences on physician attitudes toward telemedicine, the investigator implemented the teledermatology sessions that would not have otherwise been available through this telemedicine network at the time of the teledermatology study.

This chapter begins with a description of the telemedicine network and technology that was used in the teledermatology study. It includes the background to the development of the telemedicine network in Ontario. This is followed by a presentation of the rationale for research design choices followed by discussion of sampling, data collection and data analysis in the teledermatology study.

It was proposed in Chapter Two that innovation attributes as these have been variously described can provide a useful theoretical framework to explore family physicians' perceptions of telemedicine. Methodologists have considered the role of theory in the design of case study research. (Yin (a), 2003) Conceptualizing theory as a blueprint for case study design, theory development prior to data collection is an important step. (Yin

(a), 2003) "Reliance on theoretical concepts to guide the design and data collection for case studies remains one of the most important strategies for completing successful case studies...One purpose served by such concepts, as in any other empirical study, is to place the case study in an appropriate research literature, so that lessons from the case study will more likely advance knowledge and understanding of a give topic. (Yin (a), 2003, p3) Accordingly, the role of existing theoretical concepts in structuring inquiry without fettering creativity during data collection and analysis is acknowledged in the development of the teledermatology study methods.

The Telemedicine Network and Technology

All of the teledermatology sessions were conducted using the Northern Ontario Remote Telecommunication Health Network or NORTH Network, which is a telemedicine program of Sunnybrook and Women's College Health Sciences Centre in Toronto, Ontario. The NORTH Network connects urban and remote sites in five regions of Ontario through an Internet Protocol videoconferencing. Launched in 1998, the NORTH Network delivers the technical capacity for continuing medical education (CME), patient education and specialist consultations using video conferencing.

Objectives of the NORTH Network project were reported to include:

- Improved access to specialty care
- Reduced costs associated with long distance travel
- Increase access to CME
- Reduced professional isolation

and the initial sites were Kirkland Lake, Cochrane, Timmins and Toronto. (NORTH Network (a), 2003) By 2006, there were more than 100 NORTH Network telemedicine-enabled communities in Ontario. (http://northnetwork.com/northlocations.shtml)

The study dermatologist provided consultation services for all teledermatology sessions using the technology of the NORTH Network at a telemedicine studio located in Toronto, Ontario. In 2003, it was reported by NORTH Network that the largest number of consultations conducted using telemedicine was in dermatology. Other high use specialties were psychiatry and pediatrics. (NORTH Network(a), 2003)

Physician payment for care delivered through the NORTH Network was addressed. Specialists receive payment directly from NORTH Network since a telemedicine consultation is not currently a service recognized under the Ontario Health Insurance Plan Physician Schedule of Benefits. In the absence of a provincial fee schedule, fee for service physicians, including family physicians may bill NORTH Network directly at the time the telemedicine service is provided.

The NORTH Network has attempted to preserve existing referral patterns to the extent possible. (NORTH Network(b), 2003) Patients are referred to specialists in their usual referral centre, except where these specialty services do not exist. Where this occurs, patients are referred to larger urban centres. A standardized referral form was implemented by NORTH Network for use across Ontario. It requires information about the reason for referral, history and management of the problem and patient medication use. The referral form is forwarded to a central scheduling office where all appointments are booked.

The telemedicine equipment used to conduct the teledermatology sessions in all locations was a videoconference unit that functions similarly to a television set. A remote control activates the videoconference unit and makes the connection with the telemedicine network. Each remote site used the same general examination camera. It is used during videoconferencing where a detailed examination is required. It is hand held with controls on the camera. Additionally, a 50X zoom lens was sometimes attached to the general examination camera to enable even closer examination.

Study design

Development of a study design must reflect a rationale for choosing one approach over another with specific considerations that must be addressed. These considerations include: the nature of the research question; the existence of well defined theoretical constructs that explain the topic under examination; the breadth and depth of examination; the desire for generalizability to a variety of settings and; the setting for data collection. (Creswell, 1998)

Given the teledermatology study research questions that seek to understand the influences on physicians' attitudes toward telemedicine, the preceding considerations lead to a strong rationale for a qualitative study. While there are well-established theories regarding innovation adoption as shown in Chapter Two, a comprehensive theoretical model to explain physician use of telemedicine as a specific innovation does not exist. Also, the phenomenon under examination, physician perceptions before and after their participation in teledermatology sessions where care is delivered to their own patients, requires a research design that will enable in depth examination of physicians' attitudes and behaviour. Thus, data collection should occur within the natural setting of patient care delivered through telemedicine and encompass consideration of physicians both individually as well as within the larger operational and social system within which they practice. Methodologists have stated: "...qualitative methodologies refer to research procedures which produce descriptive data: people's own written or spoken words and observable behavior. This approach...directs itself at settings and the individuals within those settings holistically...". (Bogdan & Taylor, 1975) Given these considerations, the first study design decision is that a qualitative research design is best suited to the purpose of this study.

The next consideration is the identification of a specific qualitative design since alternatives such as ethnography and case study have implicit features that must be matched to the conceptualization of the research problem. A case study research design is selected based on indicators for its use: "...case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over

events, and when the focus is on a contemporary phenomenon within some real-life context." (Yin (b), 2003) These three indicators for a case study design are present in the teledermatology study as explained below.

First, the nature of the research question is consistent with case study design. As shown in previous chapters, telemedicine has gained funding and support in Canada based on beliefs that telemedicine can resolve issues of timely and equitable access to health care that confront the health care system nationally. However, it has also been shown that telemedicine use is much less frequent than anticipated and scientific understanding of the influences on physician adoption of this technology is limited. Therefore, this study seeks to answer questions related to why physicians are willing or reluctant to adopt telemedicine and how their perceptions of telemedicine may be influenced by trial use of telemedicine. It has also been suggested that when the focus of the research is the introduction of technology, case study is an appropriate study design: "Interpretative case study is a recommended method when the researcher is seeking to understand an emerging process of organizational transformation through IT." (Linderoth, 2002)

The second case study indicator, the researcher's lack of control in the study situation, is unmistakable. While the study introduced the teledermatology sessions into the physician community, physician agreement to participate and subsequent actual participation is beyond the investigator's control. Notwithstanding expressed intentions to participate, competing demands on family practice physicians' time in remote and underserviced areas means that physician participation is beyond the researcher's control. (Ironically, physicians in the most underserviced area who may most benefit from the access provided by the teledermatology sessions experience the greatest logistical challenges to their attendance.) The unpredictable and urgent demands for physician services such as emergency operative procedures rendered commitments to events such as the teledermatology sessions secondary to urgent patient care demands. The researcher did not control physician participation, the cases that physicians selected for teledermatology consultation, patient attendance at the scheduled appointment or the technological adequacy of the teledermatology examination. This study occurred in a

natural environment beyond research control thereby enabling observation of the phenomenon under examination in a real life context.

The third indicator for the use of a case study, when the topic under examination is contemporary, is also characteristic of the teledermatology study. It is a study of events within their real-life context. Prior to the study, all of the physicians had access to telemedicine networks in their local community that they could use for the delivery of patient care. Only referral to the telemedicine network was required and the referral forms had been provided by the telemedicine network to each physician's office. However, physician study participants had not chosen to utilize telemedicine for their patients' care. The teledermatology sessions organized by reason of this research study are introduced within the reality of the practice environment unique to each case. The teledermatology sessions deliver real time health care to real patients with health care needs using an existing and available technology.

In summary, based on the nature of the study questions, control of study events and, contemporariness of the research case study is identified as the appropriate design for the teledermatology study.

The next consideration is enriching the study design through the use of replication logic, a strategy to enhance the reliability of study findings. Where a literal replication is sought, cases are selected based on the expectation of similar results (Yin (b), 2003; Bryman, 1988) The replication logic applied for case selection was based on the expectation that, where subject to a consistent sampling strategy, the influences on physician attitude toward telemedicine in three separate geographically-based communities would be similar. Beginning with one case, conceptual validity would be developed through the introduction of additional cases with similar characteristics thought to be relevant to the research questions.

Based on the theoretical models outlined in Chapter Two, it was expected that physician participants in each case study would demonstrate similar attitudes toward telemedicine. This expectation was also based on the homogeneity across family physician populations

with respect to technological innovation adoption as shown in the literature review in Chapter Three. Therefore, although it was recognized that multiple communities would present differences such as the number of family physicians, the size of the patient population and, access to dermatology services similarities were expected with respect to the study questions of physician attitude toward telemedicine. Successive cases in the study are examined with respect to the findings from the previous case to identify any patterns across cases.

Thus, it was decided to use a multiple case study design in which single cases would be identified and together they would constitute a multiple case study design. This is an embedded multiple case design since each of the cases would collect the same data using the same data collection methods. It is concluded that three cases would be completed based on the view that data collection from three separate and distinct communities of physicians would provide robust data that would enhance understanding of the influences on each group of physicians with respect to care delivered through telemedicine. Three cases also present a feasible data collection and analysis venture for a solo investigator.

Some methodologists argue that more cases have the potential to 'dilute' the analysis of findings since more cases can reduce the depth of analysis. (Creswell, 1998, p63) Others suggest that external validity beyond the singular case can be enhanced through a multiple case study strategy. (Yin (b), 2003) Multiple cases can add confidence to a study's findings. (Miles & Huberman, 1994) Regardless of case number, qualitative methodologists caution that multiple cases do not address criticisms about findings' generalizability. Literal replication logic reflects exploration of a single conceptualization of an issue. This is in contrast to methods that seek to sample a divergent universe of settings with broader generalizability. (Miles & Huberman, 1994) Multiple cases selected with the intent to achieve literal replication may heighten confidence in the validity of the finding. (Eisenhardt, 1989)

There is some evidence that the facilitators and barriers to innovation adoption maybe specific to a profession such as medicine. (Chau, 2001) Influences on other professionals who frequently participate in telemedicine programs such as nurses or

hospital administrators may similarly be profession specific. Thus, other professional groups are excluded from the study. It is plausible that within the profession of medicine itself, the influences on use of telemedicine may be different based on practice specialty. For example, medical specialists who are often the deliverers of telemedicine services may have different perceptions of telemedicine from family physicians whose patients most often receive telemedicine services. Also, within the specialist community there may be differences in perceptions of telemedicine based on the nature of the specialty which may be considered as better or less suited to telemedicine as described in Chapter Three. Accordingly, specialist physicians are also excluded from the study and only family physicians are considered as eligible for study participation. Defining the study population in this manner reduces potential variation in findings that is based on variables that are extraneous to the family physician focus of the study. It also more clearly establishes from the outset the circumstances in which study findings may be relevant as study population selection contributes to limits in transferability. (Eisenhardt, 1989, p537)

Qualitative methodologists have noted that a case must be bounded in place or time with contextual information about its setting. (Creswell, 1998) In this study, the case is defined both by place and time. The place parameter of each case is established as a small group of family physicians within a geographic boundary that is defined by their delivery of health care to a geographically defined community such as a town or city.

With respect to the time parameter, telemedicine for the delivery of patient care had been established in each of the case study settings prior to the initiation of the study. Similarly, further to study completion, telemedicine continues to be available in these communities. Thus, the definition of the time of the study is unrelated to the introduction or availability of a telemedicine network. The researcher arbitrarily sets the temporal boundaries for each case. (Creswell, 1998) In this study, each case is formally recognized as commencing with the letter that introduced the teledermatology study to the geographically based physician community. The study itself continued until the completion of physician interviews further to the final teledermatology session. This identification of the beginning of the study acknowledges that the first contact with the

physician community through the study invitation may itself have an impact on the physician perceptions of telemedicine. While the events that mark the temporal beginning and end of each case are identical, the elapsed time for the study is unique to each case as it reflects the time that was required to initiate and conduct the multiple teledermatology sessions. The range of elapsed time within each case is from six to eight months.

The unit of analysis is the aggregation of individual physicians into a geographical case. Individual physician participants are a source of data, but the unit of analysis is the case, which includes all of the data collected directly from physicians as well as through other data collection methods. Qualitative research typically involves "...small samples of people, nested in their context and studied in-depth..." (Miles & Huberman, 1994, p27) This is an accurate depiction of the teledermatology study.

Overall, the study design is consistent with the research questions that include individual, social, and organizational influences on physicians' attitude toward care delivered through telemedicine technology. Methodologists focused on medical informatics advocate the use of non-experimental designs where investigations explore questions of why a technology is or is not used. (Kaplan, 2001) The study design is also consistent with the commentary in the telemedicine literature that there is a need for pragmatic telemedicine study designs that enable the collection of experiential rather experimental data that informs knowledge about telemedicine processes rather than telemedicine outcomes. (Finch et al., 2003) The interplay of influences on system users, such as those studied in the teledermatology study, requires a study design that enables the deep understanding that can be achieved through case study. Case study has been shown to be an effective design where examination of the conditions required for the integration of telemedicine into clinical practice by physicians has been completed. (Sicotte & Lehoux, 2003)

Case and participant selection

A purposeful sampling strategy is selected. This requires the specification of criteria for study inclusion based on a rationale consistent with the study purpose. (Creswell, 1998, p.118) In this study, this purposive approach is applied to the selection of each case location with criterion being established for individual participants. Three communities of physicians, as defined by their geographic location, are purposefully identified for study. There are key similarities across case studies. The first similarity is that each community had a hospital-based telemedicine studio using the same technological network thereby avoiding differences in the nature of the technology itself or the administrative processes by which referrals could be made and the telemedicine specialists could be accessed. The second similarity is that each case is a northern Ontario community underserviced for general/family practitioners and specialist services as designated by the provincial government. (Ministry of Health and Long Term Care of Ontario, 2002) The third similarity is that each community had previously identified a need, either to the study dermatologist or to the telemedicine network, for better access to dermatological services including wound care services as a subset of dermatological services. The three cases are labelled as Case Study 1, 2 and 3.

An obvious difference across cases is access to dermatology specialty services. This ranges from no local access to a dermatologist, access to a monthly visiting dermatologist and access to a local, full time dermatologist. Case placement on a continuum of access to dermatology services is consistent with population size as the smallest community has the most limited access. Despite these differences in availability of specialty services, all communities demonstrate a need for greater dermatological services to meet the needs of their patient population.

Study participants are not identified through a random process. Instead, a criterion sampling strategy is applied to the identification of a participant population, which first requires that physicians practiced family medicine within one of the three case study locations. Additional criteria are that participants must: be family physicians with no experience using telemedicine for the delivery of health care; be aware that telemedicine

is locally available; refer and present one patient at a teledermatology session and; participate in an individual interview prior to and subsequent to participation in the teledermatology sessions.

Obtaining physician participation in unpaid research such as this study is challenging. Therefore, all physicians who self-nominated to be an unpaid participant and met the sampling criteria are accepted into the study. While it is acknowledged that this sampling strategy can be detrimental to the credibility of the study's findings since it introduces a potential for selection bias, it is the most plausible sampling approach to enable the study to proceed. Study results are tempered with a caution, however, that reflects the potential for bias that accompanies this sampling approach.

To facilitate the distribution of the study invitation to potential participants, a local 'gatekeeper' approach was used. Common to case study methods, the gatekeeper has been used as a method to obtain access to the study group. (Creswell, 1998) The gatekeeper is the initial contact with the case who assists the researcher to identify study participants. Gatekeepers can be used most productively when they receive information from the researcher such as why the case site was selected, the time and resource commitments for participants, the study methods and how the results will be reported. In the teledermatology study, a local gatekeeper is identified and used to facilitate access to the study community. In each case this function is performed differently and with differing impact on participant recruitment and is thus described in detail in the case descriptions that follow.

In conclusion, all of the methodological decisions made during the planning of the study are reflective of the study purpose and research questions. These decisions themselves lead to new and interrelated study questions as the study proceeds. For example, where differences across the three case studies may be observed, can these differences be explained by any social, organizational or cultural idiosyncrasies that exist irrespective of telemedicine? Where case specific influences are revealed, is telemedicine adapted by local users to enhance the relative advantage specific to local contextual factors? The utilization of a case study design that enables flexibility and changes to interview

protocols as new information emerges with successive interviews and includes a variety of data collection methods has been shown to be well suited to a research question that includes organizational, behavioral and clinical context considerations. (Kaplan, 2001) Alteration to data collection such as additional questions in an interview protocol enable the researcher to maximize opportunities to generate information in the live case study context. (Eisenhardt, 1989)

Research Ethics Board Approval

The study protocol reflecting these methodological decisions was submitted for ethical review. It was accepted for a one-year duration. Appendix 2 is the study invitation that was approved by the Research Ethics Board for distribution to physicians as an invitation to participate in the study across the three communities.

In Case Study 1, it was determined that since some physicians invited to participate in the study practiced in a group health centre that had its own Research Ethics Board, a local ethics review and approval was also required prior to study commencement in this location. Similar documentation was provided for the local ethics review and approval to proceed without modification was received from the local Research Ethics Board.

Instrumentation and Physician Interviews

Reflective of the study purpose, which is specific to understanding the influences on physicians with respect to telemedicine use for patient care, a data source that would enable an in depth and intensive examination of a small number of physicians is required. Such in-depth data could be obtained through interviews and individual interviews with family physicians in each case is selected as the principal data source. This approach is confirmed by a study that analyzed different methods to assess physician satisfaction with telemedicine and its results that irrespective of study design, physicians must be engaged in person rather than through a mailed questionnaire when studying their views of

telemedicine. (Kennedy, Johnston, Taylor & Murdoch, 2003) This finding supports the use of in person interviews rather than survey tools with this study population in the context of telemedicine.

Rogers' innovation attribute of trialability is operationalized in this investigation. Trialability is the ability of an individual to test or experiment with the innovation on a limited basis and Rogers suggests that the opportunity to experiment with an innovation is positively related to its rate of adoption. (Rogers, 2003) In this study, physicians who had never previously used telemedicine for the delivery of patient care are sought as participants thereby permitting data collection prior to their 'trial' of telemedicine so that their naïve views can be obtained. The perceptions of study participants both before and after their telemedicine trial provides information about the impact of the trial thereby exploring whether trialability is a relevant innovation attribute to understand the influences on physicians. It is also anticipated that through a post-trial interview focused on any changes in perceptions, participants' assumptions about telemedicine prior to use may become even more evident. Thus, the study includes at least two interviews for each physician participant.

An inductive approach is used to develop the topics used to guide the interviews. There are two guides to be developed, one to be used in physician interviews prior to the teledermatology session and, a second guide for physician interviews subsequent to their participation in the teledermatology sessions. The interview guide development began with consideration of the theoretical models respecting diffusion of innovations as described in Chapter Two. Key findings and themes culled from the telemedicine literature as described in Chapter Three were also considered. For example, medico-liability was frequently identified in the telemedicine literature as a barrier to telemedicine use and hence is included within the interview guide as a topic to be explored with physicians.

In the teledermatology study, a non-financial incentive is used to encourage physician participation. Family physicians are eligible for Mainpro® credits which are conferred by the College of Family Physicians of Canada. (College of Family Physicians of

Canada, 2004) The interview guide promotes discussion of the impact of this incentive on participation in the teledermatology sessions.

Information obtained from key informants in telemedicine networks in Ontario is then used to reconsider the focus, and then to refine the interview guide. This verification method for interview guides has been described in a study of characteristics of successful telemedicine programs. (Moore, 2000) Key informant discussions are unstructured and informal and seek to attain a wide-ranging discussion with informed telemedicine administrators who may provide insight into the topics to be included in the physician interview guides. A hospital-based telemedicine coordinator in Toronto located at the site from where the teledermatology consultations would be delivered and staff at the telemedicine network is interviewed. Key informant descriptions of issues that they had observed related to physician adoption of telemedicine and the initiatives that they had implemented to increase physician utilization are used to refine the list of topics for inclusion. With the information obtained from these discussions, a first draft of a physician interview guide is developed.

In its next iteration, theoretical frameworks as outlined in Chapter Two are once again considered to achieve interview guide refinement. For example, to assess the innovation attribute of relative advantage over the status quo, the interview guide begins with an exploration of physicians' existing needs for dermatology services and the match between their perceived need for dermatology consultations and available resources. To maximize the robustness of the interview guide, clarifications and enhancements of Rogers' innovation attributes as described in Chapter Two led to the inclusion of the dimensions of result demonstrability, visibility, perceived voluntariness, and image.

With the guide almost complete, a final step is initiated that includes review of existing interview protocols reported in the literature and germane to the study questions. These are obtained either through the information that is included in published articles or through direct contact with the study investigators who provide the interview guides that had been employed in these studies. Review of these interview guides are instructive and lead to revisions to the teledermatology interview guide. Although new substantive

issues for inclusion were not identified, additional open-ended questions thought to yield physician insights are identified and included. Further to content specification, a small pre-test is conducted to determine the practicality and flow of the interview guide prior to completion of this step. As noted earlier, the interview guides are presented in Appendix 1.

The interview guide provides an initial point for discussion with study participants. Developed to structure discussion, it was not 'administered', but rather used to facilitate discussion and to ensure that all conceptual domains are explored by the completion of the interview. While this degree of instrumentation may be uncommon in qualitative research, it has been noted that this may be appropriate, particularly in a multiple case study where cross-case comparison is envisaged. (Creswell, 1998) Additionally, since obtaining physician participation in interviews is difficult, it is essential to have an efficient method to collect interview data particularly where one intends for a further interview to occur at a later date. Physicians must perceive the interview data collection to be an efficient use of their time for researcher credibility to be established to enable a subsequent interview. To balance the structure of the interview guide, each physician interview is intentionally brought to closure with a question designed to evoke an unstructured response. The final interview question is "To optimally meet your needs, telemedicine should.....(complete the sentence)". It was identified as a useful question and added to the interview guide further to review of an interview questionnaire from another telemedicine study. (Lehoux, Sicotte, Denis, Berg & Lacroix, 2002) Latitude to uniquely determine the nature and sequencing of questions for each participant enhanced the use of the interview protocol to maximize discussion that was led by the participant, not the researcher.

The interview guide itself sometimes leads to other probing questions that emerge during the course of the interview as participants describe important considerations that had not been captured in the interview guide. As these are identified, they are incorporated into interviews with subsequent participants both within and across cases. Additionally, consideration of data emerging from the teledermatology sessions in terms of refinement of the theoretical concepts is used to modify data collection in subsequent cases. Again,

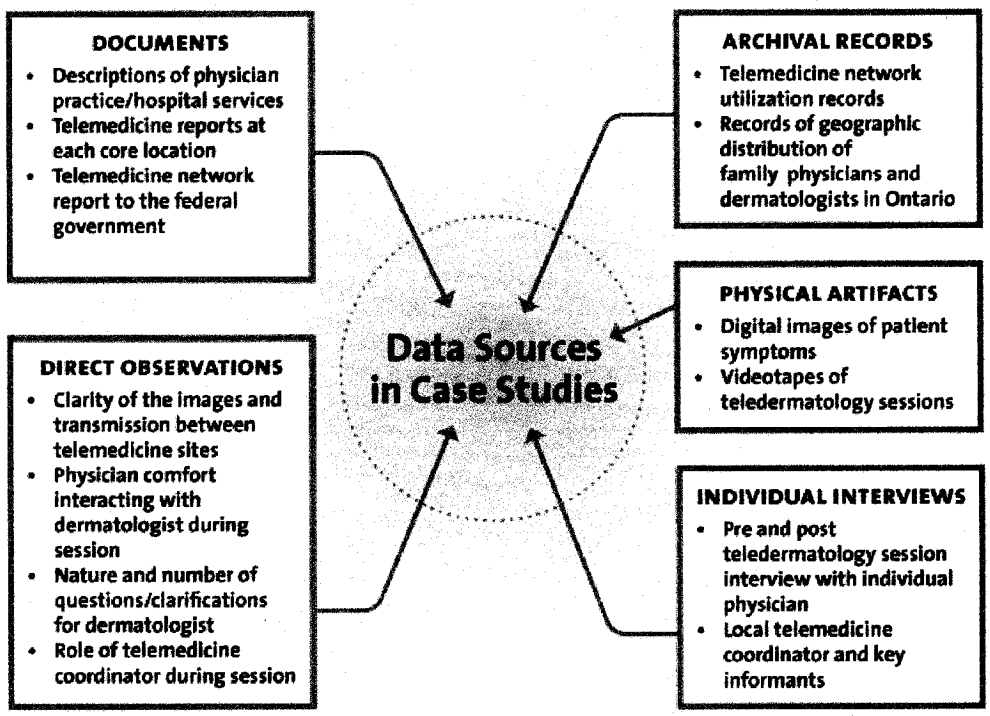
this is a methodological step that has been recognized as a viable strategy to enrich theoretical considerations for data collection. (Glaser & Strauss, 1967) The same interviewer conducted all of the physician interviews which eliminates risk of data analysis inconsistencies related to inter-interviewer variability.

Interviews and discussion with others in the telemedicine network are also conducted prior to and throughout the research study timeframe. These discussions are for the purpose of information collection that may corroborate other data collected and provide helpful contextual information. These discussions do not follow an interview guide and are not audiotaped. Summary notes are made during and subsequent to these discussions with these informants.

Data Collection

Case study research may include many sources of data and multiple data collection methods. (Eisenhardt, 1989) Multiple sources of evidence enhance the quality of a case study. (Yin (b), 2003) There are six common sources of case study evidence: documents, archival records, interviews, direct observation, participant-observation and physical artifacts. (Yin (b), 2003) In the teledermatology study, in addition to physician interviews, other data sources are included. These are: documents, archival records, direct observations and, physical artifacts. These are summarized in Figure 4.1

DATA SOURCES in the TELEDERMATOLOGY STUDY with EXAMPLES
Figure 4.1



While each of the three case studies present unique, unplanned data collection opportunities as a result of the researcher's presence in the field and interaction with both study participants as well as relevant participants in the local delivery of telemedicine, overall data collection is standardized across cases.

The case studies

Settings

According to 2001 Canadian census data, the population in Case Study 1 is 74,566 with a median age of 41 years. (Statistics Canada) There are no local full or part time dermatologists and dermatological services are provided by two visiting dermatologists who visit on a monthly basis. (College of Physicians and Surgeons of Ontario, 2002) About 30 family physicians are invited to participate in the study.

According to 2001 Canadian census data, the population in Case Study 2 is 4,906 with a median age of 40 years. (Statistics Canada) There are no dermatologists practicing in this geographic area and there is no access to visiting dermatologists. (College of Physicians and Surgeons of Ontario, 2002) About 14 family physicians are invited to participate in the study.

According to 2001 census date, the population in Case Study 3 is 109,016 with a median age of 39 years. (Statistics Canada) There is one full time dermatologist. (College of Physicians and Surgeons of Ontario, 2002) About 20 family physicians are invited to participate in the study.

Gaining access

In Case Study 1, the study dermatologist identified a local physician to act as a gatekeeper to the study as this role was described earlier. This local physician agreed to assist with dissemination of the invitation to participate in the study to physicians and to speak directly with each physician who responded to the invitation. Access to the physicians in Case Study 1 was enabled through this local gatekeeper whose participation facilitated physician recruitment. For example, he had informal discussions with local family physicians about the study, subsequent to the distribution of the letters of invitation. He also identified for the investigator that approval from a local Research Ethics Board was required prior to dissemination of the study invitation. Once that ethics review step was satisfactorily completed, physicians were then invited by letter to participate in the teledermatology sessions.

In Case Study 2, at the request of the study dermatologist, a local family physician agreed to act as the gatekeeper to the physician community. This physician disseminated a study invitation by email to family physicians who had privileges at the local hospital where the telemedicine studio is located. A notice was also posted in the physician office in the hospital that advertised the teledermatology sessions and the teledermatology study and identified the gatekeeper as a local contact for more information.

Local physicians contacted the gatekeeper directly to express their interest. These physicians were then identified by the gatekeeper to the researcher who then contacted each physician directly to explain the study purpose and provide the study protocol. The researcher scheduled pre-teledermatology session interviews either in the physicians' practice offices or at the hospital. The local telemedicine coordinator, concerned that the opportunity for local patients to receive dermatology services that was presented by this study had not been sufficiently utilized by local physicians, posted notices that she had independently written. These notices were posted in the physicians' hospital lounge prior to each teledermatology session.

In contrast to the other two cases, in Case Study 3 a local gatekeeper was not available to the study. Access to the physician community in Case Study 3 instead was initiated by a letter to the local telemedicine medical director and the local full time dermatologist. This was followed by a teleconference with these two physicians and the telemedicine coordinator to discuss this study and the teledermatology sessions. The local dermatologist indicated that additional dermatological resources to treat wound care patients were an outstanding need in the community. The teledermatology study, which would provide dermatological care specifically to wound care patients, was welcomed by the local dermatologist who identified family physicians as potential study participants. In subsequent discussion with local physicians whom had been identified by the local dermatologist, the need for increased dermatological services was confirmed. Wound care nurses in the geographic region were identified by the study dermatologist and contacted by the researcher to help assess whether this community could constitute a third case in terms of the replication logic outlined earlier. Discussion with these nurses confirmed the need for this specialty service and their description of the physician community with respect to telemedicine use suggested that this location was suitable for inclusion.

An invitation to participate in the study and the teledermatology wound care sessions was mailed to the family physicians in the geographic catchment area of this case that had been previously identified by the local dermatologist and telemedicine coordinator. The invitation was followed by a personal phone call from the researcher respecting

participation. Interviews were scheduled with the physicians who agreed to participate in the study.

The Participants

There were six physician participants in Case Study 1. Five family physicians and the local gatekeeper, who had not used telemedicine for patient care, agreed to participate in the teledermatology study. All of the participants practiced in the same group practice. Physicians were enrolled in an alternate payment plan. This means that rather than payment on a strictly fee for service basis, physicians were paid a rate by the Ontario Health Insurance Plan largely independent of the number of patient visits or the nature of services provided.

None of the family physicians who practiced in the community outside of this group practice setting expressed any interest or made any inquiries to the local gatekeeper about this initiative subsequent to the mailing of the invitation. This is important to note since the reasons for this difference in participant practice settings is unknown and the potential impact on findings is also unknown. Perhaps, only alternate payment plan physicians agreed to participate while fee for service physicians did not indicate any interest in participating. The influence of physician payment model must be considered when findings are evaluated.

In Case Study 2 there were 5 physician participants. Payment models were diverse across the physicians with a mix of fee for service and alternate payment model. Each physician practiced in a private rather than group practice setting.

As noted earlier, the gatekeeper role was not fulfilled in Case Study 3. This may provide a partial explanation for the participation of only two physicians, each of whom was recruited into the study through personal contact by the researcher. Each came from a very different practice setting. One participant was hospital-based while the other was a solo fee for service practitioner in the community.

The teledermatology sessions

In Case Study 1, in advance of the three teledermatology sessions, each family physician in the study identified one patient for dermatological consultation. The physicians explained the telemedicine process to their patients and received the patient's verbal consent to receive care through telemedicine. The referral for dermatological consultation was provided to the local gatekeeper physician who then forwarded this information to the local telemedicine coordinator, who in turn forwarded the referral to the telemedicine network central scheduling office. The telemedicine studio was booked for ninety minutes and dermatology consultations were scheduled at intervals throughout this one and a half-hour session. The family physician was not required to have any contact with the telemedicine network in advance of the session since the referral process was managed on their behalf by the local gatekeeper.

The patient was then contacted by the telemedicine network central scheduling staff who advised the patient of the appointment time and again described how the examination would be conducted. As patients arrived for the telemedicine consultation, each patient was asked to review and sign the telemedicine network consent form as well as a consent form instituted for the purpose of the teledermatology study to enable videotaping of the consultation.

The teledermatology sessions were conducted at the telemedicine studio in the local hospital from 7:30 a.m. to 9:00 a.m. This time was specifically selected to avoid clinic or in office practice schedule conflicts. The telemedicine studio was organized the day prior to the teledermatology session to ensure the best arrangement of seating for the participants and patient examination. Referral information for each patient was forwarded to the consulting dermatologist the day prior to the teledermatology session. The referral included a brief description of the presenting problem. Some referrals included results of relevant diagnostics and details of pharmaceutical use but accompanying information was sporadic and inconsistent. The telemedicine network referral form was not used since this case had an electronic health record system that made paper referrals unnecessary. All patient demographic information typically on these forms was provided to both the referring and consulting telemedicine network

coordinators since this information is collected by the network to develop utilization statistics.

During each telemedicine session, patients were presented by their family physician to the dermatologist located in a telemedicine studio in Toronto. After the presentation of history and current complaints, the dermatologist posed questions to both the physician and directly to the patient. As requested by the dermatologist, magnification was used to display the skin symptom more closely and the family physician was also sometimes asked to touch the skin and answer questions with respect to texture, temperature etc. The remote telemedicine coordinator, as well as her counterpart in the telemedicine studio with the dermatologist, operated the telemedicine equipment.

As in the first case study, in advance of the two teledermatology sessions, each participating family physician in Case Study 2 identified one patient for dermatological consultation. The physicians explained the telemedicine process to their patients and received the patient's verbal consent to receive care through telemedicine. The referral for dermatological consultation was provided by each physician to the local telemedicine coordinator, who then forwarded this information to the telemedicine network central scheduling office. Appointments were scheduled at intervals throughout the one and a half-hour session. Two local physicians referred patients for the teledermatology session but did not wish to participate in the study and did not attend their patients' consultation. The teledermatology sessions were conducted at the telemedicine studio in the local hospital from 8:00 a.m. to 9:30 a.m., a time suggested by local participants.

As patients arrived for the telemedicine consultation, each patient was asked to review and sign the telemedicine network consent form as well as a consent form instituted for the purpose of the teledermatology study to enable videotaping of the consultation.

In Case Study 3, each participating physician identified one patient who required a wound care consultation. The referrals were made from the referring physician directly to the telemedicine coordinator who then forwarded referrals to the central scheduling office of NORTH Network. Since this generated only two cases, wound care nurses also

identified patients who required a consultation and these patients were included in the teledermatology session although their family physician was not a study participant. These wound care nurses attended the session so that they could provide continuity of care further to the consultation. In this manner, the wound care nurses assumed the role of primary health professional.

The logistics of this case did not permit a field visit to the studio or interview with the telemedicine coordinator the day prior to the session so direct observation of the telemedicine studio operations prior to the session was not possible. The teledermatology sessions were held from 7:30 a.m. to 9:00 a.m.

The physician interviews

In all case studies, the day prior to the first teledermatology session, each physician participant was interviewed according to the interview guide. The same physicians were interviewed again at the completion of the first session. A second follow up interview was conducted after the final session according to the post-participation interview guide. There were some exceptions to the timing of these interviews in each case that reflected unique factors that arose unexpectedly. For example, in Case Study 1 two physicians were unavailable for participation in the third interview.

Interviews were mostly conducted at the physician's local practice office. It has been noted that during case studies the investigator must cater to the participant's availability. (Yin (b), 2003) This was essential to the achievement of the physician interviews in each case location. Interviews had to be scheduled throughout the day and evening and at different locations of convenience to each physician to accommodate office schedules. Without flexibility, data collection would have been severely hampered.

All interviews were audiotaped with the permission of the participant. The interview audiotaping did not start until the study protocol was reviewed with each participant to ensure an opportunity for questions. Then, once the consent form was signed, the audiotaping commenced. Interviews did not continue longer than 30 minutes which had been the requested time allotment. Physicians asked their office staff to ensure that there

were no interruptions during the interview and indeed no interviews were interrupted once they had commenced.

Notes were taken during each interview and, at its completion, field notes were compiled describing any additional observations that would not have been captured through the interview audiotapes. Then, at the conclusion of all interviews, the investigator's overall impressions were documented. These field notes were used to assist with interview transcription where the participant's comments could not be clearly understood from the audiotape. They formed a critical element of data analysis.

Direct observations

Field visits to the case study location created an opportunity for direct observation. Direct observation can rely upon formal observational protocols as well as less formal methods such as documenting physical features of the study setting. (Yin (b), 2003) Direct observation in this study relied on unstructured data collection tools, primarily field notes.

In each case, the investigator visited the telemedicine studio itself and interviewed the telemedicine coordinator prior to the first teledermatology session. This initial observation included written notes about the location of the studio within the hospital and the overall sense of whether the studio reflected some importance within the physical structure of the hospital. Prior to each teledermatology session, the researcher met with the local telemedicine coordinator. These meetings offered an opportunity to observe preparedness for the imminent teledermatology session. For example, reviewing the patient schedule for confirmed attendance and the availability of necessary equipment to conduct the consultation provided observations of the social and organizational milieu for each session. The researcher was introduced as a doctoral student associated with the study dermatologist. Telemedicine coordinators acted as key informants with vivid descriptions of the issues germane to the acceptance of telemedicine in each location. Field notes were taken during and subsequent to these observations.

Then, observation of study participants occurred during each teledermatology session in all cases. Observational notes were taken during the teledermatology sessions with respect to physician interaction with the technology itself, with the consulting dermatologist at the urban telemedicine studio, amongst physician participants in the telemedicine studio and with patients during the teledermatology consultation. Observation included verbal and non-verbal behaviour. Information about the technical quality of each telemedicine transmission was also enabled through this method of data collection as the researcher observed the technology. Field notes, taken throughout each teledermatology session, were an important element of the documentation of direct observations. The field notes included behavioral records of physician participants during the telemedicine sessions. Separate research diaries for each case study and meeting notes taken during planning sessions for each case study were used as tools for information collection.

Teledermatology sessions were videotaped with the written consent of each patient. All patients provided consent. Case Study 3 was an exception to this step as more than one telemedicine site was connected during the teledermatology session. Obtaining patient consent in this circumstance was not possible. The investigator's presence during the teledermatology consultation as a researcher affiliated with the consulting dermatologist was explained to patients as part of the consent process both for videotaping and examination through the use of telemedicine which is part of the NORTH Network required documentation. Videotapes provided an additional opportunity for reflection on direct observations. Videotapes were analyzed using a standardized protocol.

Table 4.1 summarizes the data that was collected through interviews and direct observation.

Table 4.1

SUMMARY OF DATA COLLECTION

Location	# of Physician Participants	# of Pages of Interview Transcripts	# of Minutes of Videotape
Case Study 1	6	118	290
Case Study 2	5	37	190
Case Study 3	2	21	0
TOTAL	**13**	**176**	**480**

Documents

Documentary evidence is relevant in every case study. (Yin (b), 2003) In the teledermatology study, documentary data sources were both specific to each of the three cases as well as applicable across all sites. Documents that were reviewed for each case included descriptions of the physician practice settings and local hospital services. Reports on the frequency and nature of use of telemedicine in each community obtained from the telemedicine network were also considered as suggestive of the integration of telemedicine into each site. In each case, the emails and memoranda sent by the local gatekeeper to engage the physicians in the study were included in the data.

Documentary evidence included reports prepared by the telemedicine network with a description and evaluation of the services for health care delivery. (NORTH Network (a) and (b), 2003) Documents describe the telemedicine network and its infrastructure across Ontario as well as initiatives implemented to encourage network use. An example of such an initiative is the introduction of centralized appointment scheduling. These documents serve to establish the telemedicine delivery framework that applied to all cases. Other documents published by the NORTH Network and publicly available through its website were also used as data sources with respect to the operation of the network and its technology.

Archival records

Archival records differ from documentary evidence insofar as these records are more likely to show numbers of some phenomenon such as patients treated, include geographic maps and survey data. Archival records in the teledermatology study included utilization reports for each case site prepared by the NORTH Network. These records showed the frequency and nature of telemedicine use at the three case study locations. Another record examined was available from the website of the provincial physician regulatory body, the College of Physicians and Surgeons of Ontario (CPSO). It provides the geographic distribution of family physicians and dermatologists across Ontario. These records were used to verify the accessibility of dermatological services in each case site.

Physical artifacts

Physical artifacts are physical evidence such as a tool or instrument that may be collected or observed. (Yin (b), 2003) While commonly ascribed to anthropological research, physical artifacts can be an important component of a contemporary case study. This source of data was not anticipated in the case study protocol. However as each case occurred in its natural setting, physical artifacts became apparent as potential study data. Examples of this opportunistic data source were digital images that supplemented patient examination at the initiation of some family physician participants who wished to illustrate changes in the patient's symptoms over time. These images demonstrated diagnostic and treatment dilemmas for which family practice physicians required specialty consultation and were prepared to use the teledermatology session to address. While the study interviews provided verbal reports of how physicians described their need for specialty services, the digital images provided physical evidence of their patient consultation needs.

Table 4.2 provides a summary of how data sources for each case study match to the innovation attributes that provided the initial structure to data collection.

Table 4.2

INNOVATION ATTRIBUTES IN THE TELEDERMATOLOGY STUDY

Attribute	Defined As	Data Sources
Relative Advantage	"The degree to which an innovation is perceived as better than the idea it supercedes."	II, AR
Compatibility	"The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters."	II, D, DO, PA
Complexity	"The degree to which an innovation is perceived as difficult to understand and use."	II, DO, PA
Observability	"The degree to which the results of an innovation are visible to others."	II, DO, PA
Trialability	"The degree to which an innovation may be experimented with on a limited basis."	II, DO, PA
Perceived Ease of Use	"The degree to which a person believes that using a particular system would be free of effort."	II, DO
Perceived Usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance."	II
Image	"The degree to which use of an innovation is perceived to enhance one's image or status in one's social system."	II
Perceived Voluntariness	"The degree to which the use of the innovation is perceived as being voluntary or of free will."	II, AR

AR = Archival Records
D = Documents
DO = Direct Observation
II = Individual Interviews
PA = Physical Artifacts

Data Analysis and Trustworthiness

Critical to the design and analysis of qualitative research is the planned approach to maximizing the quality or 'trustworthiness' of a study. (Seale, 1999) Techniques to enhance the trustworthiness of qualitative research are conceptualized using different frameworks, but typically include considerations of credibility or validity, transferability, dependability or reliability, and confirmability. (Seale, 1999) The way in which quality considerations were integrated into the study design have been described earlier, for example, multiple cases using a literal replication logic to address transferability of findings. The manner in which quality considerations were addressed during data analysis is described below.

Triangulation

Triangulation methods are used to enhance verification and validation of data analysis and thereby enhance the credibility of a study. (Seale, 1999) Data sources triangulation requires comparison of the consistency of information that has been obtained through different data collection methods. Triangulation of data sources includes comparing observational data with interview data and comparing what people say in interviews to their observable behaviour. (Patton, 1990) In this study, the variety of data sources created opportunities to determine whether a consistent understanding could be established through comparative analysis. Triangulation through multiple data collection methods can offer a stronger substantiation of a construct. (Eisenhardt, 1989) It has also been noted that the 'spirit' of triangulation is to uncover inconsistent results so that discrepancies can lead to new areas of inquiry. (Bryman, 1988)

One triangulation involved the interview transcripts with specific focus on the innovation attributes as these had been embedded into the interview protocol. These data were then compared to the data analysis of the videotapes of the teledermatology sessions. Comparisons were made both in terms of individual participants and the case as a whole. For example, the influence of the innovation attribute of trialability was studied both within the interview itself through the interview guide and through the videotapes of the telemedicine sessions. During these sessions physician participants were provided an opportunity to observe and use the technology as patient care was delivered. Their interaction with the technology demonstrated their perceptions, which could then be compared to their interview comments.

Another triangulation was the comparison of field notes of direct observations with interview transcripts. Field notes included observations that were based on a subjective assessment by the researcher during teledermatology sessions, for example, level of participation in the session or comfort with the technology. These subjective views were compared to interview transcripts and interview field notes to determine whether consistency was present.

Other data source triangulation included documentary evidence regarding the use of telemedicine for patient care in each case as compared to use of telemedicine as stated by study participants and key informants such as the local telemedicine coordinator. For example, did the participant comment about telemedicine use match archival records of use?

To reduce impaired objectivity that may have arisen from the effects of the physician participants on the researcher, a further data triangulation strategy was to use a local informant to provide background data. In each location, the telemedicine coordinator was interviewed before, during and after the teledermatology sessions. In the initial discussion, coordinators provided useful information with respect to the positioning of the telemedicine network within the local physician community from their own non-physician perspective. Data illustrating utilization patterns and pressures on physicians in the community vis a vis the availability of specialist resources provided additional contextual information that was compared to the information provided by participants.

These steps in data analysis provided a way to generate evidence that either confirmed or challenged the key findings as these arose from each data source analysis independently.

Data Management

To ensure a well-organized repository of data, the different kinds of data were kept separately. This was an important activity to address the dependability of the study. The most complex data management was the audiotaped interviews and videotaped teledermatology sessions. To accompany the interview transcripts, field notes had been recorded in separate books for each case study. Each individual interview transcript file included an interview summary form that was prepared to summarize the information while also assisting in analysis as it facilitated categorization. The interview summary form is presented in Appendix 3.

The analysis of the videotapes of the telemedicine sessions had two components that had to be included in data management. The first component was the direct observation notes

that were taken during the session. These were kept in a locked file by case study location. The second component was the videotape analysis of the teledermatology sessions by case. These notes were also kept within the locked videotape file.

The archival records and documents were kept together rather than archived by case. This data management decision primarily reflected that most records included all case sites. Artifacts that were collected were also kept centrally since these facilitated analysis cross case rather than within case analysis.

Coding

The reliability of a study's findings can be assessed by the steps taken during the coding process. (Miles & Huberman, 1994) Ensuring coding checks were made throughout data analysis heightens a study's dependability. In the teledermatology study, the coding process began with a list of codes that were based on the theoretical model concepts as described in Chapter Two. These are shown in Table 4.3. This a priori method of coding based on theoretical models and research questions is an accepted approach. (Miles & Huberman, 1994)

Table 4.3
Initial List of Codes

ROGERS INNOVATION ATTRIBUTES	IA-R
Relative Advantage	IA-R RADV
Complexity	IA-R COMPLEX
Trialability	IA-R TRIAL
Observability	IA-R OBSER
Compatibility	IA-R COMPAT
INNOVATION ATTRIBUTES FROM OTHER THEORIES	IA-O
Voluntariness	IA-O-VOL
Ease of Use	IA-O-EASE
Perceived Usefulness	IA-O-USEFUL
Image	IA-O-IMAGE
INCENTIVES	INC
CE Credits	INC-CE
Payment for Clinical Work	INC-$
SOCIAL ORGANIZATIONAL FACTORS	OF
UNEXPECTED	UNEXP

As data from interviews was collected, it became evident that there were additional important themes were being uncovered that were not part of the original coding set. These were added as they unfolded so that they could be explored in subsequent interviews. For example, it was consistently raised in the first case study that the family physician had to respect and to be 'comfortable' with the consulting specialist at the delivering telemedicine site. All participants in this case had noted that if in the first instance the family physician did not like the consulting specialist (comfortable) or lacked confidence in the ability of the telemedicine consultant, (respect), then other perceptions about telemedicine were irrelevant since these were necessary preconditions for telemedicine referrals to be made. After the first case study, this was considered as an important dimension of the innovation attribute of compatibility. This became a new coded category for audiotape analysis. A revised coding schedule is shown in Table 4.4.

Table 4.4
Evolving List of Codes

ROGERS INNOVATION ATTRIBUTES	IA-R
RELATIVE ADVANTAGE	**IA-R-RADV**
• Faster access	IA-R-RADV TIME
• Patient travel	IA-R-RADV TRAVEL
• Professional isolation	IA-R-RADV PROF IS
• Knowledge transfer	IA-R-RADV KT
COMPLEXITY	**IA-R COMPLEX**
• Administrative ease	IA-R COMPLEX-ADMIN
• Technology performance	IA-R COMPLEX-TP
TRIALABILITY	**IA-R TRIAL**
• test without commitment	IA-R TRIAL-NC
OBSERVABILITY	**IA-R OBSER**
• technology simplicity	IA-R OBSER-TS
• indigenous knowledge system	IA-R OBSER-OTHERS
COMPATABILITY	**IA-R COMPAT**
• change referral pattern	IA-R COMPAT-REF.
• confidence in specialist	IA-R COMPAT-CONFID
• belief in face to face	IA-R COMPAT-F2F
• liked specialist	IA-R COMPAT-LIKE
• time demand	IA-R-COMPAT-DEMAND
INNOVATION ATTRIBUTES FROM OTHER THEORIES	IA-O
VOLUNTARINESS	**IA-O VOL**
• patient	IA-O VOL PT
• hospital	IA-O VOL HOSP
• colleagues	IA-O VOL C
EASE OF USE	**IA-O EASE**
• referral form completed by others	IA-O-NOREFFORM
• no new work	IA-O-NNW
PERCEIVED USEFULNESS	**IA-O USEFUL**
• value for time	IA-O VALFT
• case driven education	IA-O EDU
• interaction with specialist	IA-O INTERACT
IMAGE	**IA-O IMAGE**
• leading edge	IA-O IMAGE LE
• irrelevant	IA-O IRR
NON-THEORY BASED	
SOCIAL & ORGANIZATIONAL FACTORS	**OF**
• studio location	OF-LOC
• staff competence	OF-STAFF
• time of session	OF-TIMING
• undermine local resources	OF-UNDMINE
UNEXPECTED	**UNEXP**
INCENTIVES	**INC**
• CE Credits	INC-CE
• Payment for Patient Presentation	INC-$
• Specialist reputation	INC-GS
• CE timing consuming and expensive in comparison to telederm session	INC-TIME/$$
• Care + Education	INC-C+E

The next step in coding was to move to pattern coding which groups the coded summaries of data into a smaller number of themes. (Miles & Huberman, 1994) This enabled the re-coding of data that had been affiliated with more than one of the innovation attributes into one grouping. These pattern codes are displayed in Table 4.5 with examples to illustrate their meaning.

Table 4.5
Pattern Codes

INNOVATION ATTRIBUTES
• Relative advantage – *camaraderie with peers and specialist - fun*
• Complexity –*surprise at high performance of technology and quality of images*
• Compatibility – *efficiency of teledermatology session with no wasted time – high throughput*
• Trialability – *no commitment while hands on testing of technology and processes -how does it work*

COMMON THEMES/INFLUENCES
• Quality and quantity of interaction between patient/specialist
• Quality and quantity of interaction between physician/specialist
• Value for time
• Knowledge transfer
• Quality of care – observable quality
• Quick access
• CME credit vs personal learning
• Diffusion as non-linear
• Co-operation between primary and specialty care physicians

UNCOMMON THEMES / INFLUENCES
• Reduced travel for patients – *patient inconvenience*
• System-wide cost savings
• Liability and payment – Medicolegal issues
• Image – *seen as an innovator*

Memoing is used in data analysis to connect data into clusters that illustrate general concepts. (Miles & Huberman, 1994) In the teledermatology study, since each teledermatology session data collection event required air travel to a distant community, an opportunity for memoing presented itself during each return trip. These 'flights of

fancy' were the primary occasions for memoing focused on unexpected events or data collected.

Auditing

Reliability can be enhanced with the use of an audit trail. (Seale, 1999) This technique relies on peers during and after data collection to provide commentary on the study procedures and analysis in terms of consistency and appropriateness. In the teledermatology study, there was a single researcher who collected and analyzed data and thus opportunities for peer examination were limited. However, the study dermatologist performed audit functions during the data collection phase and again during data analysis. A researcher in the study insofar as he delivered all of the patient care, the study dermatologist did not participate in data collection activities such as physician interviews. An audit function he performed, for example, was review of the methods to gain access to each community including the use of the standardized study protocol to check that it was used consistently across cases.

At the completion of each teledermatology session, discussion of emerging findings between the researcher and the study dermatologist led to preliminary indexing. This is a step that enables the identification of interesting data elements early in the analysis process before actual coding a step, which begins to attribute meaning to data. (Seale, 1999) As each case was concluded, the study dermatologist participated in a case analysis meeting where the case was summarized with discussion of unexpected events, success in engaging the participants in the study and ideas for additional constructs to be added to data collection. Both the researcher and the study dermatologist kept case analysis meeting notes. During data analysis, the study dermatologist discussed the coding of the interview data and the triangulation of interview and videotape and observational data with the objective of identifying issues of analysis adequacy. These case analysis meetings also created an opportunity for rival explanations of the influences on physicians to be developed and evaluated as all data sources were considered as a whole.

In conclusion, data analysis enabled evaluation and comparison of the data from all sources with respect to the applicability of the theoretical models as explicative of the influences on physicians' perceptions of telemedicine, the existence of alternative explanations of physician attitudes and the similarities and/or contrasts across cases. Within the limitations implicit to one investigator, techniques shown to increase reliability and validity were used to the extent possible to enhance analytic trustworthiness.

Table of Contents

Chapter 5

Teledermatology Study Findings

Chapter Five

Teledermatology Study Findings

The teledermatology study explores the influences on physician attitudes toward telemedicine based initially on theoretical models described in Chapter Two. It seeks to understand the perceptions of physicians, who are using telemedicine for the first time for the delivery of patient care, regarding the aspects of this innovation that are influential for attitude formation. The study is not designed to be predictive of subsequent telemedicine use, but rather, to provide a detailed understanding of the influences on potential physician telemedicine users.

The study results are reported using the predominant theoretical models summarized in Chapter Two. Beginning with Rogers' innovation attributes and then followed by the additional attributes and concepts outlined in the literature, the presentation of findings is structured according to these models. Findings that do not align with these innovation attributes and are not encompassed within the theoretical models identified as conceptual background to this work are subsequently presented.

Intrinsic to the use of a multiple case study design is the analysis of data both within cases and cross-cases. (Creswell, 1998) Within case analysis enables the researcher to become very familiar with the case on its own which facilitates the emergence of unique patterns. (Eisenhardt, 1989) Cross-case analysis enhances understanding of study results based on the replication logic that was explained in the previous methods chapter. (Yin (b), 2003) Cross-case analysis can also facilitate considerations of transferability of findings as similarities and differences across cases are understood. Methodologists have suggested that in multiple case research, the presentation of data may include both analytic techniques. (Miles & Huberman, 1994) Critical to cross-case synthesis is thematic interpretation rather than numeric counts of themes. The presentation of teledermatology study findings integrates cases within each innovation attribute. Case

ordered innovation attributes matters that display across cases findings are integrated into the text.

Data from all five sources are included within the description of findings by innovation attribute. Excerpts from interview transcriptions are integrated into data presentation with notation of case and participant number.

The influence of the innovation attributes encompassed within study theoretical models

Rogers' diffusions of innovation theory describes five innovation attributes (Rogers, 2003), each of which was examined in the teledermatology study. These attributes are relative advantage, compatibility, complexity, observability and trialability. Additional attributes were reflected in the study interview guide based on the theories proposed by other authors and described in Chapter Two. These attributes were perceived voluntariness, perceived ease of use perceived usefulness, and image. The influence of incentives was also included within the scope of data collection.

Relative advantage

"The degree to which an innovation is perceived as better than the idea it supercedes."

Interview data does not suggest that physicians contemplate the relative advantage of telemedicine over traditional in person care delivery in terms of those advantages identified in the telemedicine literature review, for example reduced health care system costs and reduced patient travel. In Case Study 3, one physician raised the issue of patient travel as an influence on the use telemedicine. This comment is made, however, within the context of patients who require ambulance service to travel anywhere including the telemedicine studio. Avoidance of travel for frail, elderly patients where the telemedicine studio is located within a chronic care facility is raised by this participant as a relative advantage.

"It's really difficult, very difficult to get services for these elderly patients. I mean that lady that I presented came by ambulance. She can't travel anywhere."

Case Study 3, Participant A

Avoidance of long distance patient travel is not a theme common to any of the cases as a relative advantage of telemedicine as compared to in person care. This result could be a reflection of the difference in funder and telemedicine outcome evaluator perspectives of the reasons to use telemedicine in contrast to family physicians for whom patient travel distance is not a focal consideration in decision making related to patient care.

The interview data instead shows that participants generally consider relative advantage primarily from two perspectives. One of these is the access to specialist consultations. In the two smaller case study communities, accessibility is primarily defined as a measure of speed. Would a telemedicine consultation be delivered within a shorter wait timeframe than an in person consultation? Where the telemedicine consultation wait timeframe is the same or longer than the time to access a specialist consultation in the usual delivery system, a relative advantage to a telemedicine consultation is not perceived.

"Accessibility is the key. Its accessibility would have to be at par if not better than accessibility of conventional consultations."

Case Study 1, Participant A

"In dermatology, the most helpful advice is the kind of advice that you can get right away."

Case Study 2, Participant B

Some participants across all three cases describe quick access as a prerequisite to telemedicine use rather than a relative advantage. Without quicker access, then other potential relative advantages of telemedicine would not even be considered as relevant to these referring physicians. This reflects participants' views, described more fully within the compatibility attribute results, that in person care is always preferred. The relative

advantage of telemedicine is as compromise amongst a number of considerations, with quicker access to needed specialty care as the prime concern. The other considerations are reflected in participants' descriptions of the compatibility of telemedicine with their personal views about care delivery as described in the compatibility attribute results.

The second relative advantage of telemedicine compared to standard care delivery systems is professional learning. The teledermatology sessions offered an interactive experience between the referring physician and the consultant that does not exist in traditional delivery systems. The relative advantage of family physician live interaction with the consultant, over consultations completed in the traditional manner with a letter to the referring physician that summarizes the consultation findings, is consistently and strongly reported across all cases.

> *"The advantages in terms of being there is that you not only get a consultation for your patient, but at the same time you get a chance to throw other questions to the dermatologist which get you to the next level of discussion so that if you see this condition again, you are knowledgeable."*
>
> *Case Study 2, Participant C*

This interaction with the consultant that is offered by telemedicine delivered in the manner of the teledermatology study sessions is reported across all cases as a significant relative advantage.

> *"If I am doing the follow-up, then I need to know what to do. You want an answer and telemedicine gives you a chance to have a discussion with the specialist so that you can get all of your questions answered. When you feel inadequate, you want to share the care with someone else. You want to be able to follow through on what the specialist recommends and you need to be able to do that by talking to them."*
>
> *Case Study 2, Participant D*

This finding may be unique to the manner in which telemedicine was implemented in the teledermatology study. Since physician education was integral to the teledermatology sessions participants attended with an expectation for knowledge transfer in addition to patient care. The importance of learning to engender later independence in patient management for the patients referred for the teledermatology sessions as well as future patients with similar diagnoses is consistently across all participants and all cases. Even in Case Study 3, where access to a local full time dermatologist was available, using telemedicine to achieve increased professional competence in dermatology is highlighted as a positive influence on physician attitudes toward telemedicine.

A relative advantage of consultations as delivered in the teledermatology study is the knowledge transfer.

> *"If I'm consulting someone, then I am at the stage where I've done what I can do at my level, my experience. Any added educational tool in terms of what to do that I can learn from, and apply to the next case so that I don't have to go back to the dermatologist, is beneficial. That's what this session offered."*
>
> *Case Study 2, Participant A*

Direct observation and teledermatology session videotape analysis across all cases reveals that most physicians participate in the examination of all of the patients as different clinical issues are raised. They are observed to leave their seats and individually examine the patient as the clinical presentation is being discussed by the colleague presenter. They participate in the discussion of differential diagnosis and the treatment options with the consulting dermatologist for most session patients, not merely the one patient that comes from their own practice. Participants are also observed to take notes during each teledermatology session. In Case Study 1 and 2, the physicians came to the first teledermatology session without a way to record notes and during the session obtain pen and paper and write notes while each case is discussed. In subsequent sessions, it is observed that physicians come prepared to take notes. This observational data confirms

the perceived benefit of the teledermatology sessions for professional education that is raised during participant interviews.

In the case study with the least access to specialty care and the smallest number of local family physicians, there is identification by some participants of a relative advantage of telemedicine as a way to reduce professional isolation. However, this finding is specific to two participants in this case and is not generally identified by participants as an advantage of telemedicine. While reducing professional isolation is described in the telemedicine literature as an advantage of telemedicine, this is not a strong theme in these cases where participants identify a high degree of collegiality. Ethnographic study of the nature and strength of social networks within rural physician communities and then comparing these to physician perceptions of the advantage of telemedicine in reducing professional isolation would be an effective strategy to understand this finding.

The findings regarding relative advantage are summarized in Table 5.1

Table 5.1
CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF RELATIVE ADVANTAGE OF TELEDERMATOLOGY

Case Study	Timing Of Access	Patient Travel	Knowledge Transfer	Reduce Professional Isolation
Case Study 1: Some Access to Dermatologist	POS	NA	POS	NA
Case Study 2: Little Access to Dermatologist	POS	NA	POS	POS
Case Study 3: Good Access to Dermatologist	POS	POS	POS	NA

POS = Positive Influence
NEG = Negative Influence
NA = Not Acknowledged As An Influence

Good Access = at least one full-time local dermatologist
Some Access = no local full/part-time dermatologist, regular clinics by visiting dermatologists
Little Access = no local full/part-time dermatologist, no clinics by visiting dermatologist

Compatibility

"The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters."

Interview data suggests that participants identify various aspects of telemedicine as potentially incompatible with their needs and values. As compared to other innovation attributes, the number of dimensions of this attribute is greater and suggests a greater importance to this attribute. There are many different dimensions of compatibility that are identified in case analysis.

Case Study 1 is the only case where some participants raise a dimension of the compatibility of telemedicine in reference to personal values. Some physicians in Case Study 1 report their belief that regardless of the benefits that may be offered through telemedicine, the preferred delivery system is always face to face. Their predominant personal belief is that in person care is preferable to care that is facilitated through technology. Thus, telemedicine would only ever be considered as a supplement to traditional delivery methods.

> *"I think it's hard to say exactly how it's going to be used and how often. I think it's a great adjunct."*
>
> *Case Study 1, Participant A*

Expression of incompatibility between personal beliefs about the inherent value of in person care as compared to care delivered at a distance is not raised in other cases. It is thus suggested that this is a personal value of some physicians that is not a systemic influence on telemedicine, but, an individual influence that requires a different research methodology to better understand cultural views that may be unique to physicians as a professional population.

The location of the telemedicine studio and its impact on the need for physician travel is differentially raised as a compatibility consideration across cases. While in all three

cases, the telemedicine studio is located in the local hospital a distance from the participating physicians' offices, participants are consistent within, but not across cases, in their view of the impact of travel. The differences may be reflective of the differences in the requirement for physicians to attend hospitals during their daily practice. In Case Study 1 where all participants practiced at the same non-hospital based location, travel to the hospital is considered as a negative influence on their attitudes toward telemedicine. Daily attendance at the hospital is not always required and hospital hours are typically unique to the practice schedules of each physician.

In Case Study 2, while physicians find the hospital to be an acceptable location, the convenience of the studio is nonetheless identified as needing to be compatible with practice demands. These physicians are required to complete emergency department shifts, assist with surgical procedures and thus find themselves more often within the hospital building. Thus, the location of the studio is compatible with their needs. However, it is noted that a family physician, whose practice is a distance from the town and its hospital, referred patients for each teledermatology session although she did not wish to participate in the sessions. This raises the possibility that physicians in this case who are negatively influenced by the location of the telemedicine studio are unwilling to participate in the sessions although they wish their patients to receive the teledermatology care. Interviews with physicians who would not participate in the sessions could be illuminative of the negative dimensions of compatibility that influenced their decision not to participate.

Although there is a second telemedicine studio located in long-term care facility in Case Study 3, the hospital-based studio is used for the teledermatology sessions. Participants in this case study do not raise the location of the studio as an influence on attitudes.

Synthesis across cases suggests that a requirement to travel to a studio is incompatible with needs for telemedicine to be convenient. This is consistent with the telemedicine literature where it has been noted that even requiring travel within a very short distance such as across the road can be a deterrent to telemedicine use. (Yellowlees, 1997)

Similarly, participants across cases report that the timing of telemedicine consultations must be compatible with their office hours. Any impacts on office or clinic schedules are considered as highly incompatible with their needs to efficiently run their practice. Thus, where participation in telemedicine consultations requires physicians to interrupt practice hours, an inconvenience compounded where travel to a different location is required, compatibility is not achieved.

> *"The biggest problem is that doctors in small communities don't have time to attend with their patient. Even asking them to come for fifteen minutes is hard for them to include in their day."*
>
> *Case Study 2, Participant D*

In Case Study 1 and 2 there is high compatibility between pre-existing referral patterns and the teledermatology study since many physicians had referred their patients to the study dermatologist on prior occasions outside the context of this study. In Case Study 3, where a local full time dermatologist is available, participants want to be reassured that the local dermatologist supports the teledermatology initiative. Once local specialist support is confirmed, physicians in that community are willing to consider participation in the teledermatology sessions. These findings are consistent with the telemedicine network establishment where respect for existing referral patterns was a foundation for implementation. (NORTH Network (a), 2003)

> *"The loss in telemedicine is that I like to know who I am referring my patients to. I like that type of working relationship, to know who the specialists are and what my support system is in that respect."*
>
> *Case Study 2, Participant A*

In addition to the network inclusion of specialists already referred to by family physicians, as a further dimension of compatibility participants across cases indicate that a requirement for a telemedicine referral is their confidence in the telemedicine specialist. The telemedicine specialist must be a physician that they respect in terms of skill. The

importance of their confidence and comfort with the telemedicine consultant as an aspect of telemedicine compatibility is suggested in their comments that the teledermatology study specialist was an important influence on their decision to participate in the sessions.

Physicians express the importance of a positive interaction between the telemedicine consultant and their patients. During post teledermatology sessions interviews, physicians discuss the consultant's interaction with their patients and identify the importance of interpersonal manner as consistent with their own values around patient care. This suggests that from their perspective, telemedicine consultations must be delivered in a way that is compatible with their own beliefs and values about patient care.

For telemedicine to be considered as a viable alternate delivery system, physicians report that they must have confidence in the specialist and be comfortable with that physician's interpersonal manner both with patients and colleagues.

> *"I think it would be nice to have a number of specialists that I might even get to know and I have some control over who my patients get referred to...It might be helpful to have something mailed to you to tell you the doctors that are accepting telemedicine referrals...As it is right now, it's a big black hole."*
>
> *Case Study 1, Participant F*

The results of this study suggest that remote physicians want to continue to control the referral of their patients to specialists, even where delivery is through telemedicine. Telemedicine specialists would be evaluated as to suitability based on their skill and interpersonal manner before case study physicians would make a telemedicine referral.

Overall, compatibility is described from these multiple dimensions. Some physicians consider compatibility from the perspective of professional values such as the importance of in person interaction between physician and patient in the delivery of care. Compatibility is discussed within the context of flexibility to make referrals to specific

specialists. Compatibility is also described in relation to time demands and physician travel. Compatibility is a complex innovation attribute that must be considered from a variety of perspectives to fully understand its impact on physician attitudes.

The findings regarding compatibility are summarized in Table 5.2

Table 5.2

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF COMPATIBILITY OF TELEDERMATOLOGY

Case Study	Consistent With Referral Practices	Comfort/ Confidence With Specialist	Belief In Face To Face	Demand On Physician Time	Positive Interpersonal Interaction: Physician/ Specialist	Positive Interpersonal Interaction: Patient/ Specialist	Physician Travel
Case Study 1	POS	POS	NEG	NEG	POS	POS	NEG
Case Study 2	POS	POS	NA	NEG	POS	POS	NA
Case Study 3	NA	POS	NA	NA	POS	POS	NA

POS = Pos Influence
NEG = Negative Influence
NA = Not Acknowledged As An Influence

Complexity

"The degree to which an innovation is perceived as difficult to understand and use."

Complexity is described by participants both in terms of the technology itself and the non-technical procedures that surround its use. Both through interview data and direct observation, it is shown that participants across all cases are positively influenced by the simplicity of use of the telemedicine equipment during the teledermatology sessions. During all of the teledermatology sessions, a telemedicine coordinator acted as the technical user and completed all of the technical functions related to the equipment and connectivity with the network. Utilization of this resource to perform the necessary technical functions, while physicians act as the clinical users and complete clinical

activities such as patient examination, is identified across cases as an effective way to address potential complexity of telemedicine technology.

The required effort to use the technology is described as an aspect of the innovation attribute of complexity that is considered positively by physicians in this study. This consistently positive attitude toward complexity across cases may be explained by the use of the same telemedicine network, with the same technical equipment and same technical role for the telemedicine coordinator during the sessions.

A recurrent theme is the importance of administrative processes as indicators of telemedicine complexity. Where the patient referral process requires additional or different effort from current procedures for specialist referrals, physicians in Case Study 1 and 2 consider this as complexity that contributes to a negative view of telemedicine. The extent to which the use of telemedicine requires completion of additional referral forms or new administrative procedures to refer and schedule patient appointments thought to be cumbersome or bureaucratic is perceived by participants as added telemedicine complexity. In one case study, electronic patient records are the standard for all medical records within physicians' practices. Requiring physicians to complete a paper telemedicine referral form that duplicates information already maintained in an electronic record is considered as unnecessary procedural complexity that is perceived as a negative influence on physician attitudes toward telemedicine use.

Another dimension of complexity raised by participants is related to patient scheduling. In Case Study 1, the local gatekeeper acted as a liaison between the telemedicine network schedulers and referring physician. This simplified the scheduling for the other physicians. Additionally, given the special event nature of the teledermatology sessions, the local telemedicine coordinator also intervened in a manner that does not typically occur to ensure that scheduling and patient briefing for a telemedicine examination was completed prior to the session. In Case Study 2, the telemedicine coordinator fulfilled the administrative functions performed by the gatekeeper and coordinator in Case Study 1 to maximize patient awareness and their attendance at the teledermatology session. These

are steps not followed in routine telemedicine scheduling. However, they are shown to be effective at reducing complexity from the physician perspective. Thus, while these teledermatology sessions are not described as complex since factors that increase complexity were mitigated by the context and system in which the sessions occurred, participants suggest that complexity is a relevant innovation attribute. In all cases, the physicians identify the importance of simple patient scheduling and the organization of sessions as influential on their view of the simplicity and efficiency of telemedicine.

The findings regarding complexity are summarized in Table 5.3

Table 5.3

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF COMPLEXITY OF TELEDERMATOLOGY

Case Study	Referral Process	Patient Scheduling	Onsite Coordinator	Technical Simplicity	Effort To Use Technology
Case Study 1	NEG	NEG	POS	POS	POS
Case Study 2	NEG	NEG	POS	POS	POS
Case Study 3	NEG	NEG	POS	POS	POS

POS = Positive Influence
NEG = Negative Influence
N A = Not Acknowledged As An Influence

Observability

"The degree to which the results of an innovation are visible to others."

Participants across cases state that the effective completion of a patient consultation requires a good physical examination. In this study, physicians across all cases are surprised with the adequacy of the image provided by the technology. This leads to their observations that the teledermatology specialist is able to fully complete the patient examination with reliance on the technology. Participants across all cases also suggest that the technical adequacy of the telemedicine network to enable clinically effective

consultations as demonstrated through the teledermatology sessions is a positive and observable attribute of telemedicine. The results of the technology are immediately and easily observed, thereby creating a positive influence on participant attitudes.

> *"A lot of us are just amazed by the technology."*
>
> *Case Study 1,Participant C*

A theme consistently found across cases is the specificity of effective use. The participants are able to observe the results of the use of teledermatology and independently assess the clinical circumstances for which its use would be suitable. Participants identify that the appropriateness of the technology use is disease and specialty specific. Telemedicine is reputed to be well suited to dermatology but is expected to be inappropriate for other clinical specialties where visual inspection is less central to the diagnostic process. Observability drives impressions of appropriate and inappropriate use based on the nature of the specialty service.

With respect to the visibility of the outcomes of telemedicine during the study, direct observation reveals that in both Case Study 1 and 2 there is spontaneous conversation among participants subsequent to the teledermatology sessions about its success. The quality of care delivered during the teledermatology consultations is visible to participants in a real time manner. This appears to provoke discussion about the strengths and weaknesses of the teledermatology sessions.

Central to Rogers' definition of observability is the visibility of the results of innovation to others. In telemedicine, observability is not extended to physicians who do not have direct experience with the technology. There is no observable effect for physicians outside of the study. Participation in the teledermatology sessions provides a live demonstration of the effectiveness of the technology to enable a clinical encounter, and observability is achieved but this is restricted to participants and patients. In contrast, physicians without direct telemedicine experience cannot observe these results of telemedicine. The sessions stimulate discussion amongst participants, but there is no

evidence from any of the data sources that suggest that the session participation led to interest from other physicians in using telemedicine. Observability only appears relevant insofar as it is a manifestation of trialability.

> *"If they can see the technology in action and they are personally involved because their patients are being treated, and the information is credible and helpful, they are going to be more interested in doing it again."*
>
> *Case Study 1, Participant A*

The findings regarding observability are summarized in Table 5.4.

Table 5.4

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF OBSERVABILITY OF TELEDERMATOLOGY

Case Study	Visibility To Non-Participants	Participant Discussion Between Sessions	Technological Adequacy For Dermatological Cases	Technological Adequacy For Non-Dermatology Cases	Image Quality
Case Study 1	NA	POS	POS	NEG	POS
Case Study 2	NA	POS	POS	NEG	POS
Case Study 3	NA	POS	POS	NEG	POS

POS= Positive Influence
NEG =Negative Influence
N A= Not Acknowledged As An Influence

Trialability

"The degree to which an innovation may be experimented with on a limited basis."

According to Rogers' decision process model, during the persuasion stage the person develops a view of the innovation based on its characteristics that either persuade or dissuade adoption. (Rogers, 2003, p176) These views can be developed subsequent to experimental or trial use of the innovation. "Uncertainty implies a lack of predictability,

of structure, of information." (Rogers, 2003, p6) The teledermatology sessions provide an opportunity for family physicians, who have not previously used telemedicine for the delivery of health care, to use the available technology within the context of dermatological care provided to their own patients. These teledermatology sessions essentially operate as trials and successfully reduce uncertainty as they provide information about telemedicine that was previously unknown to physician participants.

Trial use during the teledermatology sessions is reported during participants' interviews to be very influential on their attitudes toward telemedicine. The trials provided information about technical requirements, image clarity and even patient response.

Trying the use of telemedicine demonstrates to physicians how it works in their own local studio.

> *"The technology is good and sort of what surprised me is that the patients really are keen on it. Now that I have used it, I have more confidence in the technology...For certain things, it is probably as good as being in the office. Getting to use it in these session made a difference because I saw how it worked and I thought, 'oh, cool' and then I was thinking of the next patients that I would refer to a session."*
>
> *Case Study 1, Participant C*

From direct observation, physicians show their interest in experimenting with different technological equipment as part of their trial use of telemedicine. For example, during patient examinations physicians comment on the use of the magnification lens and the impact that the lens has on the image transmitted to the specialist. Room darkening is tried with some patients to enhance contrasts in skin colour between normal and diseased tissue and physicians spontaneously remark on the enhanced telemedicine image using this technique. As consultations are delivered to patients with different diagnoses, physicians are observed to actively participate in the trial of the technology by examining the patient in the room and comparing what they could observe directly to the image that is displayed on the telemedicine screen. Direct observation of the teledermatology sessions suggests that the trial of telemedicine and experimentation with different

technical options is influential with a positive impact on physician attitudes toward telemedicine.

The ease of participating in the trial is also found to be relevant to physician attitudes. In two cases, the local gatekeeper and telemedicine coordinator facilitated physician referrals for the teledermatology sessions. Thus, participation in the teledermatology session required few preparatory activities by the participant. The simplicity of arriving for the session, participating as desired and the absence of commitment to ongoing use is a theme related to trialability that shows this innovation attribute is influential on attitudes.

Availability of telemedicine is also considered as a dimension of trialability. In each case study, the telemedicine facility was already established in the community. The trial occurred within each participant's own local situation and telemedicine is available to physicians without registration or training activities. In Case Study 1 and 2, the two communities with the least access to specialty care, the easy availability of telemedicine is described as a positive dimension of their telemedicine trial. There is no effort required by participants to ensure availability of the telemedicine network or its equipment. The system is operational and available for their use.

Most physicians participated in at least two teledermatology sessions. Repeated use demonstrated technology reliability and showed that technical performance is consistent over time. Repeated trial use is reported as influential particularly for physicians who participated in three teledermatology sessions. They note that the reliability of the technology across sessions has a positive influence on their attitude toward telemedicine.

> *"...you have to develop a certain knowledge and comfort level with it and having done it a couple of times, I think that it's reasonable and I would use it again..."*
>
> *Case Study 1, Participant D*

Participants across cases emphasize that despite their ongoing participation in the teledermatology session, they have not made a commitment to using telemedicine subsequent to the conclusion of the teledermatology sessions. It is the opportunity to trial the technology in the absence of a commitment to ongoing use that encourages participation in the study.

Rogers' states that later adopters find a personal trial to be less crucial than earlier adopters. (Rogers, 2003) Later adopters will rely on the previous experience of earlier adopters to shape their views. In contrast to this theory, the study results do not show that the trial use by others is relevant to physician perceptions of telemedicine. The requirement for a personal trial found in this study suggests that physicians will not rely on the experience of others to determine their own perceptions of this innovation. Personal participation is identified as critical to the adoption decision making process and is discussed more fully in Chapter Six.

Also in contrast to innovation adoption theory, the role of early adopters in the demonstration of the benefits or the problems related to innovation use is not identified by participants in any of the study cases. Within and cross case analysis reveals that participants had varying knowledge of colleagues who had previously used telemedicine for the delivery of care and varying familiarity with those colleagues' perceptions. Regardless of knowledge about others' prior experiences using telemedicine, physicians express the view that it is their own participation in the teledermatology sessions that will impact their view of the effectiveness of telemedicine for patient care.

Trialability is found to be one of the most influential of the innovation attributes. At the conclusion of the trial of teledermatology sessions, physicians say they are convinced that the telemedicine technology is capable of delivering clear images to a long distance specialist and is an effective interactive communication channel. The technological capacity that had been previously unknown has been proven. There is agreement across cases that the technology, in conjunction with the skill of the consultant, results in effective health care delivery for their patients during these sessions. Thus, uncertainty

reduction for the technological competence of the telemedicine system is partly achieved through the trial with more significance than anticipated by innovation different in theory.

The findings regarding trialability are summarized in Table 5.5.

Table 5.5

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF TRIALABILITY OF TELEDERMATOLOGY

Case Study	Use Of Teledermatology Sessions As A Trial	Availability Of Telemedicine	Ease Of Trial	No Commitment To Ongoing Use
Case Study 1	POS	POS	POS	POS
Case Study 2	POS	POS	POS	POS
Case Study 3	POS	NA	POS	POS

POS= Positive Influence
NEG= Negative Influence
NA= Not Acknowledged As An Influence

Image

"The degree to which use of an innovation is perceived to enhance one's image or status on one's social system."

None of the data sources support the innovation attribute of image as influential on physician attitudes toward telemedicine. Social systems or collegial networks of physicians are directly observed, and noted to be strong in Case Study 1 and 2. With one participant exception, none of the participants identify their image within the physician or patient community as being affected by their use or non-use of telemedicine. Not only do participants consistently suggest that they do not perceive an effect of telemedicine use on professional image, interview data also show that being perceived as technologically competent or innovative by physician or patient communities is irrelevant to personal decision making process with respect of the adoption of telemedicine. Similarly,

physicians do not identify that the use of telemedicine would affect their image as patient centered in either a positive or negative direction.

This finding that demonstrates that image is not influential on attitude is derived from interview data only. Since there is no feasible triangulation with other data sources to further explore this finding, it is possible that physicians may have overstated their independence from the perceptions of colleagues or patients in their community during individual interviews. Further exploration of image within the physician population with respect to technological adoption is required to verify this finding.

The innovation attribute of image is shown to have some relevance in an unexpected manner in Case Studies 1 and 3 where some access to dermatology services within the community already exists. In these two cases, some participants express the concern that they do not want undermine the locally available resources, either in actuality or appearance. Their comments suggest that where perceived by the local social system to utilize 'external' telemedicine resources rather than support local physician resources, then personal image would be considered as a relevant negative influence on telemedicine use. However, this theme is not consistently reported in these two cases and remains a dimension of image to be further explored.

The findings regarding image are summarized in Table 5.6

Table 5.6

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF IMAGE

Case Study	Technologically Advanced	Innovative	Patient-Centered	Supportive Local Resources
Case Study 1	NA	NA	NA	NEG
Case Study 2	NA	NA	NA	NA
Case Study 3	NA	NA	NA	NEG

POS= Positive Influence
NEG= Negative Influence
NA= Not Acknowledged As An Influence

Perceived usefulness

"The degree to which a person believes that using a particular system would enhance his or her job performance."

The characteristics that define usefulness to physician practice are enumerated by participants as including productivity or practice efficiency, provision of an effective consultation for referred patients and, improved professional knowledge. Overall, results suggest that physicians are uncertain about the ability of telemedicine to improve their job performance or practice efficiency. With respect to productivity, it is noted by some participants across cases that telemedicine could have a negative impact on productivity where it requires additional physician time to attend the consultation.

Participants across all three cases note that the amount of effort required to participate in a telemedicine consultation is a negative influence on their perception of its usefulness. This may reflect physicians' perceptions of usefulness as diminished where the demand on their time is greater than would otherwise be required. As discussed within the context of relative advantage, physicians need to perceive a benefit to their participation in patient consultations before they would consider using their time for this purpose.

> *"It's time consuming, certainly, but that's all right. Not every patient needs this so it's okay for the few cases that do..."*
>
> *Case Study 3, Participant A*

In all three cases there is a consistent theme of the success of the teledermatology sessions to provide an effective clinical consultation and to deliver relevant professional education. High ratings by physicians of telemedicine usefulness result from the combination of care and professional education in the teledermatology sessions that created enhanced value for the time that was committed to the sessions. In routine use of telemedicine, this combined effect is not typical.

The combination of care and education is one of the most significant positive influences on telemedicine use identified by participants unanimously across cases. This study shows that there is a significant positive influence from this enhanced telemedicine use model on physician attitudes toward telemedicine.

> *"I will certainly attend the next session. This was real value for my time today. This was really useful."*
>
> *Case Study 2, Participant E*

Multiple case studies where the telemedicine trial is operationalized in the standard manner in some cases and, in this enhanced value model of the teledermatology study in other cases, could provide stronger evidence about the theoretical explanation of perceived usefulness or what emerges as a concept called value for time.

The use of theoretical rather than literal replication logic in further case studies could lead to deeper understanding of this finding that perceived usefulness is a significant influence on physician attitudes and is satisfied where multiple goals relevant to physician practice are achieved within the same timeframe. The impact of the combination of care and education is discussed in Chapter Six.

The findings regarding perceived usefulness are summarized in Table 5.7.

Table 5.7

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF PERCEIVED USEFULNESS

Case Study	Improve Practice Efficiency	Positive Use/ Performance Relationship	Achieves Consultation Requirements	Reliable Technology	Free Of Effort
Case Study 1	NEG	NEG	POS	POS	NEG
Case Study 2	NEG	NEG	POS	POS	NEG
Case Study 3	NA	POS	POS	POS	NEG

POS= Positive Influence
NEG= Negative Influence
NA= Not Acknowledged As An Influence

Perceived ease of use

"The degree to which a person believes that using a particular system would be free of effort."

Perceived ease of use as described by participants in this study is conceptually similar to compatibility and complexity. Data from interviews, physical artifacts and direct observation suggest that organizational support to make physician use of telemedicine administratively simple has a positive influence on attitudes. As noted earlier, in Case Study 1, where physicians electronic patient records are integrated into all the participants' work methods, the requirement to complete a paper referral form for submission to the telemedicine network is reported as a deterrent to making referrals.

> *"Accessibility is the key factor. It has to be easy to access."*
>
> *Case Study1, Participant E*

Additional and perceived unnecessary administrative tasks are identified as negatively influencing perceived ease of use of telemedicine. Where referrals could be integrated into the existing organizational and administrative processes, telemedicine would be perceived as easier to use.

Some physicians across cases identified ease of use for patients as an important consideration.

> *"For it to go well, it would have to be organized so the patient knows where they're going and what time and the patient is aware of how it works. They need to know that they're not going to a doctor's office, but that they are still seeing a doctor."*
>
> *Case Study 2, Participant A*

Perceived voluntariness

"The degree to which the use of the innovation is perceived as being voluntary or of free will."

Based on interview data, none of the participants perceive any external influences, either formal or informal, to use the telemedicine technology already available in their communities. Physicians describe the decision to use telemedicine to be wholly one of their personal choice. This interview finding is confirmed by documentary and archival records data sources. When telemedicine was introduced into the case study communities, local physicians were invited to a session that explained and demonstrated the technology. There is no documentation in any of the communities or held by the telemedicine network itself that suggests that focused efforts had been made in any of the cases to require physicians to attend this session or to subsequently use the telemedicine network. These other data sources confirm participant perceptions that use is entirely voluntary. Participants consider voluntariness as a given and have not contemplated telemedicine implementation in any other manner. Therefore, interviews did not lead to discussion about the importance of voluntariness.

It can be speculated that based on other findings, for example the importance of compatibility with participant needs and values, that mandatory physician use of telemedicine would be resisted. However, given the absence of data about the influence of voluntariness on physician attitude toward telemedicine, conclusions about the importance of this innovation attribute are not made.

Incentives

"The main function of an incentive for adopters is to increase the degree of relative advantage of the new idea...Offering incentives is one diffusion strategy that affects the perceived attributes of innovations, especially relative advantage..." (Rogers, 2003, p 236)

The introduction of two incentives for physician participation in the teledermatology sessions is integral to the study design. The first incentive is the availability of continuing medical education credits based on participation in the teledermatology sessions. The second incentive is physician payment through the telemedicine network for patient care delivery during the teledermatology sessions. Since study participants are primary care physicians, recognition of the teledermatology sessions as eligible for continuing medical education credits required for ongoing family practice certification was obtained. The invitation to participate in the teledermatology study explicitly highlighted this opportunity to obtain these credits.

The second study incentive is a financial incentive. As noted in Chapter Three, the importance of physician reimbursement to physician use of telemedicine is frequently raised in the telemedicine literature. (Gutierrez, 2001) Therefore, physician payment for patient care in the teledermatology sessions was offered to act as an incentive for participation.

The study results suggest that neither of these two planned incentives has the anticipated relevance to either participant attitudes toward telemedicine or to their participation in the teledermatology sessions. The interview data suggesting that that these incentives are not meaningful to participants is consistent across all cases, although there was one participant in Case Study 1 and 2 who did raise payment as an issue.

> *"I was wondering when I show up tomorrow, well how do I get paid? My time is not free so I have to figure out how I bill for that."*
>
> *Case Study 2, Participant A*

With respect to payment, in Case Study 1 and 2, the telemedicine coordinators announced during the teledermatology session that they would submit the documentation to the telemedicine network for physician payment further to their participation in the delivery of care to their own patient. The physician was required to sign the payment form prior to leaving the telemedicine studio. Through direct observation and subsequent

documentary evidence it is apparent that few physicians submitted forms for payment. While physician reimbursement is frequently identified in the literature as a barrier to telemedicine adoption, it is not observed as a relevant factor within this study. Participants who were not personally motivated by financial payment nonetheless expected that this would be an issue of importance for colleagues.

> *"It's a pretty unique situation here...but I would think in other settings somebody would be asking pretty early on in the game about the funding."*
>
> *Case Study 1, Participant B*

There are many possible explanations for this finding that contradicts a predominant theme in the telemedicine literature. Some of these explanations are discussed in Chapter Six. However, within the context of the study findings as these develop, other possible explanations emerge. One of these explanations is that the study did not require a commitment to ongoing telemedicine use. Accordingly, participants may have been unaffected by financial considerations since the time commitment was short-lived. Perhaps the infrequency of the sessions, their temporary nature and the modest potential payment explains the finding that reimbursement is not an incentive for participation.

The second planned incentive, the provision of CME credits, is also found to have little influence on physicians.

> *"The CE credit of was absolutely of no importance to anybody. I think I can tell you that definitively."*
>
> *Case Study 1, Participant B*

> *"...there are so many ways to earn credits that if you're interested, you know that they're there and there is CME on line now...you can do it at your own time..."*
>
> *Case Study 1, Participant D*

Instead, this study reveals that an effective incentive for physician participation in the teledermatology sessions is the extent of professional learning as opposed to the credit for education. This finding is drawn from both interview data and direct observation. A predominant theme in all interviews and across all cases is the importance of achieving new learning that is unavailable through other resources such as didactic professional education activities or the resources available to physicians through the Internet.

> *"There is no comparison to a lecture format without the patient. You can describe things to a consultant and so on but unless he sees the patient, I don't think he gets the true picture as he did in something like this. To have the consultant in your presence makes a big difference. By the end I understand a lot better what to do."*
>
> *Case Study 3, Participant A*

> *"The component of the learning experience with the consultation is the difference. The patient would get the same treatment if they saw him personally, but I wouldn't have the benefit of knowing what his thinking process was."*
>
> *Case Study 1,Participant D*

> *"I expected that I would learn from my own case. I didn't expect other peoples' cases to be as informative."*
>
> *Case Study 1, Participant A*

These comments are in sharp contrast to the planned incentive of a continuing medical education credit. While learning is shown to be a significant incentive for physician participation in the teledermatology sessions that positively influences attitudes, the officially recognized credit is not an effective incentive.

> *"I always have way too many credits so it doesn't matter to me."*
>
> *Case Study 2, Participant B*

"...if I wasn't interested in the topic, the fact that you are giving me a CME credit for it would not have made a difference. I am coming to get this exposure to the topic and getting a CME credit is a cherry on top."

Case Study 3, Participant B

Rogers' diffusion of innovations theory includes consideration of the effect of incentives in stating that incentives increase the relative advantage of the innovation by providing payment of cash or in kind to encourage adoption. (Rogers, 2003) In this study, the payment of cash did not appear to be influential. The incentives of professional knowledge growth and the provision of high quality care to patients are found highly influential on physician attitudes in this study. Since this may be reflective of the format and purpose of the teledermatology sessions, these incentives should be tested in other studies where telemedicine care is delivered in its standard model.

The findings regarding incentives are summarized in Table 5.8.

Table 5.8

CASE-ORDERED INNOVATION ATTRIBUTE MATRIX: DIMENSIONS OF EXTERNAL INCENTIVES

Case Study	CME Credit	Payment For Participation Consultation	Efficient Learning	Effective Learning
Case Study 1	NA	NA	POS	POS
Case Study 2	NA	NA	POS	POS
Case Study 3	NA	NA	NA	POS

POS= Positive Influence
NEG= Negative Influence
NA= Not Acknowledged As An Influence

Influences on physician attitudes not encompassed within study theoretical models

Organizational factors

Organizational factors are reported across all cases as having an influence on physician attitudes. The aspects of organization that are raised are the importance of a competent telemedicine technician who can manage the technical aspects of the telemedicine session, a well arranged room that is conveniently located within the host facility and ease of patient scheduling and adherence to the scheduled times.

Through direct observation it is evident that individual skill of the telemedicine technicians varies across cases. When the telemedicine technician utilizes the equipment effectively, the consulting dermatologist is observed to spontaneously provide positive feedback. This reinforcement is then perpetuated during the sessions by participants who compliment a good image. Participants also acknowledge that there are many roles that must be fulfilled competently for a successful consultation.

> *"Confidence in the technology is multidimensional...part of it is that the person who's there doing the touching has to be quite good at that part of it and, as far as describing what is there to the consultant, that's part of it too. The communication between them has to be pretty good. And the camera work has to be good."*
>
> *Case Study 2, Participant B*

All of these cross-organizational participants in a telemedicine consultation must perform their function with competence. This requires cross-organizational collaboration and establishment of standards or protocols for service. Participants' views of telemedicine are inclusive of organizational factors such as location of the telemedicine studio and local resources to ensure a well-run consultation.

Participants in this study do not raise medical-legal liability of physicians. Given its importance in the telemedicine literature, discussion of medical-legal issues was initiated

by the interviewer since it was not raised by any participants. Participant discussion suggests that this topic has not been contemplated by participants who are novice users of telemedicine. Only one study participant across all three cases questions raised a liability concerns with respect to responsibility for ongoing patient care subsequent to the teledermatology session. None of the participants has read about this issue in professional journals or had other exposure to this topic within the context of telemedicine. It is not found to be influential for these participants at this time in their exposure to telemedicine.

Social factors

In addition to the requirement for values compatibility between telemedicine specialist and referring physician regarding demeanor and interaction with patients, participants also describe the importance of a positive interaction between the specialist and themselves during the session. Physicians across all cases acknowledge the influence of the interpersonal style of the specialist on their participation during the teledermatology sessions and their positive perceptions of the sessions.

Observations of interactions between the specialist and study participants validate the comments during individual interviews. As teledermatology sessions proceed, physicians demonstrate increased comfort asking questions of the specialist and posing alternate treatment options that had not been recommended by the specialist and requesting an explanation why these had not been identified by the specialist as the preferred option. For example, where certain pharmaceuticals were prescribed, physicians would ask why these had been selected instead of other pharmaceuticals with which they were more familiar. There were many instances where physicians asked what treatment should be implemented if the expected result was not achieved further to the specialist's recommendation. These questions appear to maximize the usefulness of the session.

In all case studies, physician participants are observed to interact in a collegial manner during the teledermatology session. In Case Study 1 and 2, interview data confirm this observation and the positive social environment in which the teledermatology sessions are conducted is identified as an important consideration for subsequent participation. An atmosphere of camaraderie amongst participants is reported as a social influence on physician attitudes toward telemedicine.

> *"There was a sense of camaraderie because we knew each other as colleagues already. We also knew the dermatologist. I think we didn't have to stop and wonder, you know what the other people's standard of practice was and because we already knew that, we hit the ground running. It was fun."*
>
> *Case Study 1, Participant A*

The importance of the social environment to physician views about the teledermatology sessions and continued participation is a consistent theme across cases. A combination of direct observation and interview data suggests that the interaction amongst participants, and between participants and consultant dermatologist influences physician attitudes about telemedicine itself. While the performance of the technology is described as a positive surprise for most participants, the technology itself is a backdrop to the interactions that led the participants to express positive views about the teledermatology sessions and the use of telemedicine for care delivery more broadly. The focus is the social interaction that the technology enables rather than the technology.

In conclusion, the results suggest that while innovation attributes as outlined in Chapter Two explain some of the influences on physician attitudes toward the use of telemedicine for the delivery of patient care, some findings do not fit within these theories.

A summary of cross case analyses for themes beyond innovation attributes

At the time of case selection, it was identified that each of the three communities had differences in the number of primary care physicians, access to specialty services and duration of ongoing community access to the telemedicine network. While all three cases are identified as underserviced according to provincial government standards with respect to access to specialty care, as stated earlier each case can be positioned at a different point on a scale of rurality and limited specialty access. Case Study 3 has the largest community, the largest number of primary care physicians and the best access to dermatology specialty services. Case Study 2 has the smallest population and least number of family physicians with the most limited access to dermatology care. Case Study 1 is at a midpoint between these cases both in terms of population size and dermatological access.

The findings respecting the influences on physician attitudes toward telemedicine use for specialty care are remarkably similar across all three cases despite these differences in size and rurality. However, there are some differences that may be reflective of the unique characteristics of each case that must be considered to understand how the innovation attributes may function differentially dependent on circumstance.

Cross case analyses reveals that the importance of trialability is consistent for all participants. In all cases, during pre-session interviews participants are uncertain about the ability of the technology to enable a clinical examination. Interview data subsequent to the first teledermatology session consistently identifies participant surprise at the quality of image and the smoothness of real time interaction with the distant dermatologist is achieved through the technology.

The trial of telemedicine addresses their threshold question of whether the technology is adequate to enable care delivery. As noted across all cases, participants can only be satisfied that this threshold is achieved through personal use. Testimonials from other users would not be influential. Live trials are found to be essential and a prerequisite to

individual conclusions about the appropriate use of telemedicine. The conditions of the trial, for example the lack of commitment to ongoing use beyond the teledermatology sessions and the flexibility to refer patients presenting any dermatological diagnostic or treatment problem are also identified as positive elements of this telemedicine trial.

Also consistent across all cases is the requirement that telemedicine meet personal rather than system needs. Interview data suggest that while avoiding patient travel is a benefit arising from the use of telemedicine, patient travel is not an aspect of telemedicine that drives physician referrals for telemedicine patient care. Physicians in this study show that they are influenced by the benefits that accrue specific to their own patients and practices and regard system-wide benefits that may be attributed to telemedicine use by its funders as largely irrelevant influences.

The theme of value for time that emerged predominates across cases. Participants identify that the combination of patient care and professional knowledge development in the same session creates an enhanced benefit or value for their time. Physicians consistently identify that telemedicine must be an effective and efficient use of their time for value to be achieved. Combined care and education using participant generated learning needs that is scheduled at a time that minimizes practice disruption such as time set aside for family practice rounds creates value for time.

Regardless of access to specialty services, participants across all three cases identify that telemedicine is an adjunct service. No participants consider telemedicine as a mainstream delivery method. It is not described or considered as a replacement for in person care. In the two communities where there is some access to dermatological care, it is important to participants that telemedicine does not undermine local physician resources and thus its supplemental nature is ever more strongly stated.

Another common theme across cases is the influence of the telemedicine specialist. In the teledermatology sessions, the teaching method and interpersonal style of the dermatologist is described as a positive influence on attitudes. Participant emphasis on

their interaction with the dermatologist suggests that the perceived benefits of telemedicine are unique to the skill and manner of the telemedicine specialist. Where physicians are dissatisfied with competence or style of the specialist, perceptions of telemedicine may be less positive. Research designs that allow comparison of physician perceptions based on different specialists would provide greater understanding of the importance of this aspect of compatibility.

An example of a finding that is unique to each case based on setting differences is telemedicine studio location. While all participants consider the location of the telemedicine studio as an important influence on their attitudes toward telemedicine use, views of the appropriateness of hospital-based studios are reflective of organizational factors in each community. In Case Study 1, participants report that the local hospital is ill-suited for telemedicine studio location. Physicians in this community typically travel to the hospital only when one of their own patients is admitted. Travelling to the hospital to participate in a telemedicine consultation is considered a significant inconvenience. In Case Study 2, participants are frequently at the hospital to fulfill duties such as emergency care shifts, and surgical assists. In this case, the hospital is identified as the most convenient location. In Case Study 3, where there are hospitalist physicians, the hospital-based location is very convenient. However, it is also noted that the services typically offered through telemedicine are less suited to the practice of hospitalists whose patients are discharged to community physicians for ongoing management. This suggests that while convenience of location influences physicians views of telemedicine use, the most suitable location is unique to each practice context.

Through direct observation and archival data sources it is evident that each community introduced and supported telemedicine in a different manner. In Case Study 1, the telemedicine studio is located in a shared meeting room within the hospital. Hours of access to the telemedicine equipment are limited and the service is supported by a part time coordinator. In Case Study 3, upon entry into the hospital there are signs indicating the telemedicine studio location. The studio is in a designated location and the service is supported by two full time coordinators. These differences in telemedicine integration

into the host location may have an influence on physician perceptions of telemedicine that were not examined. Perhaps where telemedicine is supported as a part time service, physicians may consider it as an unproven or even experimental service that is not fully supported in the community. How the recognition of telemedicine within each host facility influences physicians is a subject for further investigation.

Table of Contents

Chapter 6

Discussion of the Teledermatology Study Findings

Chapter 6

Discussion of the Teledermatology Study Findings

"When you use the term 'buy-in' my brain stops and everyone seems to be saying this these days. It sounds to me like people are trying to sell doctors a bill of goods and pull the wool over their eyes. Buy-in. I mean, what do we have to do to sell telemedicine? I mean don't you think that if something is really good, then you must explain it, and then people will use it?"

Teledermatology study physician participant

Deepening understanding of innovation adoption within the health care system and, more specifically, the factors that influence physician attitudes toward technological innovation adoption is the overall purpose of this doctoral work. Using the example of telemedicine as an alternate delivery system for patient care, the teledermatology study uses three case studies to explore the innovation attributes that primary care physicians ascribe to telemedicine and their influence on physician attitudes regarding the adoption of this technological innovation. The findings from the teledermatology study provide insight into how physicians perceive telemedicine as an alternative method for patient care delivery, incentives for telemedicine use and the local adaptation that would be necessary for consideration of ongoing use. Through this study of the influences on primary care physician perceptions of telemedicine in the context of dermatology care, classic innovation attributes are shown to be influential only within a broader constellation of influences that are broader than the characteristics of the innovation itself.

The purpose of the teledermatology study is to explore how innovation attributes, as these have been defined in diffusion of innovations theory, influence physician attitudes toward telemedicine. The findings of the teledermatology study show that the diffusion of an innovation such as telemedicine into the physician community can not be fully understood from the perspective of existing theoretical models and innovation attributes. While each theoretical perspective as described in Chapter Two has a relevance to

understanding the influences on physician use of telemedicine for the delivery of patient care, these influences are more complex than any single theory or incentive model that was drawn from the literature. Even Rogers' diffusion of innovations theory, which is arguably the most comprehensive of existing theories, is insufficient to explain some influences on physician innovation adoption that were found during the teledermatology study. Instead, the emergence of new explanations of attitudes toward technology, especially those that recognize the social and organizational factors that may be unique to physicians as end users of technology, is required to understand technological innovation adoption in health care.

Further to the teledermatology study findings as reported in Chapter Five, this chapter discusses their implications within the context of existing theoretical frameworks and the telemedicine literature. First, it will be shown that in application to the teledermatology study findings, there is thematic consistency across attitudes toward innovation attribute definitions, with differences reflective of lexicon idiosyncrasies rather than conceptual paradigms. This chapter will also highlight where the teledermatology study findings cannot be explained within current theoretical models and identifies study themes that may be considered in future innovation adoption theory development. Finally, consideration will be given to rival explanations of the influences on physicians that, although not found in the teledermatology study, have been identified in other telemedicine studies.

Prior to discussion of case study findings, it must be established that these cases demonstrate characteristics that would be found in a broader population as contemplated by the theoretical frameworks that guided the teledermatology study. Are the experiences of the case studies typical of the 'class of phenomena' described by the theoretical models? (Bryman, 1988) Evaluation of the fit between the theory and the cases will establish the appropriateness of using the theoretical models as the framework for discussion.

The three cases were selected on the basis of replication logic. Despite known differences in community size and physician and practice characteristics, it was proposed that the physicians in these three communities could be considered as similar to adopters contemplated by existing innovation diffusion theories. Analysis of the findings of the three case studies has confirmed this proposition. The cases and the physician participants within cases were shown to be similar to the users that are contemplated by the theories used to guide data collection. Thus, there was sufficient evidence that the study cases were typical of the innovation adoption process described by the theoretical frameworks to confirm the methodological appropriateness of proceeding with this discussion.

There are three categories of findings from the teledermatology study that are discussed in this chapter. Many of the findings of the teledermatology study are aligned to the theoretical frameworks that were used to inform the study methods. Therefore, the innovation attributes that were used to provide an initial structure to the physician interview guide, provide a structure for discussion of findings arising from physician interviews. A second category of findings is also aligned to existing conceptualizations of innovation attributes, but the effect is contrary to current understanding. Finally, there are other study findings that do not fit within the theoretical frameworks selected for this study. This third category includes findings that may have been demonstrated in other telemedicine studies, but are not encompassed within the theoretical frameworks regarding innovation adoption used for the teledermatology study.

The discussion of these findings is presented in three sections. The first section includes all findings analyzed according to innovation attributes, even where the impact on attitudes is different than would have been anticipated. This includes the first two categories of findings as delineated above. The next section discusses findings that are not encompassed by innovation adoption theory as it can be applied to physician use of telemedicine. It is in this section that clues to the questions for further theory development are described. Then, rival explanations from the telemedicine literature are

considered. The implications for theory development are presented and the chapter concludes with methodological considerations.

Findings conceptualized according to innovation attributes encompassed within study theoretical models

The teledermatology study findings reveal that the innovation attributes examined in the teledermatology study, as these have been defined by Rogers, have differing levels of relevance for physician telemedicine attitudes. Discussion of these attributes as demonstrated in the teledermatology study and their concurrence with similar theoretical constructs such as the knowledge barriers described by Attewell (Attewell, 1992) and developed specifically for application to telemedicine. (Tanriverdi & Iacono, 1999) and aspects of the Technology Acceptance Model described by Davis (Davis, 1989, 1993) will elucidate how these attributes influence physician perceptions of telemedicine.

Relative advantage

The primary relative advantage of telemedicine over in person care identified by physician participants was quicker access to specialty care. There was no perceived advantage to a specialist consultation delivered through telemedicine were it to be received in the same or longer timeframe than in-person care. However, where specialty care could not be obtained for patients except through telemedicine, then a relative advantage would be ascribed to the telemedicine service. The relative advantage of telemedicine access to physician services otherwise unavailable, or with very limited availability, has been reported in the literature. (Walker & Whetton, 2002)

Knowledge transfer between the telemedicine consultant and the primary care physician was also identified as a relative advantage over traditional consultations where referring physicians do not have the opportunity for an interactive discussion with the consultant regarding treatment options and expected outcomes. Enhanced continuity of care was

reported to be achieved through referring and consulting physician dialogue. However, this relative advantage is known to be time intensive for participating physicians. (Sicotte & Lehoux, 2003) As may be expected, physicians identified that their participation in a telemedicine consultation would only occur with patients where they believed that live interaction with the consultant would improve the patient outcome.

Study participants did not describe relative advantages of telemedicine consistent with the relative advantages over the status quo that are described by telemedicine network funders. (Ministry of Northern Development and Mines of Ontario, 2002) There is a gap between the reason that provincial and federal governments have funded telemedicine and the advantages that physicians perceive as influential for use. It has been stated that telemedicine can function as a starting point for reengineering the process of health care delivery. (Dunn, 1998) This was not only absent from study participant discussion of telemedicine advantages, but contrary to the predominant view that telemedicine would only be considered as an adjunct to traditional care delivery. Process reengineering of health care delivery is not a consideration for study participants. This significant difference in relative advantage identification may partly explain the difference between expected and actual use of telemedicine described in Chapter Three.

Rogers' tenet that exchange of information about the relative advantage of an innovation promotes diffusion was not demonstrated in the teledermatology study. (Rogers, 2003, p.232) There are two possible explanations for this contrast between theory and study finding. First, although study design did not include quantitative evaluation of comparative strength of influence of innovation attributes, relative advantage which is considered by Rogers to be the strongest predictor of the rate of innovation adoption, was not the innovation attribute that was described with strongest influence on physician attitude. This could result from the relative advantages that have been proposed by Rogers such as economic profitability as non-operative within these case studies.

A second explanation may be that physicians across cases described relative advantages of telemedicine as standards that must be met rather than as relative measures of benefit

compared to the status quo. Without the relative advantages being achieved, then physicians would not consider telemedicine favourably. Therefore two dimensions of relative advantage as described in Chapter Five, quick access to specialty services and improved professional knowledge, are prerequisites for telemedicine use rather than the perception of telemedicine as better than in-person care. Relative advantages do not appear to be predictors of the rate of adoption but prerequisites to determination of whether telemedicine use will even be considered.

Compatibility

Innovation adoption requires that a problem that is recognized by the clinicians for whom the innovation is intended be addressed. (Sanson-Fisher, 2004) In the teledermatology study, all participants reported a need for more dermatological knowledge and greater access to dermatological specialty services for their patients. This was verified through the triangulation of data sources that included information on access and wait lists for dermatology services. Compatibility of the telemedicine service with physician self-identified need was not described as an influence on physician perceptions but, instead, as a prerequisite to use. Where compatibility with personal and practice needs and values is not achieved, then other positive views toward the use of telemedicine would not affect the overall perception that telemedicine is unnecessary for the delivery of patient care.

It was also noted in Chapter Five, however, that telemedicine is considered compatible where the family physician personally identifies a need for a service. The services of urban based specialists may be perceived by physicians in underserviced areas as unconnected to their local needs. These urban physicians themselves may also seem impersonal and unconnected from local physicians. The notion that telemedicine is always compatible with the needs of rurally based physicians is not supported. For example, the view that rural physicians are unable to deliver appropriate without access to urban specialists has been challenged: "This implication insults the staff of rural hospitals without access to telemedicine, who competently handle a variety of serious

conditions with outcomes equal to or better than those achieved by their tertiary care counterparts." (MacLellan, 2005)

Physicians described their use of telemedicine during the teledermatology study for both professional knowledge development and for the delivery of patient care as well suited to their needs. During individual interviews some physicians mentioned other clinical specialties where professional needs were similar and interest in the implementation of telemedicine sessions would be welcome. The nature of the specialty service being provided through telemedicine is important to its perceived compatibility with existing needs. Where professional or practice needs were already fulfilled, there was a concomitant decrease in interest in the use of telemedicine. This suggests that compatibility is a critical element of physician attitude development that is fulfilled when physicians themselves identify the need. Participation in a telemedicine session with patients appears to be compatible where the physicians identify the education topic. This is in contrast to professional learning sessions driven by institutionally-identified topics.

This finding is thematically similar to 'perceived usefulness', an innovation attribute in the Technology Acceptance Model. (Davis, 1989) The teledermatology sessions were compatible with physician needs. Patient and clinical problems were selected by each participant, which ensured relevance of at least one case per participant. Participants' note that learning was achieved and usefulness was also satisfied by the case presentations made by colleagues during teledermatology sessions. This is consistent with other studies that have shown that physicians focus on usefulness of the technology itself for ongoing use after demonstration of its usefulness for clinical practice has been achieved. (Hu, Chau, Liu Sheng & Tam, 1999) Telemedicine may be compatible with physician needs where the use of the technology is useful to their practice.

This theme was also reported in a study of videoconferenced rounds where it was shown that the selection of a topic that represents a major clinical challenge for health care professionals was related to participation, with physicians requiring that topics demonstrate practical day-to-day value. (Sclater, Alagiakrishnan, & Sclater, 2004)

Given the telemedicine literature and the teledermatology study this finding provides further evidence of the importance of compatibility with physician self-identified needs.

The integration of the innovation attribute of perceived usefulness with the compatibility innovation attribute may be a promising way to advance theory development specific to physician perceptions of telemedicine. As a professional population, study results suggest that physicians' value pragmatic use of technology to satisfy their practice specific needs. The criticality of compatibility between the technology and clinical practice from the physician perspective is consistent with results in other studies. (Chau, 2001)

Complexity

The degree to which a telemedicine is perceived as difficult or easy to understand and use was not identified as a key influence on physician attitude in the teledermatology study. It is proposed that this finding is attributable to an artefact of the teledermatology study. The manner in which the teledermatology sessions were implemented eliminated the burden of technical complexity for participants and also reduced the typical administrative burden related to patient referral and participation. This proposed explanation is supported by the direct observation that study participants found the technology straightforward and easy to use.

A local telemedicine coordinator handled all of the technical aspects of each teledermatology session including linking to the telemedicine network and using the telemedicine camera equipment thereby eliminating any telemedicine- specific technical knowledge or skill required by study physicians. The participation of the local gatekeeper to simplify referral processes for the teledermatology sessions reduced administrative complexity for study participants. Therefore, the organization of the teledermatology sessions increased simplicity for participants to such an extent that perceptions about the influence of complexity may have been distorted.

Given the need for telemedicine efficiency to reduce physician time demands that was described by participants it can be speculated that where these administrative supports are not available, thereby creating greater complexity and less efficient use of physician time, physician perceptions of complexity may be more influential. It has been shown that where the adoption of a technological innovation is inconsistent with physician practice routine, simplicity of use may be irrelevant to the adoption decision. (Hu et al., 1999) Technological simplicity may be secondary to logistical simplicity. Research findings suggest that the applicability of complexity as an innovation attribute may be specific and limited in its relevance to physicians as potential innovation adopters. (Hu et al., 1999) Perceived simplicity or ease of use was not raised by physicians as a factor that influenced their overall perceptions. Accordingly, physicians may be sufficiently dissimilar to other technology users that some aspects of theoretical models specific to technology adoption may be limited in their applicability to this population. (Ferlie, Fitzgerald, Wood & Hawkins, 2005)

Observability

Observability is described by as visibility of the impact of the innovation on others, suggesting that as other members of a system are able to observe its results, there is a positive impact on adoption. (Rogers, 2003, p258) The observability of the teledermatology sessions was identified as positively influencing participant physician attitudes toward telemedicine, but in a narrowly defined way. Some physicians noted that their patients were pleased with the teledermatology. However, observability does not extend to other physicians in the community. In addition to interview data about telemedicine observability, direct observation identified that in the intervening time between teledermatology session study participants discussed the previous session and the potential for telemedicine to address their local clinical problems. Since the teledermatology sessions were conducted as group sessions, the results of the sessions were clearly observable to all participants at the time of participation.

Spontaneous discussion amongst participants about their perceptions subsequent to the teledermatology sessions was noted. It is suggested that the opportunity to discuss what had occurred within a collegial group had a positive influence on physician attitudes toward telemedicine. This post session interactivity was facilitated in the teledermatology study by physicians within cases who identified the other participants as familiar and trusted colleagues with whom there was a high degree of comfort in exposing practice and discussing clinical issues post session.

While there was no evidence of observability operating outside of the participant group in the manner contemplated by this innovation attribute definition, as stated above it was noted by some participants that their patients had observed benefits to the teledermatology consultation. In follow up with their own patients, some patients noted that they had found the telemedicine experience to have been positive both from a quality of care and interpersonal perspective. Participants were sometimes surprised that their patients responded positively to the long distance experience, which was in contrast to their previously held belief that patients would only want in-person care. Since observability of patients who received care during the teledermatology sessions appeared to heighten physicians' positive perceptions of telemedicine, it is suggested that telemedicine implementation should recognize the importance of patient perspectives as influential on physician attitudes. However, as an innovation attribute observability does not appear to be particularly influential on adoption attitudes.

Trialability

Trialability, or the ability to 'experiment' with the technology was discovered to be a very relevant influence on physician attitudes about telemedicine. In the teledermatology study, physicians expressed a requirement to be convinced through direct, hands-on, personal experience that the telemedicine technology could deliver, with sufficient technological sophistication, the image clarity required for patient assessment and

treatment planning from a distance. Demonstration of telemedicine images that are of sufficient quality to enable diagnostic accuracy by a distantly-located physician, who is unable to personally examine the patient, held the status of a prerequisite rather than influences on physician views about use. Physicians must observe that the technology is capable of facilitating the delivery of patient care. This is similar to other study findings that technical knowledge is a requirement that once satisfied is still insufficient to lead to telemedicine adoption. (Tanriverdi & Iacono, 1999) A positive view of the technology requires a personal trial in a real situation.

Another dimension of trialability shown to influence physicians is the absence of a requirement for a commitment to ongoing telemedicine use. The performance of the technology itself was tested by participants who wanted the opportunity for trial use without committing to continuing use past the teledermatology sessions. This is consistent with the knowledge barrier theory: "...physicians do not trust the technology unless technical feasibility is accompanied by clinical effectiveness-i.e., evidence showing the technology does what it is designed to do--and maintains diagnostic quality of images." (Tanriverdi & Iacono, 1999)

While this finding about the importance of trialability or addressing, in the language of Attewell (1992), knowledge barriers may seem self-evident, the importance of individual trial of the technology was more significant than may be contemplated within existing innovation adoption theories. It has been suggested that later adopters are influenced by earlier adopter peers who act as a vicarious trial. (Rogers, 2003) However, the teledermatology study demonstrated that physicians require personal and direct experience of telemedicine for innovation attitude formation. The uncertainty reduction process that is a central principle in Rogers' diffusion of innovations theory was clearly enacted in the teledermatology sessions. Perceptions of surrogate testers of the technology would not be considered as relevant to the participants in this study.

Although the study design does not enable consideration of whether this is a phenomenon unique to physicians as an end user population, in contrast to Rogers' theory, the study

findings highlight the importance of a personal trial for physicians. Rogers' original citations for his observations about the role of early adopters and the greater importance of trialability for earlier users than later user are for studies completed in the 1940's. (Rogers, 1995) This may provide some explanation for the incongruence between Rogers' theory and the attitudes of the teledermatology study participants. It is possible that the manner in which physicians consider technology may be different from other users. Similarly, the adoption of non-technological cultural innovations as these are referenced by Rogers (1995) may be a different process than physician's expressed need for a first hand trial for information about an innovation.

Image

The teledermatology study results do not support image as relevant to physician attitudes. This finding is consistent with a study that showed that the impact of image or social status on physician intention to use telemedicine was not significant. (Gagnon, Godin, Gagne, Fortin, et al., 2003) However, it must be recognized that study limitations may also explain the lack of importance assigned to one's image within the community. An inherent bias in sampling or in data collection methods may have led physicians to present themselves as uncaring about public image. For example, physicians may have presented themselves as removed from public perceptions of their practice. It is also possible that this finding about image is unique to physicians where practice efficiency predominates over concerns about one's image as this may be affected by telemedicine use. Support for this alternate explanation is found in the acknowledgement that physicians are a unique group of professionals with variations in attitude formation from other professionals. (Gagnon et al., 2003)

Voluntariness

As noted in Chapter Five, none of the participants in the teledermatology study experienced any pressure, either formal or informal, to use the telemedicine technology already available in their communities. There are no findings from the study that enhance understanding of the role of voluntariness in the attitude formation. Participants in the study considered voluntariness to be a given and do not appear to have contemplated an organizational setting where telemedicine use would be mandatory. However, themes related to practice independence were strong and it may be inferred that voluntariness of use would be a similar physician-specific cultural value. Conflicting findings about the correlation of voluntariness to adoption exist within the literature. (Gagnon et al., 2003)

Findings not encompassed within study theoretical models

In this section, influences on physician attitudes toward telemedicine that do not align with theoretical models includes in the study development that were found in the teledermatology study are now discussed. These findings have been aggregated into themes that evolved during interview transcript analysis and incorporate within and cross case comparisons.

Social interaction

A study of general practitioners' perceptions of asynchronous telemedicine in dermatology concluded that this model of telemedicine would not be widely accepted by family physicians and that interaction between referring and consulting physicians even through telephone access would have improved perceptions of telemedicine. (Collins, Bowns, & Walters, 2004) This study of asynchronous methods suggests that merely receiving the service for patients through telemedicine does not favourably influence a

primary care physician's attitude toward telemedicine. The importance of the interaction between the consultant and the primary care physician implied by this finding is confirmed in the teledermatology study as an important influence on physician perceptions of telemedicine. In the teledermatology study, the interaction between primary care physicians and the consulting specialist engendered a positive attitude about the use of this technology.

It has been found that a social threshold needs to be achieved to facilitate positive learning. (Sclater et al., 2004) Teledermatology study participants similarity noted the importance of the camaraderie that was achieved both within the telemedicine studio amongst participating colleagues and with the consultant at a distance. Further research is required to determine the degree to which the interpersonal manner of the consultant sets a positive learning and patient care atmosphere and consequently a positive view toward telemedicine. However, it is anticipated that the manner of the consultant is a determinant of this atmosphere and attitudes toward telemedicine more broadly. It has been noted that a critical consultant can have a negative impact on referring physician telemedicine attitudes. (Lehoux, Sicotte, Denis, Berg & Lacroix, 2002)

In the two cases that are characterized as the most underserviced and the most geographically distant from urban academic health centres, direct observation revealed a group of physicians who could be characterized as highly collegial, comfortable with one another and knowledgeable about each other's practices. This was manifest in the atmosphere of trust that was observed in each teledermatology session and noted both by the investigator in the sessions and the study dermatologist at a distance providing the consultations. Participants demonstrate comfort in assisting in each other's patient examinations and posing many questions that revealed their lack of dermatological knowledge.

The collegiality identified in the two cases may be a reflection of the sampling methodology since it is possible that the physicians who were willing to participate in the study were members of a peer group that were accustomed to participating in continuing

education events together. The camaraderie that was observed was also commented upon by many participants during individual interviews as influential on attitudes since they experienced that camaraderie within sessions as a positive aspect of the teledermatology sessions. Whether the influence of social interaction is also observed where the atmosphere of telemedicine sessions is perceived to be negative or judgmental is a subject for future study.

In the third case study, where participants came from private practice or hospital-based practice in a larger urban centre, the same level of camaraderie was not evident. These physicians had little exposure to one another's practice in the usual course of events and the teledermatology session brought together physicians who would not typically observe each other's practice. However, participants expressed the view that the positive social atmosphere was created by the study consultant who set the tone of informality and collegiality for the sessions. Similarly to the other two cases, the findings from this case also suggest the importance of an interpersonal atmosphere conducive to learning.

Organizational imperatives

Simple organizational factors were identified as influences on physician attitudes toward telemedicine use. Organizational factors include telemedicine studio location, workflow, and integration with routine practice.

The location of the telemedicine studio has an impact on physician willingness to use telemedicine. (Helitzer, Heath, Maltrud, Sullivan & Alverson, 2003; Yellowlees, 1997) While telemedicine studios are typically situated within hospitals, in some communities alternative sites may be more convenient for physicians and thus more likely to be considered favorably. For instance, where physician practices are in a group health setting or long term care facility, telemedicine studios may be most appropriately situated in these practice locations. In Case Study 3, a telemedicine studio situated in a long-term care facility enabled the delivery of services that could not otherwise have been received

given the requirement for patient and physician travel. In this case, both physician and patient were present at this location and both would have been required to travel to a hospital based telemedicine studio. Location of the studio can also function as a positive influence on referrals for telemedicine services. In two case studies, participants transported a fragile elderly patient from a nursing home to the telemedicine studio located in a hospital by ambulance to receive the teledermatology service. The requirement to make such travel arrangements was identified as a deterrent to ongoing use since the coordination of ambulance service, nursing home staff, and telemedicine coordinator and teledermatologist was time intensive with a high risk for failure of all parties to meet their time commitments. This underscores the importance of organizational coordination and administrative simplicity.

The local hospital was generally described by participants as an inconvenient location for a telemedicine studio. The anticipated benefit of receiving an otherwise inaccessible service was sometimes considered to outweigh the physicians' perception of personal inconvenience. Within the context of the special event nature teledermatology sessions, it is likely that physicians were more willing to bear the inconvenience of travel than would be expected where telemedicine is used routinely. Perhaps this partly explains the predominant experience in the telemedicine literature when apparently successful pilot projects are not sustained over time.

Documentary and archival records do not provide much explanation of why hospitals were originally chosen as telemedicine sites. It may be presumed that hospitals are considered health care settings that exist within most communities where telemedicine studios would be located and include sufficient infrastructure to support a telemedicine initiative. However, since telemedicine patients are not expected to always be drawn from an inpatient hospital bed, the location of telemedicine studios is an interesting topic for further inquiry with respect to the issues of the space where health care is delivered. Telemedicine may challenge traditional views of space for the provision of ambulatory care.

The use of protocols for telemedicine staff to enhance their ability to achieve a successful telemedicine patient examination was identified as an organizational imperative to support telemedicine use. In one case, after the first session the provision of a protocol by the study dermatologist to the telemedicine coordinator describing necessary supplies for dermatological consultations that should be stocked in the telemedicine studio such as a measuring tape and sterile gloves resulted in a subsequent teledermatology session that was noted by participants to be more efficient and patient-centered than the previous pre-protocol session. Description of routine examination techniques and definition of key dermatological examination terms in advance of the teledermatology session also enhanced physician attitudes about the success of the session. These small organizational steps had a positive influence on physician attitudes.

Influencing the adoption of an innovation such as telemedicine also appears to require a broad organizational perspective. In the one case study where the local telemedicine network did not create a new workflow and organizational support for physicians to refer patients to teledermatology sessions, study participants identified these factors as barriers to telemedicine use. This pragmatic consideration is similar to the organizational knowledge barrier: "Lack of know-how in integrating telemedicine into extant organizational workflow and supporting its regular usage constitutes knowledge barriers to the further diffusion of applications." (Tanriverdi & Iacono, 1999, p.239)

The case studies revealed that where new workflows had been instituted for the teledermatology sessions, telemedicine overall was viewed more positively. For example, in one case the local telemedicine coordinator called each physician to confirm that the patient had been advised of the teledermatology consultation appointment time and location and patient expectations for the telemedicine experience had been addressed. Study physicians noted that this preparation of their patients in advance reduced the need for them to complete this step, thereby reducing the demand on their time. It was observed that in the case study where these simple workflow changes were implemented for the teledermatology sessions, it was at the initiative of an administrative person. She explained that her motivation was to maximize utilization of the teledermatology sessions

for care delivery to local patients. Administrative simplicity and new organizational infrastructure to enhance administrative ease were shown to influence physician attitudes. Provision of administrative and technical support to physicians is necessary to the successful implementation of telemedicine. (Yellowlees, 1997)

The teledermatology sessions also demonstrated the requirement for cross-organizational cooperation to schedule patients and ensure patient attendance. This co-operation between telemedicine network and local telemedicine coordinators had a direct impact on the efficiency of the sessions. Cross-organizational cooperation was also observed as a requirement for the consulting dermatologist to ensure that basic patient information was received prior to the teledermatology consultation. In this context, cooperation between telemedicine studios site staff was needed for sessions to be conducted without disruption. Consistent and frequent communication between the telemedicine schedulers who are employees of the telemedicine network, and the local telemedicine coordinators who are employees of the host facility or hospital, had an impact on the administrative ease for the teledermatology session from the physician perspective.

Fit

'Fit' is a theoretical construct that has been applied to medical informatics. (Kaplan, 2001) Fit may refer to workflow (Sicotte, Denis, & Lehoux, 1998) Fit may also refer to users. (Dixon, 1999) As suggested earlier, in the case of telemedicine applications fit can refer to telemedicine funders in contrast to telemedicine users. Therefore, fit has different dimension that must be considered when a technological innovation is implemented. (Kaplan, 2001)

As shown in Chapter Five, how telemedicine may be used is influenced by the beliefs and values of physicians as users. In this sense, fit may be conceptually similar to aspects of the compatibility innovation attribute. Although Rogers would consider that compatibility has an effect on the *rate* of adoption, (Rogers, 2003) Kaplan suggests that

fit has an impact on the *manner* of adoption. (Kaplan, 2001) In Rogers theory, the consistency of the innovation with values and needs of potential adopters affects adoption rates. The compatibility of the teledermatology sessions was found to be specific to a range of circumstances that included social and organizational factors as well as diagnostic-specific factors. The match or fit of the technology to physician values was clearly delineated across cases as participants were consistent in their perceptions of telemedicine as a supplementary, not an alternative, delivery system. Thematically common across cases was the perspective that telemedicine would not be viewed as an alternative to in person care delivery, but as a supplement in circumstances uniquely defined by each physician in each region. This is essentially a description of fit.

This is similar to other studies that have shown that telemedicine is considered by some physicians as an "add-on" rather than an opportunity to change health care delivery systems for underserviced or remote areas. (Lehoux et al., 2002) The fit of telemedicine into routine practice from a physician perspective is restricted to circumstances defined by physicians as appropriate for the use of a supplement to traditional care delivery. This limited definition of the fit based on the technology end users' philosophies about patient care may be understood as a manifestation of physician reluctance for technology to transform the traditional clinical encounter: " It is often in the seemingly 'technical' matters that deeply relevant, social issues are 'hidden' – such as ...the subtle restructuring of ..professionals' identities." (Timmermans & Berg, 2003, p.108) The importance of fit to physician attitudes toward telemedicine is significant. Since the definition of fit has been shown to encompass a multitude of dimension, it can thus be concluded that further study is essential to understanding organizational, social and contextual influences.

The teledermatology sessions changed the practice pattern for patient care delivery and the process for specialist referrals. The sessions also changed the nature of the medical care that was delivered in real time. Given participant acknowledgement of the personal need for more dermatological knowledge, the information that was provided to physicians during the teledermatology consultations was reported as leading to a change

in the way that participants would diagnose and treat similar case presentations in the future. In this study, fit was not observed to be static, but instead evolutionary as the nature of cases and the amount of interaction between family physician and consultant dermatologist involved with progressive sessions. Consistent with fit as influential on the manner of technology use, physicians increasingly tailored each session to better fit their practice and professional knowledge needs. Thus, the users were observed to drive fit.

Local adaptation is ubiquitous to innovation adoption. (Berwick, 2003) The teledermatology study results indicate that for telemedicine to become integrated into practice in underserviced communities, local adaptation will be required. In this study, the use of telemedicine was adapted to the self-identified learning needs of local physicians. Each physician selected a case for care that represented a specific and personal dermatology knowledge gap. Post teledermatology session interviews consistently showed that this tailoring of the session to local and personal needs was key to the positive attitude toward participation in the teledermatology sessions that was consistently expressed.

In one case study, a local adaptation was made to the telemedicine network referral process through re-defined roles for the telemedicine coordinator. Through direct observation, it was noted that the telemedicine network did not easily accommodate administrative adaptations suggested by participants since standardized methods of referral and information collection were already in place. It is likely that inflexibility with respect to these kinds of adaptations will negatively impact physician attitudes.

The adaptation of a system by its local users will impact whether the system is used or resisted. (Sicotte & Lehoux, 2003) Based on direct observations in the three case studies, it is suggested that a challenge for ongoing telemedicine adoption will be the flexibility of the telemedicine network to respect and accept local adaptation.

Value for time

Telemedicine system participants such as hospital administrators and telemedicine network managers have been shown to often include financial perspectives in their consideration of telemedicine outcomes. (NORTH Network (a), 2003) Telemedicine evaluation studies may measure financial benchmarks such as patient travel costs and cost of service delivery. (Jacklin, Roberts, Wallace, Haines, 2003; Oakley, Kerr, Duffill, Rademaker et al., 2000) Physicians in the teledermatology sessions were consistent in their omission of system costs as an attitudinal influence. Instead, a theme consistently found across cases was the importance of the teledermatology session to deliver care and relevant education. This was labelled by one participant as 'value for time'. Time for family physicians, particularly in underserviced areas, is extremely valuable and thus the teledermatology session had to deliver value for physician time expended during each session. Attitudes toward the use of telemedicine were contingent upon the perception that they would receive value for their time.

Value for time did not include the teledermatology study incentives of continuing medical education credits or financial payment for patient presentation. Rather, these incentives were expressly labelled as irrelevant. Methodological limitations that could be explicative of this finding were suggested in Chapter Five. Irrespective of these potential methodological explanations for the lack of importance of study incentives, for example participants' interest in presenting themselves in a positive manner, physicians across all cases consistently and clearly identified that their participation in their own patients' examinations and the use of colleagues' patients as providing relevant, timely and needed education in conjunction with patient care, created value for time. The value of interaction with peers has been shown to be a positive aspect of in person continuing medical education. (Tipping, Donahue, & Hannah, 2001) The resolution of a clinical problem in one's own patient, in combination with more generalizable dermatological knowledge gained from other cases created a perception of value for time that was shown to have a strong positive influence on physician attitudes toward telemedicine. This is consistent with other research that has shown that the use of the telemedicine consultation

as a learning experience is an effective continuing medical education tool. (Sicotte & Lehoux, 2003)

Because the teledermatology sessions were positioned as a learning opportunity, physicians participated with the intention to increase dermatological knowledge. For the initial teledermatology session, referrals were often patients with unusual or infrequently encountered dermatological diagnoses. In subsequent sessions, physicians referred cases with diagnoses that were more common to their practices. Thus, the teledermatology study may have encouraged more physician focus on knowledge transfer than would be found in standard telemedicine applications.

Physicians in remote areas comment that they are required to handle most cases independently and thus wish to expand their knowledge around routine as well as unusual cases. Thus, effective use of telemedicine to improve physician knowledge will eventually have a negative impact on telemedicine utilization rates, while having a positive impact on patient care. This paradox of effective knowledge transfer leading to a reduction in telemedicine use has been noted by other researchers. (Sicotte & Lehoux, 2003)

From the network funder perspective, the benefits of telemedicine used in the manner of the teledermatology study may be increased as compared to separate delivery of either patient care or ongoing physician education sessions. Not only do patients receive timely and quality care during their consultations, the knowledge transfer to physicians in underserviced areas is maximized within the context of their own patients and own learning needs. With the same use of network time and administrative cost, patient care is delivered, physicians learn through their interaction with the consultant enhancing their ability to handle similar cases in the future independently, and a positive view of telemedicine as a care delivery system is engendered within the physician participants. The physician perceived value for time is not the use of technology to obtain the same services that could be accessed by patients in person, but to obtain services that could not otherwise be accessed with the same benefits for the referring physician in terms of

professional knowledge. After the first session, the outcome expected by physicians from the teledermatology sessions were broader than the outcomes that they expected from a traditional referral for a specialty consultation.

While it may be purported that a telemedicine consultation further fragments care delivery by introducing a long distance consultant, the physicians noted that the telemedicine consultation led to an integration of primary and specialty care. With the opportunity to directly interact with the consultant and to bring the patient to a subsequent teledermatology session where necessary, physicians expressed a positive view of telemedicine for care delivery. In this sense, telemedicine was considered to be valuable. In the discussion between referring and consulting physician of treatment options and alternatives that should be considered where expected recovery outcomes are realized, the integration of primary and specialty care was seen to be maximized.

Rival explanations from the telemedicine literature

The teledermatology study findings are not always consistent with explanations for telemedicine use that are already proposed in the literature. These already existing explanations must be considered to determine whether differences in findings should be attributed to differences in study populations and study settings or whether differences are reflective of a true conceptual difference. Should the latter case appear to prevail, it is subsequently important to explore how the conceptual differences between the teledermatology study findings and existing theory may enhance the development of understanding of the influences on physician attitudes.

In selecting rival explanations germane to the teledermatology study findings, the initial threshold was that the explanation had to arise from research specific to physicians and to the use of telemedicine for patient care. This was necessary since some existing concepts are based on asynchronous methods or are extraneous to direct care delivery. The first set of rival explanation reflects commonly cited influences found across different studies and settings. An example is the importance of physician reimbursement. Another set of

rival explanation is social and organizational dimensions such as the concept of expertise asymmetry. (Sicotte & Lehoux, 2003) Contemplation of rival explanations has been shown to enhance analysis of study findings. (Yin (b), 2003)

Reimbursement for delivery of patient care services has been identified as influence on physician attitudes. In health care delivery systems where the research specific to the economic knowledge barrier theory was conducted, physicians expressed an interest in using telemedicine as a way to access new patient markets for economic gain. (Tanriverdi, & Iacono, 1999) In such a scenario, the importance of economic barriers may be heightened in comparison to the Ontario context in which the teledermatology study was completed. Most study physicians were reimbursed through a non-fee for service model, or alternate payment plan. As noted in Chapter Five, study interview discussion and observed behaviour during teledermatology sessions were thematically consistent with respect to reimbursement. In the teledermatology case studies, payment was not influential to the decision to trial use of telemedicine for reasons also described previously. This significant difference in market context may explain the difference in findings.

Licensure issues have been identified in the telemedicine literature as barriers to telemedicine use. (Treister, 1998) Licensure was not mentioned in any teledermatology data collection. This finding may be different where study participants are the specialist physicians delivering the consultation rather than the referring physician. Some physicians expressed a need for greater clarity regarding the responsibility for care delivery after the teledermatology consultation. The provision of a consult letter from the consulting dermatologist after the session, as is common practice for in-person consultations, was consistently identified by study participants as desirable. This suggests that while licensure is not an apparent concern for the referring physicians in this study, there is identification of a potential lack of clarity about responsibility for care where more than one physician is participating in the patients' consultation.

It has been suggested that as the distance patients are required to travel for care increases, physicians are more willing to use telemedicine for care delivery. (Lehoux et al., 2002) In this study, physicians did not raise the notion of an 'acceptable' distance to travel for care. Instead, an 'acceptable' time for patients to receive the consultation service was more influential.

Physician technophobia and change fatigue have been posited as a reason why physicians have not accepted information technology systems. (Treister, 1998) There is no evidence that these factors were influential in the teledermatology case studies. Teledermatology study participants did not identify that there was so much change in their environments that telemedicine could not be considered. No physicians raised accumulation of change within their practice as a physician as influencing their view of telemedicine.

Based on the results of the teledermatology study, it is suggested that further improvements to the technology will not likely have a parallel impact on telemedicine use. The adequacy of the technology was considered as a prerequisite to use and participants were consistently satisfied with the technological performance of the telemedicine network, which in some instances surpassed their expectations. While technological failure may have been germane at telemedicine's infancy, it is suggested that widespread technological weaknesses can no longer be used to explain poor telemedicine utilization rates.

'Expertise asymmetry' between the referring and consulting physician may have a negative impact on primary care physician use of telemedicine. (Sicotte & Lehoux, 2003) Where the consulting physician requires the primary care physician to assist in the consultation because the technology is insufficient to enable a long distance examination, dependency on the primary care physician that would not exist where care is delivered in-person was created resulting in most telemedicine use between specialists rather than primary care and specialist. (Sicotte & Lehoux, 2003) This phenomenon was not observed in the teledermatology study and was not subsequently identified as influential.

One explanation for this difference in finding is that the context for the telemedicine consultation as a physician education event led to a clear establishment of the dermatologist's role as expert from the outset. When the dermatologist asked for the local physician to provide information based on visual or tactile examination of the patient, the request was accompanied by a spontaneous explanation of the technical procedure to be followed by the local physician or responsive explanation as secondarily requested by the primary care physician. The teaching context of the teledermatology consultation may have mitigated against discomfort for any of the participants with respect to differences in expertise.

During teledermatology sessions it was observed that as participant interactions with the dermatologist increased, the number of participant questions also increased. This observation implies that as they became more comfortable during sessions, participant willingness to expose their learning needs increased. Additionally, this behaviour could also imply that as specific topics were covered during sessions, physicians became more assertive with respect to their individual learning needs and therefore asked more targeted questions to satisfy individual needs. This is consistent with findings from other studies that have shown the importance of social comfort and the quality of interpersonal interaction during on-line continuing medical education events. (Sargeant, Curran, Jarvis-Selinger, Ferrier, Allen, Kirby & Ho, 2004)

At the completion of the teledermatology sessions, physicians reported that learning specific to their personal needs for dermatology diagnosis and treatment planning was highly influential to their participation in the teledermatology sessions. Concern regarding assessment by colleagues and the dermatologist of their practice was not raised by any of the study participants. As noted earlier, this may be unique to the cases in which participants were already part of a collegial group of physicians prior to the teledermatology study.

The local champion has been identified as influential on colleagues' attitudes and behaviour. (Rogers, 2003) While it may be speculated that the local gatekeeper in the

teledermatology study could have influenced physician attitude formation, the local gatekeeper did not full the role of a local champion as it has been traditionally defined. "A champion is a charismatic individual who throws his or her weight behind an innovation, thus overcoming indifference or resistance that the new idea may provoke..." (Rogers, 2003, p.414) It has been noted that a champion is important for successful adoption of telemedicine. (Al-Qirim, 2003) This finding was not identified in the teledermatology study. This may partly be explained by the difference in connotation affiliated with the use of the term champion, for example, a technical champion who is the telemedicine coordinator as compared to a user champion who may be part of a user group but not necessarily be a physician. (Garfield & Watson, 2003)

In Case Study 1 and 2, the local gatekeeper was influential in interesting physicians to participate in the study. Both gatekeepers reported that the greatest resistance to participation was the time commitment required to participate in the teledermatology sessions. These were scheduled as ninety-minute sessions. In both cases, the local gatekeeper role was fulfilled with the recruitment of physician participants to the study and there was no observable or reported evidence of their influence on subsequent session participation. Data collection interview behaviour and discussion did not insinuate any ongoing influence of the gatekeeper on attitude development.

Since none of the case studies included a telemedicine champion as it is classically defined, the findings offer little data from which to develop conclusions about the applicability of this aspect of Rogers' diffusion theory to telemedicine adoption. Data can confirm, however, that participants' expressed their intention to make an independent, personal, experience-based decision about the role and value of telemedicine for their own practice. Other physician specific studies have similarly demonstrated that the opinions of relevant others vis a vis technology use are of limited importance. (Chau, 2001) Thus, it can be posited that the influence of a local champion on attitude development may not be as strong as has been found in other studies and proposed in current diffusion theory.

Implications for telemedicine utilization theory development

Increasingly, the impact of organizational and social influences on informatic applications adoption is being recognized with the result that social interactionist approaches are recommended. (Kaplan, 2001) It has also been noted that innovation adoption is most vulnerable at the time of diffusion. (den Hertog, Groen, & Weehuizen, 2005) The teledermatology study revealed that social and organizational factors have an impact on physician attitudes toward adoption of this technology. It has been stated that "...medical technology is inevitably politics by other means." (Timmermans & Berg, 2003, p.107) Exploration of the autonomy intrinsic to physicians' views of their profession in contrast to the intention of telemedicine funders to structure physician practice would illuminate social influences on telemedicine adoption.

The competence and interpersonal manner of the telemedicine specialist is an incentive for telemedicine use. The findings suggest that rather than preventing patients from travelling a long distance for care, physicians were more influenced to use telemedicine because of the perceived stature, knowledge and manner of the consulting dermatologist. Physicians expressed a requirement to direct referrals to specialists known and acceptable to them. It was their own direct access to an interactive discussion with the dermatologist, in addition to their patients' access to a widely respected dermatologist that influenced their attitudes. Telemedicine delivered through asynchronous methods, though more flexible in terms of physician time demands, would not be considered as positively as interactive care delivery where live interaction between referring physician and specialist is an aspect of the 'value for time' dimension of telemedicine.

A contribution of this work is the identification of the 'value for time' theme that was raised within and across cases. The multiplicity of demands on physicians' time in underserviced areas was observed and reported to be so daunting that the threshold question for physician participation in the teledermatology sessions was the ratio of personal and practice value to the time required to participate. This value measure was partly established by the achievement of patient care delivery in a timeframe that exceeds

available in-person care and increased self-identified, relevant, professional knowledge that could be applied to future patients. The time measure was established by those activities such as office hour patient visits that could not be completed while participating in the teledermatology session. In cases where the teledermatology session was conducted during time already schedule for professional development, such as already scheduled rounds, the time commitment appeared to be less concerning.

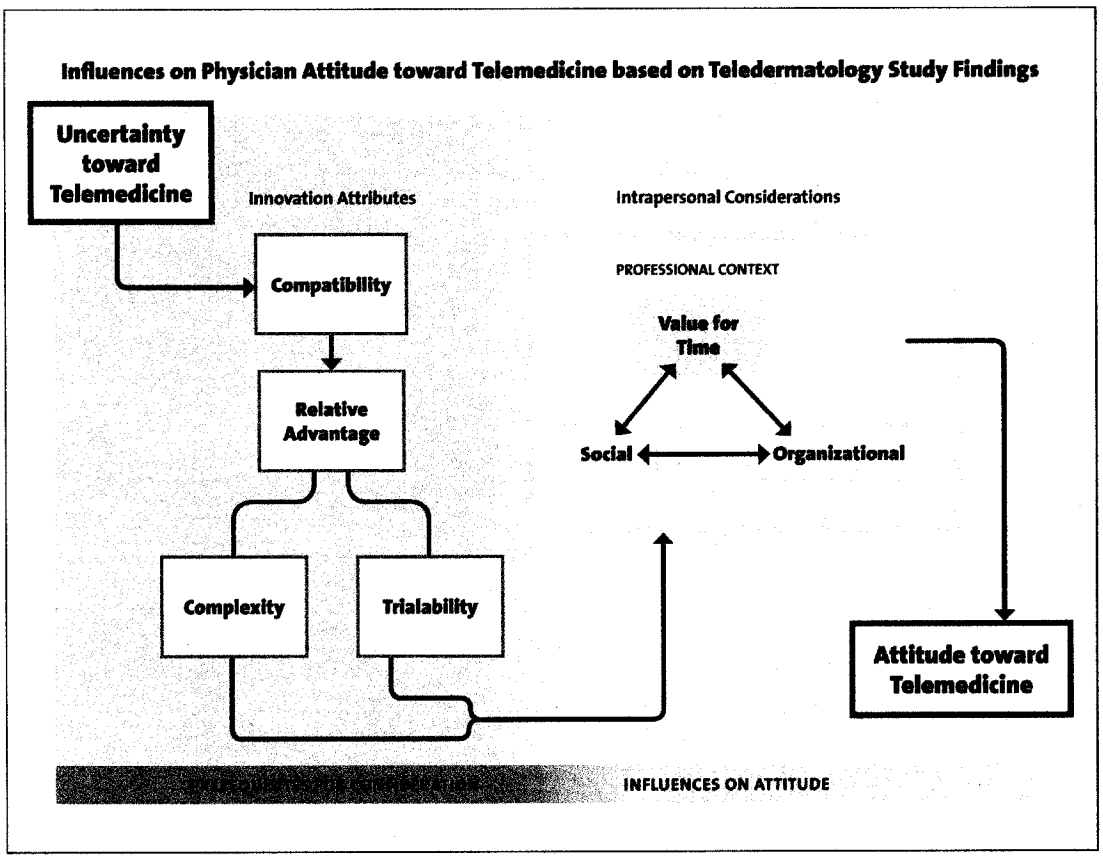
It was consistently identified that the telemedicine technology was technically adequate to enable the delivery of dermatological care. The technological competence of the network was even noted across cases to surpass expectations. Interviews also revealed that technological excellence was considered commonly considered as a telemedicine prerequisite that itself would be insufficient to lead to physicians to use telemedicine. However, were it not to meet physician perceived requirements for care delivery, then further innovation attributes would not be influential.

Further theory development could be focused toward clarification of the role of Rogers' five innovation attributes as preconditions or prerequisites for consideration of use of telemedicine rather than as merely influential. As was shown earlier, in the absence of compatibility with needs and values, then further consideration of the use of telemedicine would not likely occur. Physician attitudes toward telemedicine appear to be developed in a non-linear manner subsequent to the confirmation of certain prerequisites having been achieved. The development of theoretical constructs to address this potential difference between innovation prerequisites and innovation influences would require further scientific study. It has been found that the factors that affect health informatic technology adoption can drive attitudes in conflicting directions dependent on how they operate in any particular system. (Whetton, 2002)

A strength of the teledermatology study is its examination of the influence of classic innovation attributes and other influences on attitudes at the same time. The findings revealed that the classic innovation attributes as described by Rogers function as prerequisites that must be satisfied before other aspects of telemedicine such as the social

and organizational considerations. The innovation attributes are largely reflective of the innovation itself while the contextual factors are intrapersonal considerations that contribute to physicians' assessment of value for time. The schema in Figure 6.1 is a depiction of the conceptualization of the influences on physician attitudes toward telemedicine based on the findings of the teledermatology study. Innovation attributes that were not shown to be relevant to physician attitudes in the teledermatology study, such as observability, are not included in the schema.

Figure 6.1



Rogers' central premise is that the diffusion of an innovation is an "uncertainty reduction process." (Rogers, 2003, p232) The findings from the teledermatology study suggest that while reducing uncertainty is important, there are many factors that influence attitudes toward the adoption of a technological innovation by physicians. The teledermatology study results suggest that the explicative capacity of the selected theories vis a vis telemedicine adoption by physicians is only partial. While the limitations of the

teledermatology study as outlined below restrict the appropriateness of using its findings for theory development, teledermatology study results do suggest theoretical constructs specific to influences on physicians that could be appropriate for empirical validation in further research that may result in a contribution to theory development. A promising approach may be the investigation of the differences between innovation attributes and innovation prerequisites, complemented by a fuller understanding of the influence of social and organizational factors that have been cited in recent literature and found in the teledermatology study. A physician-specific technology adoption theory may be required where one strives to understand physicians as end users of a new technology.

Methodological limitations and considerations

Sampling

There are many methodological considerations that must be addressed as study results are discussed. First, it should be recognized that there is a potential source of error related to sampling, which is the inclusion of non-representative participants. Since the study only includes physicians who were prepared to try teledermatology even once, they may not be representative of all physicians in the case study communities. It is possible that these self-identified physicians had already established unreported preconceptions about telemedicine that could be reflective of either positive or negative attitudes. Additionally, since the teledermatology sessions were introduced as a continuing medical education opportunity, it is also possible that participation may be a reflection of a positive attitude towards ongoing professional development. Given that the sessions were exclusive to dermatology, it is unknown whether the self-expressed need for more dermatological knowledge may differentiate participants from other physicians in a manner that could have the effect of non-representativeness.

Generally, sampling non-representative informants can lead to an overreliance on elite informants. (Miles & Huberman, 1994, p264) In the teledermatology study, it is possible

that participating physicians are members of a subset within the community of physicians in each case. As noted in Chapter Four, a subset of family physicians accepted the invitation to participate in the teledermatology sessions. Thus, it is possible that there was some non-representativeness based on a variable that cannot be determined or that may not exist. It is certain, however, that sampling the population of family practice physicians is an appropriate strategy to obtain relevant participants to inform the research questions.

Most physician participants across cases were paid through an alternate payment system rather than a traditional fee for service model. This is a unique participant characteristic that is not representative of most Ontario physicians. While this payment characteristic could reflect the case study locations where these alternate payment models predominate, it could also be a reflection of physicians who are generally more accepting of alternative practice approaches. As an example, in Case Study 1 where more local physicians are paid on an alternate payment plan than fee for service, all study participants were paid through alternate payment plan arrangements. No fee for service practice physicians in this location expressed any interest in participating in the teledermatology sessions. Thus, the Case Study 1 participants while representative of most physicians in their community with respect to payment models did not include physicians from all potential payment schemes in that community. To address this potential source of non-representativeness, particularly since the importance of reimbursement for services is frequently noted in the literature but was not found in the teledermatology study, future research could employ a sampling strategy that requires participants across all physician payment schemes.

Researchers may affect the behaviour of participants, which in turn may skew study findings. (Miles & Huberman, 1994) In this study, participants may have been influenced by the use of an internationally recognized dermatologist as the teledermatology study consultant. They may have interacted during the teledermatology sessions, and during individual interviews, in a manner that they believed would present themselves positively to that dermatologist. It is also possible that individual physicians

may have felt some reliance on the teledermatology study consultant for ongoing care delivery to their patients, thereby influencing their behaviour. Physicians who agreed to participate in the teledermatology study may also have been influenced by their ongoing relationship with the local gatekeeper during study participant recruitment in the two case studies where a local physician acted as an intermediary between investigator and participant. It is possible that the local physician gatekeeper was more effective in garnering interest in the teledermatology study with a group of physicians in the community based on a range of factors that are not accounted for in the sampling strategy.

In addition to the bias arising from impact of the research team on the study participants, bias arising from the effects of the case study site on the researcher must also be considered when evaluating the validity of the study findings. Using an informant who can provide background data has been described as a useful strategy to address this potential issue. In each case study, the local telemedicine coordinator was interviewed prior, during and subsequent to completion of the teledermatology sessions in that location. In the initial discussion, each coordinator provided personal views with respect to the positioning of the telemedicine network within the local physician community. Data illustrating utilization patterns and pressures on physicians in the community vis a vis the availability of specialist resources was obtained from these informants. It was used as an objective collection of data that could support or refute conclusions drawn by the investigator that were developed further to physician interviews and could have been reflective of a bias developed as a consequence of interaction with study participants both in a group and individually. Through triangulating data sources the credibility of study findings is enhanced.

Verification of teledermatology study findings

In Chapter Four, the techniques used to enhance overall trustworthiness of the teledermatology study including transferability and confirmability were outlined. The

results of these techniques are summarized below with the goal of improving the capacity to estimate the credibility of the foregoing discussion of study findings.

Transferability of findings from study cases to other communities of physicians is limited by the predicted similarity in professional development needs across communities. While the cross case analysis suggested consistency across physician communities with respect to the influences on telemedicine attitudes, the specific learning needs in each community were different. The case study that had the best access to dermatology services identified wound care as it is delivered by dermatologists as a local patient care and professional learning need. This is in contrast to the other two case studies where a broader range of dermatological diagnostic and treatment issues was identified as patient care and knowledge gaps. Therefore, developing a detailed understanding of the issues unique to communities based on their patient needs and available resources is necessary since transferability of findings across these variables is limited in the absence of this information. (Gagnon et al., 2003) Despite this potential limitation on transferability based on the importance of specific local needs, the consistency across cases with respect to the research questions predominates. Data collection from the field did not present new themes nearing the conclusion of the third case study at which time saturation was achieved.

There are also limits in transferability of findings across physician subgroups such as family physicians, emergency physicians, hospitalists and specialists. The nature of patient care delivered by emergency physician and hospitalists can be characterized as specific to acute cases where more immediate consultative service is typically required. The role for telemedicine may by contemplated differently by these physician subgroups as compared to the family physicians in the teledermatology study where the sense of urgency for a dermatology consultation is less typical.

Study participants themselves recognized a limitation in transferability. Physicians repeatedly noted across all cases that clinical specialties are differentially suited to telemedicine. As reported in Chapter Five, the visual nature of dermatology is noted by

participants to be suited to telemedicine services. Participants were doubtful that their attitudes toward telemedicine would be similar across all specialties. Thus, it is proposed that the teledermatology study findings may be limited in their applicability to dermatological uses of the technology.

In considering all of the study findings holistically, it can be stated that understanding the influences on physician attitudes toward telemedicine requires complex and multiple theoretical considerations and multiple methodological strategies.

Table of Contents

Chapter 7

Conclusion

Chapter 7

Conclusion

"...the more important point is the need to broaden evaluation through a variety of methods and approaches that investigate social, cultural, organizational, cognitive, and other contextual concerns. Methodological pluralism and a variety of research question can increase understanding of many influences concerning informatics applications development and deployment."

Dr. Bonnie Kaplan
Centre for Medical Informatics
Yale University School of Medicine
In International Journal of Medical Informatics, 2001

The diffusion of innovation in health care has been shown to be a challenging endeavour with many initiatives, including telemedicine, making marginal progress into mainstream practice. (Yellowlees, 1997) Identification of those factors that affect innovation adoption in the health care sector is required to facilitate change. (den Hertog et al., 2005) The purpose of the teledermatology study is to complete a detailed analysis of the influences on physician attitudes toward telemedicine in three communities where the need for enhanced access to dermatology specialty services has been identified at a system level and confirmed at an individual physician level. Subsequently, it is to be determined how these findings yield theoretical or methodological considerations that are relevant to the further development of knowledge about the diffusion of innovation in health care delivery systems.

Policy makers anticipate the implementation of telemedicine will address access to specialist care both from a timing and geographic distribution perspective. (Williams et al., 2003) The reality of telemedicine adoption is much different: "However optimistic policy discourse about telemedicine might be, in practice these new technologies seem to have not 'diffused' into practice, and penetrated service provision." (Williams et al.,

2003, p.40) User technology acceptance is a challenge that confronts health care organizations today as they consider using telemedicine as a health care delivery system. (Hu et al., 1999) Through its identification of influences on physician attitudes, the teledermatology study makes a contribution to public policy discussion about the introduction of technological innovations where physician willingness to change practice patterns and integrate these innovations into routine practice is a requirement for system-wide change in health care delivery.

Contribution of the teledermatology study to theory development

The teledermatology study has shown that existing theories of innovation adoption are unable to fully explain physician attitudes about the diffusion of a technological innovation and are thus limited in their ability to facilitate innovation adoption in the health care sector. This is not unique to technological innovations as it has been similarly noted in efforts to change physician clinical practice through non-technological innovations such as clinical practice guidelines, that knowledge of factors that are decisive in to leading to change is limited. (Grol & Wensing, 2004) While many research studies have contributed to knowledge about physician utilization of telemedicine, further theoretical development is required.

To enable deeper understanding of physician adoption of innovations such as telemedicine, research in the future could be directed at redefining theoretical models to more specifically address technological innovations. The diffusion of technology innovations may be different from other kinds of innovations and should be appraised separately. To influence adoption, a better understanding of effective incentives that are relevant for physician practice change is also necessary.

Methodological considerations for future research

As stated above, methodological pluralism is needed to understand the influences on technological innovation diffusion within the health care sector. (Kaplan, 2001) Given the range of questions that still must be explored, it is evident that both qualitative and quantitative methods are required.

Quantitative methods would be well suited to a variety of future research questions. For example, given the finding that physicians may be atypical of technology end users, further research could explore how Rogers' innovation adoption curve applies to physician adoption of technology. Consistently raised across cases in the teledermatology study was physicians' views that they would not rely on others' experience to determine their own views of telemedicine. Thus, it may by that the normal curve proposed by Rogers does not apply to the adoption of a technology like telemedicine where individual practice patterns and preferences are disrupted. Study of adoption patterns could yield information about expected adoption rates and may identify where implementation strategies to encourage physician use of technology may be most effective. Similarly, studies that weight the factors that influence telemedicine use could provide insight into incentives and their timing to facilitate implementation activities. Where researchers have supported the use of Rogers' diffusion of innovations theory, it has been noted that prospective testing of Rogers' innovation attributes would improve insights into why practice changes. (Sanson-Fisher, 2004)

The exclusive use of quantitative methods would be insufficient to describe contextual factors such as social networks, group relationships and professional values that are known to affect physician attitudes and must be considered. (Kaplan, 2001) Studies that involve multiple locations and multidisciplinary participants such as specialists, family physicians, nurse practitioners and telemedicine coordinators may also be better suited to qualitative methods. The teledermatology study has demonstrated the appropriate use of qualitative methods to understand physician attitudes. In contrast to the research questions of the teledermatology study that focused on attitude, studies that seek to

understand the potential for actual innovation adoption within a community of physicians would require very detailed and sustained data collection. Ethnographic methods that more fully immerse the researcher into the community over a longer period of time would be well suited to understanding physician innovation adoption behaviour with the progression of time. Data collection using combined quantitative and qualitative methods could be implemented to understand the influences on physician behaviour in communities shown to have low and high use telemedicine networks.

The focus for future research

The telemedicine literature revealed that many professionals experienced in telemedicine projects have sage advice for novices who are preparing to implement new telemedicine initiatives based on their experience. This advice is largely focused at a program rather than at an individual level. The literature is less successful in providing empirically-based information about the influences on individual physician use of telemedicine. The three case studies of physician communities in northern Ontario provided qualitative data collected in a systematic manner using theoretical frameworks that have already been shown to have applicability to the adoption technological innovations. The detailed examination of influences on attitude for individual physicians reveals where existing theoretical models contribute to understanding the influences on physician attitudes toward telemedicine as well as elucidating where conceptual gaps currently exist. The necessity for theory refinement discovered by the teledermatology study is widely acknowledged. (Gagnon et al., 2003)

The teledermatology study supports the importance of non-technological aspects of telemedicine in shaping physician attitudes about the use of telemedicine for patient care. Telemedicine must be considered in terms of social and organizational factors that are already known to be influential. It has been shown that telemedicine has the potential to change social relationships and it must be considered as a social innovation rather than a technological innovation.

The teledermatology study findings are validated by the comment that focusing on health technology assessment without a concomitant knowledge about the most effective way organize and deliver health care will risk failure to achieve anticipated benefits from the technology. (Fulop et al., 2003) Research into service delivery to answer questions such as how changes to health care delivery could be introduced, the impact of alternative models of care delivery such as telemedicine on individual and organizational relationships and matching models of delivery to specific clinical situations will help to advance the incorporation of medical technologies into practice: "...it is vital that research...takes account of the role of the context within which the organisation and delivery of health services takes place, as well as their underlying process." (Fulop et al., 2003, p163)

Physicians will likely independently determine which subsets of patients and clinical activities are well suited to telemedicine and future use will be likely restricted to those personal views where voluntariness exists. Thus, each community will define for itself the ways in which telemedicine will be used and the pattern of use. Additionally, the positive impact of the continuing education context of the teledermatology sessions on physician attitudes suggests that future research about the delivery of professional education in this format warrants further study. Using participants' self-identified learning needs, in combination with the delivery of necessary patient care in a collegial learning environment, is identified as a professional education delivery model with significant promise for distance education. This is consistent with other studies that have shown a physician preference for efficient and immediate discussion during a CME event. (Sargeant, Curran, Jarvis-Selinger, Ferrier, Allen, Kirby & Ho, 2004) Comparison of the determinants of physician adoption of telemedicine for different clinical and educational purposes would contribute to a broader understanding of telemedicine adoption. (Gagnon et al., 2003)

The teledermatology study was conducted within the setting of new use of telemedicine technology by study participants for the delivery of patient care. Accordingly, relevance

of the teledermatology study findings to settings where attitudes specific to sustained rather than introductory use is under examination was beyond its scope. Given that the enthusiasm of study participants that was a hallmark of all three cases emanated from their initial surprise both at the high performance of the technology in addition to the clinical knowledge gained during each teledermatology session, attitudinal influences with sustained use should be explored. Other investigations have shown that effective incentives and the relative importance of innovation attributes change with the passage of time. (Hu et al., 1999) It is possible that as telemedicine use becomes more common, physician enthusiasm may diminish in concert with the fulfillment of patient care needs and personal learning needs. Therefore, further research is required to identify influences on attitudes and required physician incentives where telemedicine use is to be sustained over time. This is particularly relevant given the evidence with specific reference to teledermatology projects, that ongoing and sustained use is not frequent. (Wootton & Oakley, 2002) Ironically, given the recognition that few telemedicine applications are integrated into routine practice, the study of sustained programs is a challenge. (Helitzer et al., 2003) Nonetheless, this is a topic that merits further inquiry.

The teledermatology study is focused on family physicians who are considered to be the end users of the technology. Telemedicine networks are designed to address needs for patient care as these are identified mostly by family physicians. The influence on the attitudes toward telemedicine from those who are required to deliver the care, the specialists, is not within the scope of the teledermatology study. The research questions applied to specialty physicians must be further explored.

The value for time theme that emerged in the teledermatology study could be further explored in other studies. As has been discussed in previous chapters, it is well established that travel to the telemedicine studio is considered as a negative aspect of telemedicine care delivery. The use of time is maximized in the teledermatology sessions as physicians left their offices to participate in session where many patients were examined during one session. Time use was efficient and did not require multiple trips to the studio. Where telemedicine participation requires more frequent travel, the

perception of value may be diminished and the balance between time and value should be studied.

Additionally, the value assessment as it relates to professional education could be explored in future studies to determine whether it is the patient specific learning and case specific resolution or the broader learning across all patients that makes the greatest contribution to the identification of value. It is widely acknowledged that the majority of telemedicine usage is to deliver medical education rather than patient care. (Perednia, 1995) A strength of the teledermatology is its use of professional education as the setting in which to examine physician attitudes toward telemedicine for the delivery of patient care. The teledermatology sessions were introduced as continuing education events. Physicians referred patients for whom they identified a requirement for a dermatology consultation. Each session included multiple patients and all participants could participate in the consultations for the purpose of their own learning needs. Study of the use of teledermatology sessions to explore the delivery of continuing medical education through telemedicine facilitated situational learning has received funding and data collection is underway.

Future research that enables comparison of the influences on physicians unique to the characteristics that may be relevant to physician attitude development such as practice setting, clinical service and timing of access would address a gap in current knowledge. It has also been suggested that comparison of determinants of physician use of telemedicine in differing cultural settings is required. (Gagnon et al., 2003)

Changes to primary care delivery are being contemplated and initiated in Canada. (Ministry of Health and Long Term Care of Ontario, 2005) In Ontario, traditional relationships between family physicians, their patients and specialists will be changed through primary care reform. For example, Family Health Teams are being introduced. These teams are intended to bring health professional from different disciplines together into one team. This organizational structure is also expected to provide better access to care within patients' home community. (Ministry of Health and Long Term Care of

Ontario, 2005) Through its restructuring of the way that health professionals interact, Family Health Teams have the potential to change the pattern of social relationships in the delivery of primary care. Thus, it is timely during their implementation to understand how this restructuring at the primary care level may impact physician perspectives on the need for and the use of telemedicine. Will family health teams affect physician amenability for care delivery from non-team and non-local resources or will long distantly located physicians become part of local family health teams? Whether these new social and organizational structures have an impact on attitudes toward telemedicine use and, if so, in what manner is a topic for inclusion in the Ontario telemedicine research agenda.

Health care delivery systems have not shown an ability to understand and leverage the contexts and processes that engender innovation adoption. "This might be regarded as the big paradox in health care innovation: while the technological and professional competencies have been progressing at a fast pace, the functioning of the health care system as a whole appears not to have profited from this progress." (den Hertog et al., 2005, p.4) While the purpose of the teledermatology study did not include assessing the quality of care delivered, both through physician commentary and direct observation it was evident that the continuity of care afforded by live interaction between primary and specialty care physicians enhanced the quality of care received. Patients as active participants in the live interaction also appeared to have an impact on quality of care. These effects of telemedicine consultations should be specifically included within the definition of outcomes in telemedicine evaluation studies. The live interaction amongst participants and use of clarifying questions to improve results that was observed in the teledermatology sessions should be further investigated. These are issues of quality of care that supercede whether the interaction is in person or facilitated through telemedicine.

The results of the literature review, the teledermatology study and interviews with key informants coalesce to form a conclusion that future research into technological advances in telemedicine such as improved image quality or speed of transmission will likely have

a small impact on changing physician practice. It is the diffusion of the innovation, not its invention, which must garner research interest. (den Hertog et al., 2005) New theoretical models specific to the health care sector can be useful where they are able to demonstrate the multiple levels of factors including individual, social and organizational influences that influence change in clinical practice and in what circumstances. If technologies such as telemedicine contribute to improved health care delivery as policy makers and government funders purport, then expanded knowledge of innovation adoption in health care is the key to achieving the improvements.

While the teledermatology study focuses on physicians, it is evident that there are many other disciplines involved in the delivery of health care and the diffusion of telemedicine has importance. However, it has also been shown that health care professionals behave within uniprofessional communities of practice. (Ferlie et al., 2005) Therefore, future research must separately address other health care disciplines such as nursing to improve understanding of the innovation adoption process within the context of telemedicine.

However, the diffusion of innovation is an issue that extends beyond health care. "Success in the new knowledge-based economy increasingly depends on the ability to apply the results of innovation -–a new, or significantly improved, service, product, production technique, or management method." (ISRN, 2003) Therefore, the importance of understanding the influences on physician use of telemedicine is only a small element of a larger innovation adoption challenge that confronts business and governments regionally and internationally. Future research that makes a contribution to the discussion of innovation diffusion in health care could also make a contribution more broadly. .

In summary

The results of the teledermatology study have implications for both understanding the gaps in theoretical understanding of innovation adoption by physicians as well as

practical considerations for those funding and implementing telemedicine networks. The teledermatology study suggests that physician attitudes toward telemedicine are a result of factors including innovation attributes, social and organizational factors. The individual physician assessment regarding the use of telemedicine as value for time is an assessment with little resemblance to telemedicine funders' definition of value. The physician value perspective is individual and personal, and is developed in a local context. The funder definition of value reflects system wide achievements such as reduced patient travel costs. This chasm between value identification can contribute to the failure of telemedicine to achieve success. Future research that can make explicit these value issues could ultimately improve innovation diffusion.

All system participants must also recognize that a physician's definition of value for time may change with repeated use of telemedicine. Presuming that the initial enthusiasm that accompanies a telemedicine trial abates through continued use, the value assessment may change for physicians. This is consistent with the recognized problem of sustained use of telemedicine past the demonstration project phase that was identified from the outset of this work as a reason for research to improve diffusion understanding. Future research that deepens knowledge of value assessments over time could also make a contribution to evolving knowledge about the diffusion of innovation.

Although not a planned research focus, an outcome of the teledermatology study is the information that it provides regarding delivery methods for continuing medical education. (CME) This study provides further evidence of the importance of real time interaction amongst peers, and with the educator, during CME sessions. The implementation of the teledermatology sessions as fulfilling the dual purposes of patient care and physician education specific to self-identified learning needs illustrates the benefits of this format for physician education. This simultaneous achievement of two physician-centric outcomes, care for their patients and professional learning, were reported by participants as key to the value for time assessment and holds promise for further investigation as a continuing education delivery method.

As governments continue to provide additional financial resources for telemedicine networks, the importance of understanding the influences on telemedicine use will escalate. A key aspect of the teledermatology sessions shown to enhance the perception of value for time is the combination of care delivery with professional education. Based on the finding of this germinal study, this model of telemedicine use must be further developed and explored. Adapting this model to other specialty services in addition to dermatology would enable investigation of the social, organizational and environmental contexts that influence telemedicine use. Building on the strengths of situational learning for professional education, investigating the use of telemedicine to provide real time care to address contemporaneous patient needs across specialists and geographic regions would increase understanding of the potential for this delivery model to be accepted and adopted by family and specialty physicians.

References

Aas, I. H. M. (2000). Working with telemedicine: User characteristics and attitudes. *Journal of Telemedicine and Telecare*, 6(Suppl. 1), 66–67.

Aas, I. H. M. (2002). Changes in the job situation due to telemedicine. *Journal of Telemedicine and Telecare, 8,* 41–47.

Agency for Healthcare Research and Quality. (2003). Telemedicine for the Medicare Population. *Evidence Report/Technology Assessment No. 24.* AHRQ Publication No. 01-E012.

Allen, A., & Hayes, J. (1996). Patient satisfaction with teleradiology: A pilot Study. *Telemedicine Journal, 1,* 41–46.

Al-Qirim, Nabeel A.Y. (2003). Teledermatology: The Case of Adoption and Diffusion of Telemedicine Health Waikato in New Zealand. *Telemedicine Journal and e-Health, 9*(2), 167–177.

Ashford, J., Eccles, M., Bond, S., Hall, L. A. & Bond, J. (1999). Improving health care through professional behaviour change: introducing a framework for identifying behaviour change strategies. *British Journal of Clinical Governance 4, 1*, 14-23.

Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science* 3, 1-19.

Barlow, J., Bayer, S., & Curry, R. (2003). The design of pilot telecare projects and their integration into mainstream service delivery. *Journal of Telemedicine and Telecare, 9*(Suppl. 1): S1: 1–3.

Bashshur, R. L. (1997). Telemedicine and the Health Care System. In R. L. Bashshur, J. H. Sanders, & G. W. Shannon (Eds.), *Telemedicine: Theory and Practice* (pp. 5–35). Springfield, Illinois: Charles C Thomas Publisher Ltd.

Bashshur, R. L., Reardon, T. G., & Shannon, G. W. (2000). Telemedicine: A new health care delivery system. *Annual Review of Public Health, 21*, 613–637.

Bauer, J., & Ringel, M. (1999). Telemedicine and the Reinvention of Healthcare. Chapter 7 New York: McGraw Hill

Bauer, J., & Ringel, M. (1999). Issues and Policies of Telemedicine. In *Telemedicine and the Reinvention of Healthcare* (pp. 157–181). New York: McGraw-Hill.

Bauer, J., & Ringel, M. (1999). Telemedicine: Impact of the Seventh Revolution. In *Telemedicine and the Reinvention of Healthcare* (pp. 85–124). New York: McGraw Hill.

Berwick, D. (1999). Foreward. In C. Z. Margolis & S. Cretin (Eds.), *Implementing Clinical Practice Guidelines* (pp. xi-xiii). Chicago: AHA Press.

Berwick, D. (2003). Disseminating innovations in Health Care. *Journal of the American Medical Association, 289*(15), 1969–1975.

Birch, K., Rigby, M., & Roberts, R. (2000). Putting the 'tele' into health-care effectively. *Journal of Telemedicine and Telecare, 6*(Suppl. 1), 113–115.

Bogdan, R., & Taylor, S. J. (1975). *Introduction to qualitative research methods*. New York: John Wiley & Sons.

Bradley, E. H., Webster, T. R., Bala, D., Schlesinger, M., Inouye, S. K., Barth, M. C., et al. (2004) Translation Research into Practice: Speeding the adoption of innovative health care programs. *The Commonwealth Fund*, Issue Brief #724.

Brauer, G. (1992). Telehealth: The delayed revolution in health care. *Medical Progress through Technology, 18*, 151–163.

Bryman, A. (1988). *Quantity and quality in social research*. New York: Routledge.

Burdick, A. E., & Berman, B. (1997). Teledermatology. In R. L. Bashshur, J. H. Sanders, & G. W. Shannon (Eds.), *Telemedicine: Theory and Practice*, (pp. 225-247). Springfield: Charles and Thomas Publisher.

Campbell, J. D., Harris, K. D., & Hodge, R. (2001). Introducing telemedicine technology to rural physicians and settings. *The Journal of Family Practice, 50*(5), 419–424.

Chau, P. Y. K. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision Sciences*, Fall 2001

Collins, K., Bowns, I., & Walters, S. (2004). General practitioners' perceptions of asynchronous telemedicine in a randomized controlled trial of teledermatology. *Journal of Telemedicine and Telecare, 10*, 94–98.

College of Family Physicians of Canada. (2004). Mainpro® - *Maintenance of Proficiency*. Retrieved August 7, 2004 from http://www.cfpc.ca/English/cfpc/cme/mainpro/maintenance%20of%20proficiency/default.asp?s=1

College of Physicians and Surgeons of Ontario. (n.d.). *Doctor Search*. Retrieved October 7, 2002, from http://www.cpso.on.ca/Doctor_Search/dr_srch_hm.htm

Cradduck, T. D. (2002). Sustainability – the Holy Grail of telehealth? *Journal of Telemedicine and Telecare, 8*(Suppl. 3): S3: 7–8.

Craig, J. (1999). Introduction. In R. Wootton & J. Craig (Eds.), *Introduction to Telemedicine* (pp. 3–16). London: The Royal Society of Medicine Press Ltd.

Creswell, J. W. (1998). *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*. Thousand Oaks: SAGE Publications.

Currell, R., Urquhart, C., Wainwright, P., & Lewis, R. (2002). Telemedicine versus face to face patient care: Effects on professional practice and health care outcomes (Cochrane Review). In: The Cochrane Library, Issue 1, 2002. Oxford: Update Software.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, September 1989, 319–340.

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies, 38*, 475–487.

Davis, P., Howard, R., & Brockway, P. (2001). Telehealth consultations in rheumatology: Cost-effectiveness and user satisfaction. *Journal of Telemedicine and Telecare, 7*(Suppl. 1), 10–11.

Demiris, G., & Tao, D. (2005). An analysis of the specialized literature in the field of telemedicine. *Journal of Telemedicine and Telecare, 11(6)*, 316-319.

Den Hertog, F., Groen, M., & Weehuizen, R. (2005). Mapping health care innovation: Tracing walls and ceilings. MERIT-Infonomics Research Memorandum series, 2005-007, 1-40. Maastricht Economic Research Institute and Technology.

Dick, P., Filler, R., & Pavan, A. (1999). Participant satisfaction and comfort with multidisciplinary pediatric telemedicine consultations. *Journal of Pediatric Surgery, 34*(1), 137–142.

Dixon, D. R., (1999). The behavioral side of information technology. *Int J Med Informatics,* 56 (1-3), 117-123.

Doolittle, G. C. (2001). Telemedicine in Kansas: The successes and the challenges. *Journal of Telemedicine and Telecare, 7*(Suppl. 2), 43–46.

Doolittle, G. C., & Cook, D. (1999). Defining the Needs of a Telemedicine Service. In R. Wootton & J. Craig (Eds.), *Introduction to Telemedicine* (pp.79–92). London: The Royal Society of Medicine Press Ltd.

Dunn, K. (1998). Overview of Reengineering Process Using Telemedicine Implementation. In S. F. Viegas & K. Dunn (Eds.), *Telemedicine: Practicing in the Information Age* (pp. 123–128). Philadelphia: Lippincott-Raven Publisher

Eedy, D. J., & Wootton, R. (2001). Teledermatology: A review. *British Journal of Dermatology, 144*(4), 696–707.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532–550.

European Commission Directorate General XIII. (1993). *Research and Technology Development on Telematics Systems in Health Care: AIM, 1993.* Brussels: European Commission.

Finch, T., May, C., Mair, F., Mort, M., & Gask, L. (2003). Integrating service development with evaluation in telehealthcare: An ethnographic study. *British Medical Journal 2003, 327*, 1205–1209.

Fulop, N., Allen, P., Clarke, A., & Black, N. (2003). From health technology assessment to research on the organisation and delivery of health services: Addressing the balance. *Health Policy, 63*(2), 155–165.

Gagnon, M. P., Godin, G., Gagne, C., Fortin, J. P., Lamothe, L., Reinharz, D., et al. (2003). An adaptation of the Theory of Interpersonal Behaviour to the study of telemedicine adoption by physicians. *International Journal of Medical Informatics, 71*(1-2), 103–115.

Garfield, M., & Watson, R. (2003). Case study: Four case studies in state-supported telemedicine initiatives. *Telemedicine Journal and e-Health, 932*, 197– 205.

Gilmour, E., Campbell, S. M., Loane, M. A., Esmail, A., Griffiths, C. E. M., Roland, M. O., et al. (1998). Comparison of teleconsultations and face-to-face consultations: Preliminary results of a United Kingdom multicentre teledermatology study. *British Journal of Dermatology, 139*(1), 81–87.

Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research.* Chicago: Aldine Pub. Co.

Gomez-Ulla, F., Fernandez.M.I., Gonzalez, F., Rey, P., Rodriguez, M., Rodriguez-Cid, M.J., Casaneuva, F.F., Tome, M.A., Garcia-Tobio, J., & Gude, F. (2002). Digital Retinal Images and Teleopthmalmology for Detecing and Grading Diabetic Retinopathy. *Diabetes Care, 24,* 1384-389.

Grigsby, B., & Brown, N. A. (2002). A Survey of Teledermatology in the USA. In R. Wootton & A. M. M. Oakley (Eds.), *Teledermatology* (pp. 59–70). London: Royal Society of Medicine Press Ltd.

Grol, R., & Wensing, M. (2004). What drives change? Barriers to and incentives for achieving evidence-based practice. *MJA, 180*(6 suppl) S57-60.

Gustke, S., Balch, D. C., Rogers, L. O., & West, V. L. (2000). Profile of users of real-time interactive teleconference clinical consultations. *Archives of Family Medicine, 9*(10), 1036–1040.

Gutierrez, G. (2001). Medicare, the internet, and the future of telemedicine. *Critical Care Medicine, 29*(8), N144–N149.

Hakansoon, S., & Gavelin, C. (2000). What do we really know about the cost-effectiveness of telemedicine? *Journal of Telemedicine and Telecare, 6*(Suppl. 1), 133–136.

Health Canada. (n.d.). *Canada Health Infostructure Partnership Program, 2000-2002.* Retrieved November 7, 2004, from http://www.hc-sc.gc.ca/hcs-sss/ehealth-esante/onfostrucutre/finance/chipp-ppics/index-e.html

Helitzer, D., Heath, D., Maltrud, K., Sullivan, E., & Averson, D. (2003). Assessing or predicting adoption of telehealth using the diffusion of innovations theory: A practical example from a rural program in New Mexico. *Telemedicine Journal and e-Health, 9*(2), 179–187.

Hersh, W. R., Helfand, M., Wallace, J., Kramer, D., Patterson, P., Shapiro, S., & Greenlick, M. (2001). Clinical outcomes resulting from telemedicine interventions: A systematic review. *BMC Medical Informatics and Decision Making, 1*(5), 1472– 6947. From http://www.biomedcentral.com/1472-6947/1/5.

Hersh, W. R., Wallace, J. A., & Patterson, P. K. (2001). Telemedicine for the Medicare Population. Evidence Report/Technology Assessment No. 24 Prepared by Oregon Health Sciences University, Portland. *AHRQ Publication No. 01-E012*, Rockville (MD) Agency for Healthcare Research and Quality.

Heterington, L. T. (1998). High tech meets high touch: Telemedicine's contribution to patient wellness. *Nursing Administration Quarterly*, Spring, 22(3), 75–86.

Houston, M. S., Myers, J. D., Levens, S. P., McEvoy, M. T., Smith, S. A., Khandheria, B. K., et al. (1999). Clinical consultations using store-and-forward telemedicine technology. *Mayo Clinic Proceedings, 74,* 764–769.

Hu, P. J., Chau, P. Y. K., Liu Sheng, O. R., & Tam, K. Y. (1999). Examining the technology acceptance model using physician: 'Acceptance of telemedicine technology'. *Journal of Management Information Systems*, Fall, 16(2), 91–112.

Ingvarsson, G., & Moseng, D. (2002). Real-Time Teledermatology in Norway. In R. Wootton & A. M. M. Oakley (Eds.), *Teledermatology* (pp. 71–79). London: Royal Society of Medicine Press Ltd.

Innovation Systems Research Network. (2003). *Working papers*. Retrieved December 11, 2003, from http://www.utoronto.ca/isrn/aboutus.htm.

Institute of Medicine, Committee on Evaluating Clinical Applications of Telemedicine. (1996). M. J. Field (Ed.), *Telemedicine: A Guide to Assessing Telecommunications in Health Care.* Washington: National Academy Publishing Press.

Jaatinen, P. T., Firsstrom, J., & Loula, P. (2002). Teleconsultations: Who uses them and how? *Journal of Telemedicine and Telecare, 8*(6), 319–324.

Jacklin, P. B., Roberts, J. A., Wallace, P., Haines, A., Harrison, R., Barber, J. A., et al. (2003). Virtual outreach: Economic evaluation of joint teleconsultations for patients referred by their general practitioner for a specialist opinion. *British Medical Journal, 327*, 84.

Jones, D. H., & Crichton, C. (1996). Teledermatology in the highlands of Scotland. *Journal of Telemedicine and Telecare, 2*(Suppl. 1), 7–9.

Kaplan, B. (2001). Evaluating informatics applications—some alternative approaches: Theory, social interactionism, and call for methodological pluralism. *International Journal of Medical Informatics*, 64, 39–56.

Kennedy, C., Johnston, K., Taylor, P., & Murdoch, I. E. (2003). Determining clinician satisfaction with telemedicine. *Journal of Telemedicine and Telecare, 9* (Suppl. 1), 62–64.

Larsen, F., Gjerdrum, E., Obstfelder, A., & Lundvoll, L. (2003). Implementing telemedicine services in northern Norway: Barriers and facilitators. *Journal of Telemedical Telecare, 9*(Suppl. 1), 517–518.

Lehoux, P., Sicotte, C., Denis, J. L., Berg, M., & Lacroix, A. (2002). The theory of use behind telemedicine: How compatible with physicians' clinical routines? *Social Science and Medicine, 54*, 889–904.

Lesher, J.L., Davis, L.S., Gourdin, F. W. et al. (1998). Telemedicine evaluation of cutaneous diseases: a blinded comparative study. *Journal of the American Academy of Dermatology, 38,* 27-31.

Lim, A. C., Egerton, I. B. & Shumack, S. P. (2000). Australian teledermatology: The patient, the doctor and their government. *Australian Journal of Dermatology, 41*, 8– 13.

Linderoth, H. C. J. (2002). Managing telemedicine: From noble ideas to action. *Journal of Telemedicine and Telecare, 8*, 143–150.

Loane, M. A., Bloomer, S. E., Corbett, R., Eedy, D. J., Hicks, N., Lotery, H. E., et al. (2000). A randomized controlled trial to assess the clinical effectiveness of both realtime and store-and-forward teledermatology compared with conventional care. *Journal of Telemedicine and Telecare, 6*(Suppl. 1), 1–3.

Lowitt, M. H., Kessler, I. I., Kauffman, C.L., Hooper, F. J., Siegel, E., & Burnett, J. W. (1998). Teledermatology and in-person examinations: A comparison of patient and physician perceptions and diagnostic agreement. *Archives of Dermatology, 134*(4), 471–476.

Mair, F. S., Haycox, A., May, C., & Williams, T. (2000). A review of telemedicine cost-effectiveness studies. *Journal of Telemedicine and Telecare, 6*(Suppl. 1), 38– 40.

Mair, F., & Whitten, P. (2000). Systematic review of studies of patient satisfaction with telemedicine. *British Medical Journal, 320*, 1517–1520.

Mairinger, T., & Ferrer-Roca, O. (1998). Social Aspects of Technology Transfer (Chapter 11). In O. Ferrer-Roca & M. Sosa-Iudicissa (Eds.), *Handbook of Telemedicine*. Washington: IOS Press.

Malmquist, G., Hansson, U., et al. (2000). Health practice by remote expert: A case study from mid-Sweden. In M. Rigby, R. Roberts, & M. Thick (Eds.), *Taking Health Telematics into the 21st Century* (pp. 27–50). Abingdon: Radcliffe Medical Press Ltd.

Mardon, J. (2003). Telemedicine education in accident and emergency. *British Medical Journal Career Focus, 328*, 545–546.

Massman, N. J., Dodge, J. D., Fortman, K. K., Schwartz, K. J., Solem, L. D. (1999). Burns follow-up: An innovative application of telemedicine. *Journal of Telemedicine and Telecare, 5*(Suppl. 1), 52–54.

May, C., Gask, L., Atkinson, T., Ellis, N., Mair, F., & Esmail, A. (2001). Resisting and promoting new technologies in clinical practice: The case of telepsychiatry. *Social Science & Medicine, 52*, 1889 –1901.

May, C., Harrison, R., MacFarlane, A., William, T., Mair, F., & Wallace, P. (2003). Why do telemedicine systems fail to normalize as stable models of service delivery? *Journal of Telemedicine and Telecare, 9*(Suppl. 1), 25–26.

MacLellan, K. (2005). Telemedicine and rural care. *Canadian Medical Association Journal, 173, 2,*127.

McIntosh, W. A., Alston, L. T., Booher, J.R., Sykes, D., & Segura, C. B. (2000). Predictors of use of telemedicine for differing medical conditions. *Research in the Sociology of Health Care, 17,* 199-213.

McIntosh, W. A., Booher, J. R., Alston, L. T., Sykes, D., Segura, C. B., Wheeler, E. J., et al. (2001). Predictors of continued use of telemedicine by primary care professionals, medical specialists and patients. *Changing Consumers and Changing Technology in Health Care and Health Care Delivery, 19*, 153–177.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis* (2nd ed.). Thousand Oaks: SAGE Publications.

Ministry of Health and Long Term Care of Ontario. (2002*). Underserviced Area Program.* Retrieved April 6, 2003, from http://www.health.gov.on.ca/english/providers/program/uap/uap_mn.html

Ministry of Health and Long Term Care of Ontario. (2005). *McGuinty government announces creation of 31 new family health teams: second wave of teams will provide thousands of Ontarians with more access to doctors and nurses.* Retrieved January 7, 2006, from http://www.health.gov.on.ca/english/media/news_releases/archives/nr_05/nr_120905.html

Ministry of Northern Development and Mines of Ontario. (2002, September 4.). *Ontario expands telemedicine initiative to Parry Sound – Muskoka region.* Retrieved September 8, 2005, from http://www.mndm.gov.on.ca/mndm/pub/newrel/NRPrint.asp

Mitka, M. (1998). Physicians find teleactivity hot near the North Pole. *The Journal of the American Medical Association, 1296*(1).

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192–222.

Moore, G. C., & Benbasat, I. (1995). Integrating diffusion of innovations and theory of reasoned action models to predict utilization of information technology by end-users. In K. Kautz & J. Pries-Heje (Eds.), *Diffusion and Adoption of Information Technology* (pp. 132–146). New York: Chapman & Hall.

Moore, M. (1999). Characteristics of users of medical innovations. *Lecture Notes Computer Science, 1593*, 912-918.

Moore, M. (2000). Elements of Success in Telemedicine Programs: Advice from Telemedicine Leaders. In A. Marsh, et al. (Eds.), *Advanced Infrastructures for Future Healthcare* (pp. 6–19). Washington: IOS Press.

Moser, P., Hauffe, H., & Lorenz, I. (2003). Publication output in telemedicine during the period January 1964 to July 2003. *Journal of Telemedicine and Telecare*, 10, 72–77.

Nguyen, L. T., Massman, N. J., Franzen, B. J., Ahrenholz, D. Z., Sorenza, N. W., Mohr, W. J. 3rd, et al. (2004). Telemedicine follow-up of burns: Lessons learned from the first thousand visits. *Journal of Burn Care & Rehabilitation, 25*(6), 485–490.

Noorani, H. Z., & Picot, J. (2001). Assessment of Videoconferencing in Telehealth in Canada. Ottawa: Canadian Coordinating Office for Health Technology Assessment; 2001. Technology report no. 14.

NORTH Network(a). (2003) *NORTH Network Program Final CHIPP Project Report.* Toronto

NORTH Network(b). (2003) *NORTH Network Program Phase II Evaluation Report.* Toronto.

Norton, S. A., Burdick, A. E., Phillips, C. M., & Berman, B. (1997). Teledermatology and underserved populations. *Archives of Dermatology, 133*, 197 –200.

Oakley, A. M. M., Kerr, P., Duffill, M., Rademaker, M., Fleischl, P., Bradford, N., & Mills, C. (2000) Patient cost-benefits of realtime teledermatology – a comparison of data from Northern Ireland and New Zealand. *Journal of Telemedicine and Telecare, (6),* 97-101.

Obstfelder, A. (2003). Social dilemmas in a telemedicine network: Experience with the implementation of the Norwegian Pathology Network. *Journal of Telemedicine and Telecare, 9*(Suppl. 1), 29–30.

Pak, H. S., Welch, M., & Poropatich, R. (1999). Web-based Teledermatology Consult system: Preliminary results from the first 100 cases. In M. Nerlich & R. Kretschmer (Eds.), *The Impact of Telemedicine on Health Care Management* (pp. 179–184). Washington: IOS Press.

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Thousand Oaks: SAGE Publications Inc.

Perednia, D.A.. (2002). Foreward. In R. Wootton & A. M. M. Oakley (Eds.), *Teledermatology,* p.xiii-xv. London: The Royal Society of Medicine Press Limited.

Perednia, D. A., & Allen, A. (1995). Telemedicine technology and clinical applications. *Journal of the American Medical Association, 273*(6), 483–488.

Phillips, C. M., Burke, W. A., Bergamo, B., & Mofrad, S. (2000). Review of Teleconsultations for Dermatologic Diseases. *Journal of Cutaneous Medicine and Surgery, 4*(1), 71–75.

Picot, J. (2000). Meeting the need for educational standards in the practice of telemedicine and telehealth. *Journal of Telemedicine and Telecare, 6*(Suppl. 2), 59 –62.

Pong, R. W. & Hogenbirk, J. (1999). Licensing physicians for telehealth practice: issues and policy options. *Health Law Review*, 8(1), 3-14.

Rigby, M., Roberts, R., & Birch, K. (2000). Telematics in healthcare: New paradigm, new issues. In M. Rigby, R. Roberts, & M. Thick (Eds.), *Taking Health Telematics into the 21st Century* (pp. 1–16). Abingdon: Radcliffe Medical Press Ltd.

Robinson, D. F., Savage, G. T., & Campbell, K. S. (2003). Organizational learning, diffusion of innovation, and international collaboration in telemedicine. *Health Care Management Review, 28*(1), 68–78.

Rogers, E. M. (1995) *Diffusion of Innovations* (4th ed.). New York: Free Press

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.

Roine, R., Ohinmaa, A., & Hailey, D. (2001). Assessing telemedicine: A systematic review of the literature. *Canadian Medical Association Journal, 165*(6), 765–771.

Rooney, C. D. (1999). Standing at the millennium's dawn: Telemedicine leads our health care system into the twenty-first century. *Compensation & Benefits Management. 15(*4), 42–48.

Sanson-Fisher, R. W. (2004). Diffusion of innovation theory for clinical change. *MJA 180* (6 suppl): S55-56.

Sargeant, J., Allen, M., & Langille, D. (2004). Physician perceptions of the effect of telemedicine on rural retention and recruitment. *Journal of Telemedicine and Telecare*, 10, 89–93.

Sargeant, J., Curran, V., Jarvis-Sellinger, S., Ferrier, S., Allen, M., Kirby, F., & Ho, K. (2004). Interactive On-Line Continuing Medical Education: Physicians' Perceptions and Experiences. *Journal of Continuing Education in the Health Professions*. 24, 227-236.

Sclater, K., Alagiakrishnan, K., & Sclater, A. (2004). An investigation of videoconferenced geriatric medicine grand rounds in Alberta. *Journal of Telemedicine and Telecare, 10*, 104–107.

Seale, C. (1999). *The Quality of Qualitative Research*. Thousand Oaks: SAGE Publications Ltd.

Shannon, G. W. (1997). Telemedicine: Restructuring rural medical care in space and time. In R. L. Bashshur, J. H. Sanders, & G. W. Shannon (Eds.), *Telemedicine: Theory and Practice* (pp. 37– 51). Springfield, Illinois: Charles C. Thomas Publisher Ltd.

Sicotte, C., Denis, J. L., & Lehoux, P. (1998). The computer based patient record: a strategic issue in process innovation. *J. Med. Syst, 22(6),* 431-443.

Sicotte, C., & Lehoux, P. (2003). Teleconsultation: Rejected and emerging uses. *Methods Inf Med, 42*, 451–457.

Sinha, A. (2000). An Overview of Telemedicine: The virtual gaze of health care in the next century. *Medical Anthropology Quarterly, 14*(3), 291–309.

Sjorgren, L. H., Tornqvist, H., Schwieler, A., & Karlsson, L. (2001). The potential of telemedicine: Barriers, incentives and possibilities in the implementation phase. *Journal of Telemedicine and Telecare, 7*(Suppl. 1), 12–13.

Smith, A. C., Isles, A., McCrossin, R., Van der Westhuyzen, J., Williams, M., Woollett, H., et al. (2001). The point-of-referral barrier - a factor in the success of telehealth. *Journal of Telemedicine and Telecare, 7*(Suppl. 2), 75–78.

Smits, H. L., & Baum, A. (1995). Health Care Financing Administration (HCFA) and reimbursement in telemedicine. *Journal of Medical Systems, 19*(2), 139–142.

Snowden, S., Harrison, R., & Wallace, P. (2001). General practitioner participants in a telemedicine trial: Comparisons with their peers. *Journal of Telemedicine and Telecare, 7*, 32–37.

Spaulding, R. J., Russo, T., Cook, D. J., & Doolittle, G. C. (2005). Diffusion theory and telemedicine adoption by Kansas healthcare providence: Critical factors in telemedicine adoption for improved patient access. *Telemedicine and Telecare*, (Suppl. 1), 107–109.

Statistics Canada. (n.d.) *Census of Population*. Last accessed November 4, 2005, from http://www.statcan.ca:8081/english/clf/highlight/index.html

Stumpf, S. H., Zalunardo, R. R., & Chen, R. J. (April 2002). Barriers to Telemedicine Implementation. Healthcare Informatics Online. New York: The McGraw-Hill Companies.

Tanriverdi, H., & Iacono, C. S. (1999). Diffusion of telemedicine: A knowledge barrier perspective. *Telemedicine Journal, 5*(3), 223–244.

Taylor, P. (1998). A survey of research in telemedicine. 1: Telemedicine systems. *Journal of Telemedicine and Telecare, 4*, 1–17.

Timmermans, S., & Berg, M. (2003). The practice of medical technology. *Sociology of Health & Illness, 25*, 97–114.

Tipping, J., Donahue, J., & Hannah, E. (2001). Value of unstructured time (breaks) during formal continuing medical education events. *Journal of Continuing Education in the Health Professions. 21*(2),90-96.

Treister, N. W. (1998). Physician acceptance of new medical information systems: the field of dreams. *Physician Executive*. May/June, 20-24.

Triandis, H. C. (1989). Values, attitudes and interpersonal behavior. In M. M. Page (Ed.), *Nebraska Symposium on Motivation, 1979: Beliefs, attitudes and values*. Lincoln: Lincoln University of Nebraska Press.

Wakefield, B. J., Buresh, K. A., Flanagan, J. R., Kienzle, M. (2004). Interactive Video Specialty consultations in long-term care. *Journal of the American Geriatric Society, 52*(5), 789–793.

Walker, J., & Whetton, S. (2002). The diffusion of innovation: Factors influencing the uptake of telehealth. *Journal of Telemedicine and Telecare, 8*(Suppl. 3), 73–75.

Wallace, P., Haines, A., Harrison, R., Barber, J., Thompson, S., Jacklin, P., et al. (2002). Joint teleconsultations (virtual outreach) versus standard outpatient appointments for patients referred by their general practitioner for a specialist opinion: A randomised trial. *The Lancet, 359,* 1961–1968.

Watts, L., & Monk, A. (1999). Telemedicine: What happens in a remote consultation. *International Journal of Technology Assessment in Healthcare, 15*(1), 220–235.

Whetton, S. (2002). The diffusion of innovation: An investigation of the impact of innovation attributes, organisational characteristics and user characteristics on the

adoption of health informatics education. *School of Information Systems*, University of Tasmania.

Whited, J. D. (2001). Teledermatology, Current Status and Future Directions. *American Journal of Clinical Dermatology, 2*(2), 59–64.

Whited, J., Hall, R. P., Simel, D. L., Foy, M. E., Stechuchak, K. M., & Drugge, R. J., et al. (1999). Reliability and accuracy of dermatologists' clinic-based and digital image consultations. *Journal of the American Academy of Dermatology, 41*(5).

Whitten, P. S., & Allen, A. (1995). Analysis of telemedicine from an organizational perspective. *Telemedicine Journal, 1*(3), 203–213.

Whitten, P. S., & Richardson, J. D. (2002). A scientific approach to the assessment of telemedicine acceptance. *Journal of Telemedicine and Telecare, 8*(4), 246–248.

Whitten, P. S., Mair, F. S., Haycox, A., May, C. R., Williams, T. L., & Hellmich, S. (2002). Systematic review of cost effectiveness studies of telemedicine interventions. *British Medical Journal, 324*, 1434–1437.

Whitten, P., & Adams, I. (2003). Success and failure: A case study of two rural telemedicine projects. *Journal of Telemedicine and Telecare, 9*, 125–129.

Whitten, P., Kinglsey, C., & Grigsby, J. (2000). Results of a meta-analysis of cost-benefit research: Is this a question worth asking? *Journal of Telemedicine and Telecare, 6*(Suppl. 1), 4–6.

Whitworth, J.M., Wood, B., Morse, K., Rogers, H., & Haney, M. (2002). The Florida Child Protection Team Telemedicine Program. In R. Wootton & A. M. M. Oakley (Eds.), Teledermtaology (pp. 135-149). London: The Royal Society of Medicine Press Ltd.

Williams, T., May, C., Mair, F, Mort., M., & Gask, L. (2003). Normative models of health technology assessment and the social production of evidence about telehealth care. *Health Policy, 64*, 39–54.

Wootton, R. (2001). Telemedicine. *British Medical Journal, 323*, 557–560.

Wootton, R. (2000). The development of telemedicine. In M. Rigby, R. Roberts, & M. Thick (Eds.), *Taking Health Telematics into the 21st Century* (pp. 17 –26). Abingdon: Radcliffe Medical Press Ltd.

Wootton, R., & Hebert, M. A. (2001). What constitutes success in telehealth? *Journal of Telemedicine and Telecare, 7*(Suppl. 2), 3–7.

Wootton, R., & Loane, M. (1998). Teledermatology. In O. Ferrer-Roca & M. Sosa-Iudiciassa (Eds.), *Handbook of Telemedicine*. Washington: IOS Press.

Wootton, R., & Oakley, A. M. M. (2002). *Teledermatology*. London: Royal Society of Medicine Press Ltd.

World Health Organization. (1998). A Health Telematics Policy. Geneva: *World Health Organization*

Yellowlees, P. (1997). Successful development of telemedicine systems –seven core principles. *Journal of Telemedicine and Telecare, 3*, 215–222.

Yellowlees, P. M. (1999). Successfully Developing a Telemedicine System. In R. Wootton & J. Craig (Eds.), *Introduction to Telemedicine* (pp. 93–103). London: The Royal Society of Medicine Press Ltd.

Yin, R. K. (a) (2003). Applications of Case Study Research, Second Edition. *In Applied Social Research Methods Series, Vol. 34*. Thousand Oaks: SAGE Publications.

Yin, R. K. (2003). Case Study Research: Design and Methods, Third Edition . *In Applied Social Research Methods Series, Vol. 5*. Thousand Oaks: SAGE Publications.

Participant Number:	**Interview Date:**
Start of Interview:	**End of Interview:**

Thank you for agreeing to participate in our study on the use of telemedicine for the delivery of dermatological consultations. Our objective is to understand your views about the use of telemedicine for the delivery of dermatological consultations to your patients. We believe that the physicians in this study will have a wide range of opinions about telemedicine and we are keen to understand your views.

As you know, your participation in these telemedicine sessions can be used for CME credits for the course titled "Distant Learning in Dermatology and Wound Care."

This interview has about twenty questions and will take about 30 minutes. At the beginning, I will ask you to describe your usual referral patterns when you require dermatological consultations and any views you have on the need for dermatological consultations in your practice. I'd then like to obtain your opinion regarding your perceptions of the characteristics of telemedicine that you think are important to its use in health care delivery.

As explained in our letter to you, it is preferable to audiotape our conversation as this not only allows me to concentrate on your answers, but also gives me the chance to analyze the transcripts later in detail. Do you have any questions or would you like me to clarify any points before we begin our discussion?

The first group of questions is about your referral patterns for dermatological consultations.

1. In your practice, do you have a need for dermatology consultation services? Why or why not?

2. Does your current access to dermatology specialty care meet the needs in your practice?

3. Do you need more knowledge about diagnosing and treating dermatology cases?

4. How many patients do you refer in a month/year? Please describe the clinical situations or factors that lead you to make a referral for a dermatology consultation. For example, do you refer cases where you are uncertain of the diagnosis or where the condition is complex? Do you already refer patients to the specialist who is doing today's teledermatology consultation?

5. Are there cases that you would like to refer but don't? If yes, why and how could the reasons that stop you from referring be addressed?

The next set of questions is about your views of telemedicine.

6. Have you heard of telemedicine? Can you describe what you know about it? What is your impression of telemedicine?

7. Do you currently have access to a telemedicine network for patient care? If yes, are you expected to use it, and by whom?

8. Do any of your colleagues refer patients for services delivered through telemedicine? If so, what was their experience?

9. What would be the gains or losses if you used telemedicine as compared to your usual way of doing things? (For example, in terms of time, travel, effectiveness, efficiency.)

10. How difficult would it be for you to try using telemedicine for dermatology consultations? In what ways?

11. How helpful would it be for you to use telemedicine for dermatology consultations?

12. Would the use of telemedicine for patient consultations mean significant change? What kinds of changes and for whom?

13. What would your colleagues think of you if you used telemedicine?

14. How much confidence do you have in a consultation delivered from a distance?

15. Have you heard of any issues related to legal liability or reimbursement that would have to be clarified before you would use telemedicine?

16. What is the importance of receiving a CME credit to your use of telemedicine?

17. In summary, to optimally meet your needs, telemedicine should .... (complete the sentence).

Are there any points we have not discussed that you feel might be useful to add?

Thank you.

Participant Number:	**Interview Date:**
Start of Interview:	**End of Interview:**

Thank you for meeting with me again to discuss your views about telemedicine now that you have participated in the teledermatology sessions. This interview has about 11 questions and will take about 30 minutes. As in our previous interview, with your permission I would like to audiotape our consultation.

1. First, I am interested in your reaction to the teledermatology sessions. Is there anything about them that surprised you?

2. How much confidence do you have in a dermatology consultation delivered from a distance?

3. How difficult would it be for you to use telemedicine for dermatology consultations in your practice? In what ways?

4. How helpful would it be for you to use telemedicine for dermatology consultations on an ongoing basis?

5. What would be the gains or losses if you used telemedicine as compared to your usual way of doing things? (For example, in terms of time, travel, effectiveness, efficiency.)

6. Would the use of telemedicine for patient consultations mean significant change? What kinds of changes and for whom?

7. How important is receiving continuing medical education credits to your ongoing participation in teledermatology consultations? If there were no credits would you continue to use telemedicine?

8. How important is the integration of education and patient care to your participation in teledermatology consultations?

9. Is telemedicine a technology that should be integrated into physician practice? If yes, how?

10. Do you think that you will integrate telemedicine into your practice in the future? If yes, how?

11. In summary, comparing what you think about telemedicine now and before this project started, are there any differences in your views. If so, what are the main differences?

Department of Medicine
University of Toronto
3-805, R. Fraser Elliott Building
190 Elizabeth Street
Toronto, ON M5G 2C4

Dear Physicians:

You are invited to participate in a continuing education program "Distant Learning and Dermatology and Wound Care." The program will be delivered through telemedicine and is part of a study investigating factors that influence use of telemedicine for dermatology consultation and professional education. You will qualify for 2 Mainpro-C credits per case further to your participation. Course participants are required to complete the "Linking Learning to Practice" form which is available at http://cfpc.klickit.com/local/files/CME/Mainpro/generic.pdf and will also be provided at the telemedicine sessions.

Participants in this CE program will be asked to participate in a half hour interview before and after the first dermatology consultation session delivered through telemedicine. Each session will include presentation of one patient for dermatological consultation by each course participant and the consultation will be videotaped. I will conduct the dermatology consultation from a telemedicine studio in Toronto. Each telemedicine session will last about 90 minutes as I anticipate that during a session about five to six patients will be examined. It is your decision who to refer with any dermatological problem.

The date of the teledermatology session is xxxxxx and a second session will be scheduled for xxxxxx. Sessions will be held from xxxxxx at the telemedicine studio. Your study interview on xxxxxx and after the telemedicine session on xxxxxx can also be conducted at this location or another location convenient for you.

This study is being conducted through the Institute of Medical Science and the Department of Medicine at the University of Toronto and Sunnybrook and Women's College Health Sciences Centre. This initiative has received approval from the Research Ethics Board. A full study description and a participant consent form will be provided to you. Questions can be directed to Donna Bain at xxxxxx or d.bain@utoronto.ca.

Yours truly,

Dr. R. Gary Sibbald, Director
Dermatology Daycare
and Wound Healing Clinic
Sunnybrook & Women's College
Health Sciences Centre

INTERVIEW SUMMARY

Location:	
Subject #:	
Date of Interview:	
Pre/Post:	
Comments About Innovation Attributes	**Theme**
Comments not reflected in Interview Guide	
Observations	