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TECHNOLOGY VENDOR, ADMINISTRATIVE, AND COST ISSUES IN TELEMEDICINE

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ABSTRACT

TECHNOLOGY VENDOR, ADMINISTRATIVE,
AND COST ISSUES IN TELEMEDICINE

By

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Telemedicine, the provision of healthcare from a distance via telecommunication technology, has the potential to help researchers and health practitioners address escalating costs while providing new and innovative healthcare services. Despite continued interest in telemedicine, many of the factors that contribute to the success or failure of a project have not been studied adequately. Also, many research projects do not survive beyond the grant phase of operation. This research sought to address several issues requiring greater attention: (1) issues related to the partnering of a healthcare organization and its technology vendor; (2) administrative issues within the healthcare organization; (3) cost issues related to the provision of telemedicine services.

Three case studies were conducted, one focusing on each of the topics of interest. Results outlined the evolution of the healthcare organization-technology vendor partnership, governance issues in this relationship, keys to success in telemedicine implementations, administrative strategies to be used in planning and managing a multi-site telemedicine system, strategies for achieving financial viability and a description of how telemedicine can be tied to organizational goals. The implications of this work for researchers and practitioners are discussed, as well as directions for future research and limitations of this research.

To my parents, family, friends, and colleagues.

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I. INTRODUCTION

New telecommunication technologies seem to be emerging everyday, changing the way people go about their everyday lives at work and play. Perhaps one of the more innovative uses of telecommunication technology, an application that explores the frontier of what such technologies can accomplish, is healthcare. The concept of telemedicine, of providing medical care from a distance using telecommunication technologies, is not a new one. The earliest work in the United States was carried out by Wittson and colleagues in 1961, through the establishment of a video-based telepsychiatry service that linked providers in Nebraska at the Psychiatric Institute in Omaha with a distant psychiatric hospital (Wittson, Affleck, & Johnson, 1961). Over the course of more than four decades the number of telemedicine projects and services operating in the United States has grown to the point that it is no longer possible to quantify the exact number (Whitten & Kuwahara, 2003). Continued interest in telemedicine is evident in the existence of two peer-reviewed telemedicine journals (*Telemedicine and e-Health Journal* and *Journal of Telemedicine and Telecare*, both of which are indexed on Medline) and a website operated by the Telemedicine Information Exchange that includes a searchable database of over 16,000 articles related to telemedicine.

Despite extensive and varied research in telemedicine, the problem remains that a great number of telemedicine implementations are sustainable only for the duration of a research project, with adoption and actual usage of telemedicine system often disappointing (Grigsby et al., 2002). Even projects

that might be considered successful during their research cycle, when they are funded by external research dollars, often fail once this research funding disappears (Grigsby et al., 2002). More work must be done to discover why telemedicine systems often fail to survive beyond the research phase of a system. This research illuminates three particularly relevant factors thought to influence telemedicine systems' longevity: (1) issues related to the partnering of a healthcare organization and its technology vendor; (2) administrative issues within the healthcare organization; (3) cost issues related to the provision of telemedicine services.

Telemedicine projects rely on the successful application of telecommunication technology to provide healthcare services of some kind. If the communication technology or telecommunication services to be used in providing healthcare do not function properly, it is simply impossible for a telemedicine application to succeed. In short, the telemedicine technology needs to "just work." Healthcare organizations, particularly as they take their first experimental steps into providing telemedicine services, might be hesitant to attempt a system implementation without outside support – they may feel they lack the necessary resources or experience with advanced technology to successfully install a complicated telemedicine system. In such situations, partnering with a technology vendor that has experience in implementing telemedicine systems might seem like a prudent approach. Any sort of Information Technology (IT) project can be a challenging task; research in the Information Systems (IS) discipline has shown that at least 25% of IT projects are

not successful (Keil & Mann, 2000). Partnering with an external technology vendor to complete an IT project, with all the associated coordination and communication issues it involves, can make this even more challenging. Healthcare organizations operate under a variety of regulatory conditions – such as the Health Information Portability and Accountability Act (HIPAA) – that traditional businesses and organizations do not need to worry about; as a result the partnership between a healthcare organization and its telemedicine vendor faces challenges beyond those faced in traditional technology outsourcing projects. In spite of this, telemedicine researchers have not adequately investigated this relationship, with only a handful of papers describing the partnership between a healthcare provider and its telemedicine vendor (e.g., Kinsella, Lee, & Ecken, 2004; Starren, Abbruscato, Porter, Ring, & Wolff, 2002). This research helps to address this gap in existing telemedicine research by investigating the relationship between a group of healthcare organizations – namely, nursing homes in Michigan – looking to implement a telemedicine system and the technology vendor (SBC) selected to install the system.

Once a telemedicine system is technically operational, researchers can turn their attention to other reasons a project may or may not succeed. One area that researchers must further address is the proper administrative and management response to the implementation of a telemedicine system. Administrative strategies and organizational support are recognized in the IS field as being key to the success of IT projects (George, 2000). Effective administrative and management strategies are particularly important in

telemedicine implementations, which often look to deploy new technology and applications at a number of sites simultaneously. This is often a result of research project goals (evaluating differences in similar systems implemented in rural and urban settings, for example) while other times it is a functional requirement of the system (such as starting a videoconferencing network). In either case, more must be learned about effective strategies for handling the installation and growth of telemedicine systems in multi-site rollouts. This research seeks to illuminate successful strategies on the part of administrators and management used in rolling out a successful multi-site telemedicine system that has grown significantly over its lifetime – the TeleKidcare telemedicine system operated by Kansas University Medical Center.

Assuming a telemedicine system is technically operational, and the proper administrative steps have been taken to manage its installation and maintenance, long term financial viability of the service can become an issue. As stated earlier, many telemedicine research projects supported by grants do not survive the grant phase of operation (Rogers & Muttitt, 2003). Unlike the topics discussed to this point, research into the costs of telemedicine systems is something that has received a great deal of attention from researchers. The trouble here is that this research into telemedicine costs tends to be conflicting, is rife with inconsistent results, and often lacks real quantifiable data (Whitten et al., 2002). This study addresses the issue of telemedicine system costs from a different perspective, looking at a project that has operated well beyond the original grant stage of the system. This research looks at aspects of pre-project

planning and ongoing monitoring of costs that help a telemedicine system achieve financial stability and become a viable part of a healthcare system's operation – specifically the members of the Upper Peninsula Telehealth Network in the Upper Peninsula (UP) of Michigan.

There are any number of issues that telemedicine researchers can choose to focus on, and an assortment of lenses through which to study these topics. This research project targeted three particular issues related to telemedicine that merit further attention, and selected three organizations in which to study these concerns. Utilizing a case study methodology, this research focuses on (1) the relationship between a healthcare provider and its technology vendor, (2) administrative issues in telemedicine deployment, and (3) cost issues as telemedicine projects seek to achieve financial viability. Each of these three topics is studied in a particular organization selected for its unique situation as an exemplary case for the selected issue. The results of this project will help researchers and practitioners in their efforts to use telemedicine to improve the provision of healthcare.

This work continues with Chapter 2, which includes a literature review of a number of areas relevant to this work and concludes with a discussion of the research questions that guided this research. Chapter 3 offers a description of the methods used to conduct this project. Chapter 4 provides information about the results of this research. Chapter 5 completes this report by discussing the implications of this work for researchers and practitioners, offering directions for continued research into these topics, and discussing limitations of the study.

II. Literature Review

While telemedicine could be considered a relatively young field in terms of academic research, the breadth of topics and strategies for studying telemedicine systems is already significant. This chapter provides a review of literature relevant to this research, including a general overview of telemedicine research and specific sections focusing on the specific issues under investigation – the partnering of a healthcare provider and a telemedicine technology vendor, administrative issues in telemedicine implementations, and cost issues in telemedicine. Chapter 2 ends with an outline of the research questions this project seeks to answer.

Telemedicine Overview

A proper introduction to telemedicine as a research field can help set the stage for understanding the issues on which this research focuses. This section includes discussion of the history of telemedicine, an overview of telemedicine technology and common applications, and an outline of the methods most typically utilized in studying telemedicine systems.

Telemedicine History

Telemedicine in the United States started with work in 1961 at the Psychiatric Institute in Omaha (Wittson, Affleck, & Johnson, 1961). Another early project, conceived by the National Aeronautics and Space Administration (NASA) was the Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC). STARPAHC, which ran from 1972-1975, delivered care to the Papago Indian Reservation in Arizona via a special van equipped with an

electrocardiograph, x-ray, and a microwave transmission link to connect with specialists at remote hospitals (Bashshur, 1980). Other early telemedicine work included a link from Massachusetts General Hospital to Logan International Airport in 1967 (L. Murphy & K. Bird, 1974; R. Murphy & K. Bird, 1974) and a study of video consultations to rural Alaskan residents via satellite technology (Foote, 1977). By 1975 there were fifteen active telemedicine projects running in the United States (Bashshur, Armstrong, & Youssef, 1975).

Several other notable telemedicine projects began operations in the late 1970s and 1980s. The Memorial University of Newfoundland made use of satellite technology to provide distance education for medical care (House & Roberts, 1977). The North-West Telemedicine Project in Australia used satellite technology to provide medical care to remote patients (Watson, 1989). Also, NASA initiated the first international telemedicine program, the Space Bridge to Armenia/Ufa to help provide specialist consultations to the Soviet Republic of Armenia after an earthquake in December of 1988 (Brown, 1995).

A recent literature review by Whitten and colleagues (2006) reviewed the telemedicine literature from 1990 through 2006. Telemedicine research grew significantly during this period, with the meta-analysis covering 1,637 telemedicine research articles. Studies came from countries all over the world, on average included over 200 patient subjects, utilized a variety of methods, and investigated a wide array of telemedicine applications. The breadth of work reviewed in this project is a testament to the explosive growth of telemedicine as

a field from early work through today. The next section continues with a discussion of different types of telemedicine technologies and applications.

Telemedicine Technology and Applications

Since those early projects telemedicine technology has evolved significantly. A strategy for broadly classifying telemedicine technology would be to make a distinction between synchronous and asynchronous systems. Synchronous systems bring together medical professionals and patients in "real time" to provide healthcare services; this is most often accomplished through videoconferencing technology, though the advent of the Internet has brought about online chat rooms and instant messaging applications that would also qualify as synchronous telemedicine (Baruffaldi, Gualdrini, & Toni, 2002; Cowain, 2001; Nelson, 2004). Asynchronous telemedicine does not bring people together at the same time. Examples of asynchronous telemedicine applications include home-based systems that transmit information about patients' chronic conditions to Veterans Administration Medical Centers overnight (Hopp et al., 2005), Picture Archiving Systems used to store and transmit images for teleradiology and similar applications (B. Raman, Raman, Raman, & Beaulieu, 2004), and the use of e-mail to let patients consult providers via the Internet (Heinzelmann & Kvedar, 2004).

Telemedicine has been used in an assortment of medical applications, including dermatology (Burgiss, Clark, Watson, & Haynes, 1997; Chen, See, & Shumack, 2002), pathology (Joel, Leong, & Leong, 2004; Mireskandari, Kayser, Hufnagl, Schrader, & Kayser, 2004), radiology (Aas & Geitung, 2005; Crowe &

Sim, 2004), psychiatry (Greenwood, Chamberlain, & Parker, 2004; Kuulasmaa, Wahlberg, & Kuusimaki, 2004), and physical therapy (Rizzo, Strickland, & Bouchard, 2004). Telemedicine has also been used extensively to provide healthcare services directly to patients' homes, enabling such services as telehospice (Bensink & Irving, 2004; Demiris, Oliver, Fleming, & Edison, 2004) and home monitoring of patients with congestive heart failure (S. M. Finkelstein et al., 2004; McManus, 2004).

Another way of classifying the variety of telemedicine applications would be to focus on the types of interactions different technologies make possible. Perhaps the most obvious communication enabled by telemedicine technology is that between providers and patients. These systems are intended to improve the amount of contact between providers and patients, such as telehospice systems that put videophones into the homes of patients (Clemens, Sypher, & Doolittle, 2004). A particular telemedicine system might be implemented to ease the process of providers consulting with one another; an example of this type of system would be the Partners Online Specialty Consultations (POSC) program implemented by Brigham and Women's Hospital and Massachusetts General Hospital, a website intended in part to enable provider consultations (Heinzelmann & Kvedar, 2004). Other systems are meant to bring patients together, the most common application in recent years being the establishment of online support groups (e.g., Arrington, 2004). Similar online communities have sprung up to help caregivers get in touch with one another; a good example is the AlzOnline network designed to support the caregivers of older adults

suffering from Alzheimer's Disease (Glueckauf, Ketterson, Loomis, & Dages, 2004). It is also possible for telemedicine systems to enable group collaboration (e.g., Wallace, 2004) and mass communication through websites, news aggregators, and blogs (Neuhauser & Kreps, 2003).

Having discussed different types of telemedicine technology, the sorts of applications this technology makes possible, and the relationships they facilitate, this literature review continues with a discussion of the methods most frequently used to conduct telemedicine research.

Telemedicine Research Strategies

Since early researchers began to develop telemedicine as a field, researchers have built upon the success of these early projects to the point that it has become impossible to quantify the number of active telemedicine projects (Whitten & Kuwahara, 2003). Such a significant number of projects is a sure sign of growth in telemedicine as a research field, as is the wide array of methods and perspectives to study telemedicine implementations.

Telemedicine researchers are aware of the distinction between asynchronous and synchronous telemedicine applications. There are particular tradeoffs to be made when choosing one form of telemedicine over another – convenience for patients, convenience for providers, how quickly care can be provided, ease of integration into the healthcare organization, etc. Investigating these tradeoffs, advantages and disadvantages, has been a significant research area of exploration in telemedicine research looking at everything from videoconference consultations (Wallace, 2004) to Internet-based collaboration

tools (Heinzelmann & Kvedar, 2004) to online support groups (Arrington, 2004). This brand of telemedicine research, focusing on the technology used in an application, helps the field as a whole recognize the abilities of different technologies and pick the right tools for particular telemedicine implementations.

Moving beyond the technology itself, a key question that telemedicine must address is patient outcomes - do telemedicine systems provide inferior, comparable, or superior care when compared to traditional methods of delivering healthcare services? Researchers have looked at this particular issue in a range of settings and applications, including intensive care units (Breslow et al., 2004), the provision of psychiatry and telepsychiatry services (Ruskin et al., 2004), stroke rehabilitation (Winters & Winters, 2004), home-based care of CHF patients (Schofield et al., 2005), and dermatology (Krupinski, Engstrom, Barker, Levine, & Weinstein, 2004). Results, at times, have shown significant benefits to patient outcomes as a result of telemedicine; a study of a system used by diabetes patients showed that participants had an improved quality of life, fewer inpatient admissions, and less frequent emergency room visits (Cherry, Moffatt, Rodriguez, & Dryden, 2003). Finkelstein et al. (2003) reported on a telemedicine system that positively impacted patient outcomes for individuals managing chronic conditions including anticoagulation therapy, asthma, and Chronic Obstructive Pulmonary Disease (COPD). At the same time, other researchers have reported that it can be challenging to achieve satisfactory outcomes in certain telemedicine applications, such as remotely monitoring women with high risk pregnancies (Balas & Iakovidis, 1999). This focus on patient outcomes is

extremely important for the field, as it helps provide justification for the concept of telemedicine-based healthcare provision – it is not simply about cost savings, as telemedicine systems can go beyond traditional models of healthcare delivery and improve patient care. Continued work focusing on patient outcomes will help researchers broaden the range of healthcare issues where telemedicine can be shown to have a proven track record of success.

Moving past patient outcomes, another common paradigm for studying telemedicine projects is investigating the perceptions of providers and patients toward use of a new telemedicine system (Bratton, 2001; Seckman & Romano, 2001; Whitten, Collins, & Mair, 1998; Whitten, Doolittle, & Mackert, 2004). Such work looks to explain telemedicine system utilization as a result of how providers and patients perceive the technology. Conventional wisdom could hold that low levels of patient acceptance result in low levels of telemedicine usage, but patients tend to have favorable impressions of telemedicine (Bratton, 2001; Krousel-Wood et al., 2001; Whitten, Doolittle, & Mackert, 2004). Other researchers have suggested that low levels of provider acceptance of telemedicine technology could pose problems. Again, though, providers frequently report high levels of satisfaction with telemedicine equipment and services (Allen, Hayes, Sadasivan, Williamson, & Wittman, 1995; Hui & Woo, 2002; Lee et al., 1998; Nordal, Moseng, Kvammen, & Løchen, 2001). Some have suggested that these generally high levels of provider satisfaction can obscure the fact that providers act as gatekeepers to telemedicine services and

are the most critical factor in the success or failure of a telemedicine system (Whitten & Mackert, in press).

Another stream of research in this area looks at the costs associated with telemedicine projects (Doolittle, 2000b; Doolittle, Williams, & Cook, 2003; Luce & Elixhauser, 1990; Reardon, 2005; Zollo, Kienzle, Loeffelholz, & Sebille, 1999). The primary mode of thought is that learning more about the costs and expenses of adopting telemedicine technology could explain the failure of some projects, particularly once research funding ceases. The relevance of this method of studying telemedicine has recently been questioned in the field, with only a small minority of such studies even including real, quantifiable data (Whitten, Kingsley, & Grigsby, 2000; Whitten et al., 2002).

Other researchers have used a variety of methods to look at various issues thought to contribute to the success or failure of telemedicine research projects: administrative issues (Gagnon et al., 2004; P. Jennett, Yeo, Pauls, & Graham, 2003; West & Milio, 2004; Whitten & Kuwahara, 2004), legal and reimbursement issues (Lapolla & Millis, 1997; Wachter, 2001; Whitten & Kuwahara, 2003), privacy and security (Blanchette & Noll, 2004; Joshi, Aref, Ghafoor, & Spafford, 2001; Kenyon & Sessions, 2003; Moehr, 1994; Sogner, Goidinger, Reiter, Stoeger, & zur Nedden, 2000; Stevenson, 1996; Swartz, 1998), ethnic and cultural issues (Bali & Naguib, 2001; Cheong, Wilkin, & Ball-Rokeach, 2004; Demeester, 2000; Lewis & Griffin, 1997; Lopez, Webster, Kurker, Ranger-Moore, & Weinstein, 2003; Mechanic, 2002), and implementation hurdles (Gerrard, Grant, & Maclean, 1999; P Jennett & Andruchuk, 2001; Luethi,

Risch, Korte, Bader, & Huber, 2004; Williams & Singh, 1996; Wooton & Tahir, 2004), among others.

The presence of core strategies for researching telemedicine systems is important to continued success in the field – it simplifies the process of researchers building upon the work of other telemedicine projects. At the same time, the exploration of researchers into issues less commonly studied with novel methods is also important to the health of the discipline; it helps bring new issues and methods into mainstream telemedicine and introduces researchers to topics they otherwise may not have considered.

Summary

Telemedicine as a research field has existed for over forty years, evolving from the earliest attempts to provide healthcare remotely to applications that have been proven as efficacious, cost-effective methods of delivering healthcare services. Synchronous and asynchronous telecommunication technologies have been used successfully in a number of healthcare settings, and such systems have been studied using a variety of methods. The next section continues with a review of research conducted focusing on the partnership between healthcare organizations and the companies they partner with to provide the necessary telecommunication technology to enable telemedicine.

Vendor Issues In Telemedicine

Given the considerable importance of the telecommunication technology used in telemedicine applications, there has been surprisingly little research focusing on the relationship between healthcare providers and external

companies providing telemedicine hardware and services. This is not to say that such work has been completely lacking, though, or that research conducted in related fields cannot help shed light on this particular issue in a telemedicine context.

Healthcare Organizations and Telemedicine Vendors: Existing Research

One good example of such work is a discussion of the partnership between a home health agency in Pennsylvania and the technology vendor chosen to provide home monitoring equipment for its patients (Kinsella, Lee, & Ecken, 2004). The home health agency worked at length with its technology vendor to test the product and customize it for its patients. This partnership led to a number of changes in the product, including the addition of a practice feature to let elderly patients practice using it and increase their comfort level with the system, the removal of some confusing options, and the customization of some of the health status questions to meet the home health agency's needs. The end result was a product that worked well for the home health agency and its patients, leading to a successful system implementation. An important point comes out of this research, that "using this disciplined planning and implementation approach required more effort and time than simply installing technology" (Kinsella, Lee, & Ecken, 2004, p. 287). The payoff, of course, is a system that works the way providers and patients want it to, a key component to the success of any telemedicine project.

Another relevant discussion of the partnership among healthcare providers and technology vendors focused on success factors in a multi-vendor

partnership in the IDEATel Project (Starren, Abbruscato, Porter, Ring, & Wolff, 2002). This clinical trial in New York put a home telemedicine unit (HTU) into the homes of diabetes patients to help improve the management of the disease. The project involved the HTU, case management software, a clinical information system, Web access for patients, and data security applications to protect the entire system. Different components of the overall system were provided by different vendors, which required a great deal of coordination and expectation management. Researchers took great pains to contract effectively with the multiple vendors involved in the project – intelligently coupling services that should be delivered by a single vendor (keeping together hardware installation and support), while including explicit line items to describe how different external components would need to be integrated into the overall system. A reliance on established protocols – Lightweight Directory Access Protocol (LDAP) and Open Database Connectivity (ODBC), for example – to provide interfaces among different vendor components was also viewed as an important strategy for success. The IDEATel Project's success in bringing together multiple vendors is an excellent example of how to work successfully with external technology providers in the installation of a telemedicine system.

Relatively few research reports, like those discussed above, focus exclusively on the relationship between a healthcare organization and telemedicine technology providers. This is not to say that other research completely ignores the vendors of telemedicine equipment and telecommunication services, as issues with technology are frequently reported in

telemedicine research projects. This includes problems with network reliability and troubles achieving sufficient bandwidth (Wooton & Tahir, 2004), descriptions of the decision process involved in choosing among technology options (McNeill, Weinstein, & Holcomb, 1998), and a discussion of trends from custom solutions to off-the-shelf technology options for telemedicine systems (Stumpf, Zalunardo, & Chen, 2002). Researchers have also focused on the software side of telemedicine systems, looking at software interoperability in telemedicine systems (Ganguly & Ray, 2000), security and privacy concerns in the development of telemedicine systems (R. S. Raman, Jagannathan, & Reddy, 1997), and the security of transmission from remote monitoring systems (Sima, Raman, Reddy, Hunt, & Reddy, 1998).

The relative lack of previous research into this relationship between healthcare providers and telemedicine vendors highlights the knowledge to be gained through this research. It also necessitated investigation into another research field that can provide insight into some of the coordination and monitoring issues that would arise in the partnering of two organizations – Transaction Cost Economics (TCE).

Transaction Cost Economics

While not directly related to telemedicine, an area of research that is certainly relevant to the partnership between healthcare organizations and their technology vendors is TCE. At its broadest, TCE could be looked at as the study of varying institutions of governance (Williamson, 1996). While much of traditional economics looks at explicit costs of production, TCE focuses on the

transactions incurred when two parties interact. It is possible that various methods of organizing might increase or reduce these transaction costs, influencing market structure and the degree of vertical integration present in various firms (Shelanski & Klein, 1995).

The TCE lens is a powerful one, with the theoretical unit of analysis always the transaction level. Transactions can vary on several important dimensions – the degree to which relationship-specific assets are required for the transaction, the complexity of the transaction, and the frequency with which the transaction occurs (Williamson, 1996). Relationship-specific assets are those which are devoted to exchange with a particular trading partner that cannot be easily shifted to transactions with another organization. One important point related to the complexity of transactions is that it is the level of complexity of a transaction relative to the expertise of those transacting that is important – what could be a simple transaction for some might be a complex transaction for others.

There are two primary behavioral assumptions that guide work in TCE that are certainly relevant should TCE be applied to the study of telemedicine – opportunism and bounded rationality (Williamson, 1996). The assumption of opportunism is that those taking part in transactions will often act in their own self-interest and take advantage of opportunities to shirk in their work or look for personal economic gains. The bounded rationality assumption is that humans have a limited ability to process information. This limitation makes it impossible for individuals to consider all the possible courses of action in a given situation,

leading to decision strategies aimed at reaching satisfactory results – as opposed to the maximization strategies often assumed in traditional economics. This also means that institutions and organizations are designed to limit the vulnerabilities created by the bounded rationality assumption.

The range of situations in which TCE has been used is a testament to its power and flexibility. To provide a few examples, it has been used to study contracting practices in the aerospace industry (Matsen, 1984), cable television franchising (Williamson, 1975), contracting between authors and publishers in the book publishing industry (Hansmann & Kraakman, 1992), and offshore oil drilling (Corts & Singh, 2004). Lest concern grow that TCE can only be used to look at contracts and business-oriented issues, TCE has been used in a variety of contexts to study issues related to healthcare. Examples include studies of the level of vertical integration in public and private hospitals (Coles & Hesterly, 1998), referral practices between hospitals and home health agencies (Dansky, 1996), analysis of HMO contracting (Hodgkin, Horgan, & Garnick, 1997), and work regarding telemedicine (Mackert, in press; Pelletier-Fleury, Fargeon, Lanoe, & Fardeau, 1997). It is worth noting that work in TCE can be conducted using a qualitative case study approach, a quantitative case study approach, or cross-sectional econometric analysis (Shelanski & Klein, 1995). This further improves the flexibility of TCE and increases the number of situations in which it can effectively be utilized.

For the purposes of this particular research study, and particularly the issues related to a healthcare organization partnering with a technology vendor,

TCE can help illuminate some of the vulnerabilities that arise when a healthcare organization becomes dependent on an external technology vendor for services. Significant information asymmetries arise when the healthcare organization does not, and likely cannot, have the technological expertise required to know whether the vendor is putting forth its best effort to install and maintain telecommunication hardware and services. TCE can also provide recommendations for contracting arrangements between healthcare organizations and technology vendors to help alleviate some of the vulnerabilities created by these information asymmetries.

TCE and its focus on the governance issues that arise when individuals and organizations interact provides a theoretical framework to be used when looking at the partnership between healthcare providers and telemedicine technology vendors. As such, it can be used to highlight failures in inter-organizational partnerships, point to the reasons these failures occurred, and offer insight into possible fixes for these relational failures.

Summary

Given the relative importance of the technology used in a telemedicine project – telemedicine simply cannot succeed without working technology – the lack of research focusing on how healthcare organizations partner with external telemedicine technology vendors is an issue that merits further attention. The Pennsylvania and IDEATel Project examples show that this issue is at least gaining traction, but more work is required. TCE provides a useful theoretical framework for analyzing this relationship, pinpointing failures, and providing options for possible solutions.

Administrative Issues

Research into organizational issues related to telemedicine systems has been a popular stream of research for many years, though explicit focus on administrative issues has been less common. This section gives a brief overview of organizational research and focuses on work that has been conducted related to the administration and management of telemedicine systems as they are planned, begin operation, and grow into integral parts of the healthcare system.

Telemedicine researchers have put a great deal of effort into studying organizational factors that can help or hinder the adoption of a telemedicine system in a healthcare organization. Aas (2001) interviewed a series of telemedicine providers to investigate organizational consequences of telemedicine; some of the more significant organizational changes included shifts in workflow, organizational restructuring, new organizational units, and different flows for patients through the healthcare system. In other work, Aas (2000) categorized organizational impacts of telemedicine into four categories:

1. Changes in the distribution of work between different levels of healthcare provision.
2. Changes in the distribution of work between different organizations at the same level of healthcare provision.
3. New divisions of work and new skills for healthcare workers.
4. Groups of healthcare providers that are not co-located can more easily cooperate to solve problems.

Other researchers have investigated what aspects of an organization make it more or less likely for a telemedicine implementation to succeed. Such work has focused on organizational features and activities such as learning propensity (Doktor & Bangert, 2000), uncertainty avoidance (Bangert & Doktor, 2003), successfully marketing the telemedicine system internally and externally (Welsh, 2002), and effective communication systems within the organization (Whitten & Allen, 1995). Jennett et al. (2003) illuminated aspects of planning readiness (a telemedicine strategic plan, a needs assessment and analysis, and a business plan) and workplace readiness (preparing staff, having a telemedicine coordinator, and technical readiness) that contribute to telemedicine success; in the same work these researchers emphasized staff resistance as a major organizational factor to overcome in successfully bringing a telemedicine system online. One of the most common organizational factors mentioned in this area is the importance of organizational support in helping a telemedicine project succeed (Edwards, 2003; Welsh, 2002; Whitten, Cook, Kingsley, Swirczynski, & Doolittle, 2000; Whitten & Kuwahara, 2004).

Other organizational-level work has looked at possible differences between different types of telemedicine and the ease with which they can be incorporated into clinical practice – that asynchronous systems might be simpler to integrate than synchronous systems (Baruffaldi, Gualdrini, & Toni, 2002). Bellon et al. (1995) emphasized the importance of not focusing on a direct translation of traditional methods of working when implementing a telemedicine system, instead adapting workflow to the new possibilities that telemedicine can

help create. In a related area, role ambiguity and work satisfaction, both of which the introduction of a telemedicine system could impact significantly, were found to be major influences on work satisfaction among telenurses (Schlachta-Fairchild & B., 2001).

Organizational factors thought to promote or hinder telemedicine programs have received considerable attention from researchers. In contrast, despite the perceived importance of administrative and management strategies that contribute to the success of telemedicine implementations, this is an area that has been understudied.

A prime example of such work that has been conducted, however, is an explanation of the strategy employed by management in achieving buy-in for a home telehealth program (Britton & Chetney, 2004). This research describes the process used by management to receive buy-in from nursing staff for a new project, including the selection of a telehealth champion, involving nursing staff in the earliest stages of project planning, piquing interest through demonstrations of the system and its capabilities, and making documentation a simple process, among others. The importance of training staff is also stressed, a frequent theme of the research on telemedicine successes and failures (e.g., P. Jennett, Yeo, Pauls, & Graham, 2003). Work of this nature helps provide a roadmap that can be followed by other healthcare organizations looking to begin work on telemedicine projects, offering guidance on the key issue of receiving buy-in from staff.

An excellent case study described leadership and management issues in a startup company looking to bring a health-oriented search engine online during the Internet boom (Patterson & Shulman, 2004). This work focused on the leadership issues that occurred in the startup as one of the members of the initial founding team shifted himself to the position of ultimate authority within the company and changed the dynamic of the group from one of cooperation and teamwork to one of structured rules that stifled creativity. The final outcome from this case study was the importance of open communication within an organization to help members build trust in one another, understand their purpose and place within the organization, know how decisions within the organization are made, and maintain a clear vision of the goals of the organization. This type of case study, particularly in an entrepreneurial startup, sheds light on management strategies and how different administrative styles can stifle or promote organizational cohesion and performance.

Another good example of research into the proper management and administration of a telemedicine effort, specifically in proposing a large-scale telemedicine project, is offered by Effertz et al. (2004) in their description of the efforts at starting at telemedicine network to improve the care of prisoners in the New Mexico Corrections Department. The primary focus of this work was the importance of constructing a business case to persuade decision makers and possible partners about the benefits to be reaped in constructing a telemedicine network to connect New Mexico correctional facilities to one another and external networks. This is particularly important in healthcare, where healthcare

organizations often do not undertake significant planning when planning for new IT investments (Turisco, 2000). The case used to justify this New Mexico telemedicine network is outlined – from a basic explanation of what telemedicine is to decision makers unfamiliar with the concept, to an analysis of the costs and savings of the network, to a summary of externalities and other groups and institutions that would benefit from the network. This work would serve as an excellent guide for any group of administrators or researchers proposing a large telemedicine network, particularly in an environment – healthcare – where such formal business cases for IT investment are rare and can help work to make a project a success.

A different case study, on the rollout of a healthcare information system in Greece, did not focus exclusively on administrative and management issues but included interesting comments on some of these topics (Kourouabli, Detmer, Tsiknakis, & Orphanoudakis, 2004). The key lesson to be learned from this case was that the healthcare information system was allowed to grow organically within the Greek healthcare organizations taking part in the project; the more common alternative is a formal, rule-based implementation filled with guidelines for usage in different scenarios, protocols, and procedures. These researchers focused on the fact that the healthcare information systems introduced into these Greek healthcare facilities were successful because the implementation relied on a culture of "philotimo," a sense of self-esteem and duty that govern day-to-day operation in these clinics. Administrators and managers let the healthcare workers pick up and implement the healthcare information systems on their own,

which was a successful strategy in this case. This case highlights the importance of administrators choosing a proper strategy for implementing a healthcare system that matches organizational culture.

Other researchers have touched on administrative and management issues surrounding telemedicine implementations in reporting their work. Perhaps the most common point researchers discuss is the importance of a formal, written business plan to establish the efficacy of the system (Avery, Wallum, Rose, & Ferguson, 2003; Smith, 2001; Tohme & Olsson, 1996). Another common point is the importance of having a formal training plan in place to help orient users to the new telemedicine technology and procedures, if necessary (Blignault & Kennedy, 1999; Sen Gupta, Wallace, & Bannan, 1998).

Research into these administrative issues could be strengthened by making use of a theoretical framework to investigate the topic. In this case, Adaptive Structuration Theory (AST) was chosen as a relevant and useful theoretical base upon which to build this research. The basic concept behind structuration theories is that technology is a social construction, influenced by and influencing the social structure of an organization adopting the technology. Such work is founded on the general work with structuration by Giddens (1979; , 1984). Structuration theories have been used widely in IT research to study a number of different technologies (Dennis, Wixom, & Vandenberg, 2001; DeSanctis & Poole, 1994; Orlikowski & Yates, 1994; Yates & Orlikowski, 1992). AST is one of the more popular forms of structuration theory in the IT field, which looks at both the structure of a specific technology and how social interactions

change and shift as a result of its implementation in an organization. Specifically, AST focuses on social structures, the resources put in place by technology, and institutions for interpersonal interaction within an organization (DeSanctis & Poole, 1994). One of the stated goals of AST is to investigate "structuring's central paradox: identical technologies can occasion similar dynamics and yet lead to different structural outcomes" (Barley, 1986, p. 105). This sets up AST to be a very useful tool for telemedicine researchers evaluating systems, particularly given the multi-site nature of many telemedicine projects. Looking at such projects through an AST lens could help researchers determine why technically identical systems successful at some project sites could fail at others, and highlight the role that administrative behavior played.

Extensive research into the administrative issues involved in bringing telemedicine systems into healthcare organizations has been conducted. Such work has looked at common organizational barriers to telemedicine acceptance and characteristics that lead to success. Researchers have also looked at what administrators can do, beyond general organization characteristics, to promote telemedicine success – from adequate training to plans for achieving buy-in among providers and staff. Given the frequency with which researchers and practitioners look to implement large-scale telemedicine systems across a number of sites, though, focus on the proper strategies for achieving success in such situations has been relatively lacking. This research sought to address this deficiency, focusing on these issues using an AST lens. This literature continues

by turning to the third issue under consideration, issues related to costs in telemedicine.

Cost Issues

Research that focuses on the costs of telemedicine systems, and the possible savings over traditional modes of healthcare delivery, could certainly be viewed as one of the more active streams of research in the telemedicine discipline. This is a particularly key area of work as researchers and administrators look for ways to leverage possible benefits of telemedicine to provide quality, cost-effective healthcare. Examples of the results of such projects that focus on costs, from a range of telemedicine applications, include:

- Doolittle et al. (2003) reported that a telemedicine system in elementary schools achieved cost equivalence with a traditional medical center ambulatory pediatric consult when the system was used 165 times ($153/patient). The average cost per patient at different sites within this project varied from a low of $173.13 (129 consultations) to a high of $7,328.17 (1 consult).
- Loane et al. (2001) found that over the course of a ten month randomized teledermatology trial in New Zealand that telemedicine was more cost efficient than traditional dermatology care (NZ$279.23/patient vs. NZ$283.79/patient).
- Bailes et al. (1997) investigated the potential savings of implementing a telemedicine system to aid in the provision of specialty care in neurological surgery. This telemedicine system,

NeuroLink, resulted in an estimated savings of $502,638 in the provision of care to 100 patients.

- Brunicardi (1998) looked at the provision of healthcare via interactive videoconferencing to inmates in the Ohio Department of Rehabilitation and Corrections. The telemedicine system could only be shown to provide cost savings when at least 129 consultations were performed in a quarter.
- Noble et al. (2005) found that telemedicine was the more expensive option when compared to traditional care for the analysis of minor injuries (£78.61/patient vs. £39.15/patient). Even a marginal benefit in terms of reduced costs for families (£43.95/patient for telemedicine vs. £58.24/patient for routine care) did not push telemedicine as the superior alternative in terms of costs.
- Artiles et al. (1999) reported that for a teledermatology system implemented in the Canary Islands to be cost effective it would need to hit a threshold of 722 consultations per year.
- Doolittle (2000b) found that telehospice services provided a significant cost savings over traditional hospice services ($29/patient vs. $126/patient).
- Doolittle et al. (1998) looked at the provision of oncology services in three ways – conventional clinics, outreach clinics, and telemedicine clinics. Traditional clinics ($149/patient) proved to be

the superior option compared to outreach clinics ($897/patient) and telemedicine clinics ($812/patient).

Several things are clear from the above examples, which represent only a subset of the research conducted in this area. First, the possible cost savings of telemedicine over traditional methods for delivering healthcare are highly dependent on how much the system is used (e.g., Doolittle, Williams, & Cook, 2003). Second, there is no general consensus as to whether telemedicine services can provide cost savings to healthcare organizations; research has shown significant differences in favor of telemedicine care (e.g.,Doolittle, 2000a) and traditional care (e.g., Doolittle, Yaezel, Otto, & Clemens, 1998).

A more detailed description of how such research is typically conducted will be helpful in illustrating where problems could occur in this particular area of telemedicine research. Schuffham and Steed (2002) conducted a cost analysis of a teledentistry project in two communities in the United Kingdom – the Orkney Islands and the Scottish Highlands. In this project the costs of the telemedicine system were compared to two traditional methods of dental healthcare in the area – outreach visits where specialists visited remote communities and hospital visits where patients would come to urban hospitals for care. To investigate the costs of these two systems, costs were separated into direct and indirect costs for patients, providers, and the National Health Service (NHS). Costs to patients included travel costs, as well as fees to be paid for the services received. Costs to providers included a loss of time and revenue to provide telemedicine care as it required extra preparation and NHS did not reimburse for these visits. Costs to

the NHS included patient reimbursement for travel and accommodation, hospital visits, consultation time with providers, a portion of the provider fees, and providers' travel time and expenses. Indirect costs such as the value of travel time and lost leisure time, as well as fixed costs of telemedicine equipment and telecommunication connections, were also factored into the analysis. The final result for the Orkney Islands patients was that teledentisry visits cost NHS an additional £36 per patient compared with outreach visits, but saved £270 over hospital visits. For the Scottish Highlands patients, telemedicine cost an additional £44 over outreach visits but saved £1.54 compared with hospital visits. The researchers concluded that teledentistry costs would likely decline as providers became more familiar and comfortable with the use of the equipment; they also stated that savings for teledentistry would be highest among patients in remote communities where travel costs would be most significant. Concerns about such methods of studying telemedicine projects, though, could be raised by other researchers questioning the cost estimates used to produce these results. It is possible that the same basic set of "hard" cost data could be shown to favor telemedicine or traditional healthcare depending on the values of estimates of "softer" data in the analysis.

Research into the costs of telemedicine services has received significant criticism. Whitten et al. (2000) conducted a meta-analysis of telemedicine cost research and came to a very negative conclusion about such work. Criticisms included: a frequent lack of real, quantitative data (only 38 of 551 articles included such data); frequent omissions of the number of patients or

consultations conducted through the course of the study; lack of longitudinal data collection; and lack of uniformity in cost analysis. This is ten years after Luce and Elixhauser (1990) recognized the problem of estimating costs of technology in healthcare and provided a listing of specific cost elements that should be considered in such research, as well as processes for identifying and estimating costs. Other recent work has further critiqued the effectiveness of cost analysis studies in telemedicine (Whitten et al., 2002).

While research into the costs of telemedicine systems has certainly been a vibrant area of research, it is not without weaknesses or criticism. This particular research looks to investigate cost issues using the theoretical lens provided by Markus' critical mass theory (1987); critical mass theory extends more traditional diffusion theory by accounting for the fact that some technologies involve adopter interdependencies and network effects. Given a telemedicine application such as videoconferencing, these adopter interdependencies can matter a great deal – a critical number of users can tip a system toward making financial sense. Specific aspects of critical mass theory relevant to this study of costs in telemedicine include adopter expectations and sponsorship. Adopter expectations look at the view potential adopters hold that a technology will or will not be widely adopted; such expectations can be affected by sponsorship, with a sponsor coordinating early efforts at adoption and even subsidizing adoption efforts (Katz & Shapiro, 1986). Critical mass theory is thus a useful theoretical framework for studying the effective implementation and adoption of telemedicine

technology, as such systems evolve from pilot research projects to financially viable methods of delivering healthcare.

Research into the costs of telemedicine systems has been beset with issues – a significant amount of the results could be thought to be dependent on the assumptions and estimates of the researcher, a problem exacerbated by the small number of studies built on hard data. As a result of this, this research looked to take a different approach to looking at telemedicine systems – what strategies can be taken to help a research project successfully move from grant-funded research to viable healthcare service with critical mass theory providing a theoretical viewpoint. This chapter moves forward with a discussion of the research questions this project was intended to address.

Research Questions

This research was meant to address three primary issues, so the research questions for this project fall into three broad categories: (1) the relationship between a healthcare provider and its technology vendor, (2) administrative issues in telemedicine deployment, and (3) cost issues as telemedicine projects seek to achieve financial viability. Each set of questions is discussed in detail below.

Vendor Issues in Telemedicine

Focusing on the interaction between a healthcare organization and a technology vendor, it is clear that this is a complicated relationship which begins before a contract is ever signed and likely could last long after a system is technically operational. Despite the tremendous importance of this relationship

to the success of a telemedicine research project, little attention has been paid to the evolution of this relationship. The first research question proposed by this research is:

> *RQ1a: How does the relationship between a healthcare organization and a technology vendor evolve from the pre-contract stage through system implementation and beyond?*

Investigation of the evolution of this relationship over time can provide valuable information about how this relationship progresses. Further, adequately investigating the development of this partnership provides the proper background and makes it possible to delve more deeply into this relationship.

A second significant question to be addressed in this study is what can be done by healthcare organizations to cope with the information asymmetries in partnering with an external vendor in the provision of telecommunication technologies and services. As technology becomes more complex it will become an even more challenging prospect for healthcare organizations to monitor the performance of a technology vendor. Proper contractual mechanisms will need to be constructed to create the appropriate incentives to ensure technology vendors perform in the most efficient manner possible on behalf of the healthcare organization. The research question becomes:

> *RQ1b: What kind of governance mechanisms can help ensure technology vendors perform effectively in the provision of telecommunication technology and services to healthcare organizations?*

Investigating the relationship between the MSU research team, along with its partner nursing homes, and SBC will help uncover possible contractual

mechanisms that could have been put in place to make this relationship more productive and less complex. Answering this research question effectively will also help provide useful guidance for other healthcare organizations looking to contract with an outside vendor in the provision of telemedicine services.

Answering these two research questions regarding vendor partnership issues is important for several key reasons. First, a good description of how this process takes place will help healthcare organizations understand what such a partnership entails, to adequately prepare for such an endeavor. Second, insights garnered from looking at this inter-organizational interaction through the TCE lens will point to possible governance mechanisms – contractual or otherwise – that can ensure the telemedicine vendor acts responsibly. Investigating issues surrounding the healthcare provider-telemedicine vendor relationship is important to helping telemedicine projects succeed, and answers to these questions will help increase knowledge about the issue.

Administrative Issues

Shifting to administrative issues in telemedicine projects, it makes sense to begin with a logical first step – that most researchers intending to implement a telemedicine system would take time to plan the endeavor. It is important to learn more about what steps taken during the initial planning stage of a telemedicine system that can help lead to system success further down the road. As a corollary to this, it is important to get a good grasp on who should be involved in the planning process. The first research questions are thus:

> *RQ2a: What are key steps to be taken in the planning phase of a telemedicine system?*

RQ2b: What individuals should be involved in the planning process?

The importance of these research questions cannot be overlooked, as inadequate planning in the earliest stages of implementing a telemedicine system can create future problems that might not be overcome. As such, the proper administration of a telemedicine system begins before technology is even purchased. It is also important to highlight the relationship between these two issues, as effectively thinking about the telemedicine system and all its implications will be much more challenging if administrators do not talk to all relevant stakeholders.

A great number of telemedicine systems are meant from the start to operate at a number of different facilities. Operating a multi-site telemedicine system can present a unique set of challenges. The next research question focuses on special issues related to operating a multi-site telemedicine system:

RQ2c: What factors contributed to the success of a multi-site telemedicine system?

This research question has two primary aims. The first is to uncover issues specific to multi-site projects during the planning, installation, and initial implementation of the telemedicine system. The second is to look at other issues that arise as a system begins to grow to new sites.

Once a new telemedicine system is up and running in a consistent manner, both technically and within the organization in which it operates, it is important that it continues this smooth operation. This goes back to the fact that

the actual adoption of telemedicine systems tends to be quite poor (Grigsby et al., 2002). A final research question for this case becomes:

> *RQ2d: What contributed to the complete adoption and continued operation of a telemedicine system beyond the initial research phase of operation?*

While a great deal can be learned from the research phase of a telemedicine system, seeing telemedicine become a permanent component of healthcare delivery should be a more significant goal of telemedicine researchers. As such, answering this question can provide important lessons for what can be done to help users fully embrace and adopt a telemedicine system and continue operation once research is complete.

Answering these research questions will help researchers appropriately handle issues related to the administration of telemedicine systems, from planning the implementation to ongoing management of the system's operation. A particular focus on issues arising related to multi-site projects, and strategies for handling these issues, is important given the prevalence of multi-site telemedicine applications. Adequately addressing the issues raised by these research questions will provide new guidance and strategies for success to be used by telemedicine researchers and practitioners bringing multi-site telemedicine systems online.

Cost Issues

Moving to the third topic to be covered, cost issues in telemedicine projects, research has shown that formal business plans and analysis of needs that could be served by a telemedicine system are factors that can help

telemedicine projects succeed (Effertz, Beffort, Preston, Pullara, & Alverson, 2004; P. Jennett, Yeo, Pauls, & Graham, 2003). Further investigation into formal business plans and any sort of cost-benefit analysis that could contribute to long-term success would be key to helping others replicate the success of a successful telemedicine project. The first research question is thus:

> *RQ3a: What aspects of pre-project planning focused on costs long-term financial viability of a successful telemedicine project?*

Successfully answering this question will provide guidance for other researchers and healthcare organizations looking to build the foundation of a large scale telemedicine network.

As important as proper planning is before rolling out a major telemedicine system, ongoing monitoring of costs can provide important information for administrators and providers in the benefits – or lack of benefits – of the telemedicine system. The second research question becomes:

> *RQ3b: What ongoing monitoring of costs guide decision making and operation of a successful telemedicine system?*

Continuous tracking of costs could help administrators monitor the progress of a telemedicine network and look for aspects of it that are particularly efficient when compared to traditional healthcare delivery, as well as identify weak services within the network that might not be justifiable in the long term. Successful strategies for tracking such costs could help provide others managing telemedicine networks additional tools to ensuring the long term financial health of their own systems.

Finally, effectively tying telemedicine to the strategic plans of a healthcare organization can help provide focus for telemedicine efforts and ensure such systems are not just an add-on or afterthought to traditional healthcare delivery. The third research question, focusing on how telemedicine ties into the strategic plans of a healthcare organization, is:

> *RQ3c: How are telemedicine services tied into the economic and strategic goals of a healthcare organization?*

Successfully answering this question will provide information about how a healthcare organization might view telemedicine as a tool to achieve its economic and strategic goals. Effective strategies on the part of a successful healthcare organization to integrate telemedicine into its strategic planning could be replicated by other healthcare organizations implementing telemedicine technology, easing the process of leveraging the potential benefits of telemedicine to reach organizational goals.

Answering these three questions will provide a great deal of information about costs and how a healthcare organization planned for the costs of a telemedicine system, continues to track costs and benefits, and the role the telemedicine system plays in its long-term, strategic planning. These answers will help other organizations replicate the success of a healthcare organization that has successfully moved its telemedicine system from grant-supported research project to necessary and cost-effective means of providing healthcare.

Summary

Telemedicine research has enjoyed over forty years of growth and success. Over time the technology used to provide remote healthcare services has advanced significantly, enabling the spread of telemedicine into a growing number of medical applications. Three specific issues requiring more significant attention were described, and the research questions meant to guide investigation into these topics discussed. This work continues with Chapter 3, focusing on the methods used in conducting this research.

III. METHODOLOGY

Case study research conducted in an appropriate manner can be a powerful tool to help researchers learn more about the phenomena in which they are interested. This section includes an overview of the importance of case study research in the social sciences, specific examples of case study research in telemedicine, and a general overview of proper case study research methods employed in this research.

Case Studies in the Social Sciences

Case studies have long been a popular method in the social sciences. In his *Applications of Case Study Research*, Yin states that the case study method is useful when:

> "investigators either desire or are forced by circumstances (a) to define research topics broadly and not narrowly, (b) to cover contextual or complex multivariate conditions and not just isolated variables, and (c) to rely on multiple and not singular sources of evidence." (Yin, 2003a, p. xi)

This certainly serves as a good description of much social science research, particularly when researchers want to investigate complex phenomena in organizations where the interactions among different individuals, groups, and technology cannot be boiled down into something simple that can be assessed using a survey.

Case study research was initially associated more as a tool for evaluation, to document and analyze implementation processes; over time its value as a method of investigating outcomes of programs – particularly those sponsored by federal agencies or private foundations – has become more evident (Yin, 2003a).

In *Applications of Case Study Research* Yin provides a number of examples of case study research used to evaluate programs from education, to local economic development, to job training, to substance abuse prevention. A more varied sample of case studies are provided in *The Case Study Anthology*, including a mass vaccination of the American public in the 1970s, the emergence of social class in American society in a New England city, the operation of the Head Start preschool program, and nuclear confrontation during the Cuban Missile Crisis (Yin, 2004).

Case studies have a strong tradition in the communication field, as well, particularly in organizational communication. In *Case Studies in Organizational Communication*, Sypher (1990) offered twenty case studies covering the broad topics of organizational culture, the interaction between individuals and the organization, issues of powers and ethics, managerial communication, communication and organizational change, and communication and new technology. A second book from Sypher (1997) focused on contemporary work life, from conflict and communication in a R&D unit to control in self-managing teams. Sypher's collections are excellent examples of the flexibility of the case study method, with researchers successfully using the case study method to investigate a host of issues.

The social sciences have made great use of case study research as a method, to the benefit of many different fields. The next section provides examples of case study research in telemedicine, conducted all over the world investigating many different types of telemedicine systems and issues.

Case Studies in Telemedicine Research

Apart from the general popularity of case studies in the social sciences, case study research has a proven track record in telemedicine research. Telemedicine, with its typical focus on implementing a particular technology in an organization (or group of organizations), is particularly well-suited to case study research as an effective methodology. An entire volume of case studies in telemedicine research, *Understanding Health Communication Technologies*, points to the value of this method of studying telemedicine applications (Whitten & Cook, 2004).

A first example of such work is research into the apparent failure of a teledermatology system in the United Kingdom (May, Mort, Finch, & Mair, 2004). This particular case study looks at the evolution of a teledermatology project as it went through numerous phases – from an experimental service to a clinical trial to an actual service offered to patients requiring dermatology services. The researchers discuss each phase of the project in detail, explaining the rationale for each piece of the study and providing in-depth quotations interviews with providers to support their observations. This case is particularly useful for two reasons. First, it is an exploration of what at first glance is a failure, nothing that "champions of telecare celebrate success, but it is equally important to understand failure" (May, Mort, Finch, & Mair, 2004, p. 86). More importantly, though, the case study approach here allowed the researchers to show how this service could reasonably be considered a success; while teledermatology never caught on as a regular service, it did help solve a structural problem in the

delivery of dermatology care and drastically reduced the time patients spent on waiting lists for a consultation.

Another good example of case study research into the challenges of implementing telemedicine systems looks at the Shriners Hospitals for Children (SHC) system (Niederpruem et al., 2004). SHC facilities are spread all over the United States and the world, resulting in an assortment of challenges and opportunities for telemedicine systems. From looking at this collection of facilities researchers were able to focus on some general lessons that were consistent across contexts – the importance of having trained and competent individuals to support patients in the use of telemedicine, the importance of organizational support, and general patient satisfaction. One advantage of studying a telemedicine program across such a broad selection of sites is the ability to focus on important lessons that might not be seen through a single-site study, such as the importance of establishing technological standards early in the process to keep all sites working together. This work with SHC is a good example of how a case study looking at multiple sites can begin to help researchers learn more about what matters, or does not matter, as the context of telemedicine implementation changes.

Wooton and Tahir (2004) investigated issues surrounding the start of a pilot telemedicine system in Malaysia. A detailed study of this 41-site pilot project results in a number of reasons that this particular telemedicine consultation network failed – mismatched referral patterns between the telemedicine system and traditional care, turnover in telemedicine coordinators,

poor network reliability and bandwidth, and poor promotion and management of the changes associated with implementing this telemedicine network. One final conclusion of this study is that a smaller number of sites would likely have made the overall success of the project more likely, easing the process of making sure the system was technically and organizationally capable of proper operation. This particular case study is a good example of how a failed system or application can result in valuable knowledge that can help others avoid making the same mistakes in bringing new telemedicine systems online.

Tucker and Carlson (2004) provide an insightful examination of the Veterans Affairs Medical Center's implementation of a point-of-care system to reduce medication errors. This Bar Code Medication Administration (BCMA) system was an ambitious project rolled out in 173 medical centers in the United States. This case study discusses the reasons for implementation of the BCMA, but focuses primarily on key steps that helped the system succeed – choosing appropriate technology that met users' needs, focusing on user acceptance of the technology and the reasons for implementing the BCMA, and creating collaborative teams from different units within the VA to design the system. A great strength of this particular case study is its focus on the human side of system adoption, something that is too-easily overlooked when installing new technology in an organization.

A search of the online bibliographic database of the Telemedicine Information Exchange for telemedicine case studies returns hundreds of results (Telemedicine Research Center, 2005). Researchers have used the case study

approach to investigate how telemedicine can improve mental health services in rural areas (Bischoff, Hollist, Smith, & Flack, 2004), how videoconferencing can bring hospital-bound children into their classrooms (Fels & Weiss, 2001), look at how telehealth can be used to improve chronic wound care (Visco et al., 2001), how computer supported cooperative work affected consultations (Monk & Watts, 1999), and how teleradiology services are perceived in a rural hospital (Franken, Whitten, & Smith, 1996). This is just to name a few, as the list of possible applications of case studies in telemedicine research is almost endless.

The case study method has certainly proven its value in telemedicine research, and likely will continue to be a staple in the field for some time. As stated in Whitten and Cook's (2004, p. xiv) collection of telemedicine case studies, "case studies enable us to address contemporary problems and challenges within one context that have transferable relevance to other settings." What is learned in one telemedicine case study can be applied to other cases, so long as researchers put in proper thought about what differences might result from changing contexts. To make use of the explanatory power of case study research, though, it is important to focus on proper methods when conducting a case study and ensure that quality research occurs. The next section outlines some of the key points to be considered when undertaking case study research.

Case Study Methodology: Effective Strategies, Validity, and Reliability

One aspect of case study research that may have held it back was the lack of an established guide to doing case study work. The publication of Yin's *Case Study Research: Design and Methods* in 1984 addressed that hole. Yin

(2003b, p. 3) criticized existing texts that "offer few guides on how to start a case study, analyze the data, or even minimize the problems of composing the case study report." His handbook of case study research emphasizes a variety of important steps in the proper completion of field studies – designing case studies, preparing for data collection, actually collecting the data, analyzing evidence, and reporting on case study results. Each of these steps is described in detail below.

While it is possible to attempt to just jump directly into case study research, Yin focuses on the importance of proper planning in conducting a case study (2003b, Chapter 2). One important part of conducting case study research is to focus on the research questions to be addressed by the project. This project consists of three individual cases, each designed to answer different research questions. The statement of these research questions, guided by previous research in the field, helps the individual cases maintain focus on the relevant issues to be studied. It is also important to be clear about the unit of analysis in case study research, as it prevents researchers from trying to explain anything and everything they discover through the process of data collection. In each of the three cases that comprise this work, the unit of analysis is a specific telemedicine system. Finally, it is of particular importance in thinking of the design of a research project how the data will be linked to answering the study's primary questions. One of the most common ways of doing this is the "pattern matching" strategy discussed by Donald Campbell (1975), which focuses on the collection of information from multiple sources which can then be linked to some

theoretical proposition or prior research that guides the research. This is why the inclusion of theory and previous research in the design of a case study is important, as it helps researchers focus on relevant data to be collected and how it might relate to the study's primary research questions. For this reason relevant research was reviewed in the design of each case in this proposed research.

Another important step that is key to the success of a case study project is an effective plan for data collection, something which many researchers simply forgo in favor of beginning to collect data without a clear plan in mind (Yin, 2003b, Chapter 3). The most significant point here is that researchers should not just jump directly into data collection with no plan. Instead, it is important to think about all the possible sources of data for a case study – archival records, notes from meetings, memos, interviews with key individuals involved with the case, etc. – and what might be done to access as many possible sources of information as possible. Having a formal plan for data to be collected helps ensure multiple sources will be investigated and that these different sources will help establish a pattern of data to answer a project's research questions.

Actually collecting the data is what researchers tend to think of first when planning a case study. Yin focuses on six sources of data and three principles of data collection that researchers should keep in mind when conducting a case study (2003b, Chapter 4). The six sources of evidence are documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts. Each of these sources of evidence has various strengths and weaknesses, when they are relevant or available at all. Three principles of data

collection help provide some overall guidance in collecting data: (1) using multiple sources of evidence, to allow for data triangulation; (2) creating a case study database, to allow for the collection of evidence in a single place to ease analysis and maintain organization; and (3) maintaining a chain of evidence that makes it possible for a reader to follow the researcher's process from data collection to data analysis to final conclusions. Three good examples of providing that chain of evidence and logic include studies of town meetings to encourage action against drug dealing, interagency collaboration in the reduction of boating-while-intoxicated incidents, and a designated driver program described in *Applications of Case Study Research* (Yin, 2003a, Chapter 5).

Once data have been collected, a proven strategy for organizing and analyzing the data is essential (Yin, 2003b, Chapter 5). Three general strategies for analyzing data include relying on theoretical propositions, thinking about rival explanations, and developing a case description. This research makes use of all three methods of analyzing the data, applying the proper strategy to address each research question.

Researchers, no matter the method selected to conduct their investigations, must ensure validity and reliability in their work. Case studies address these topics largely through the (1) the collection of data from a variety of sources and (2) explicit description of the methods used in collecting, organizing, and analyzing data so that other researchers could replicate a case study to arrive at the same conclusions (Yin, 2003b, Chapter 2). As such, an effective case study collects data from different types of sources to improve

validity and offers explicit descriptions of the process of data collection and analysis to ensure reliability of the results.

The previous discussion highlights some of the most important points in conducting rigorous, productive case study research. Such attention to detail helps ensure that case study research is effective and can withstand the criticism of researchers that do not fully understand what it is to conduct formal case study research.

Data Collection and Analysis

This research was interested in three primary issues – the relationship between a healthcare provider and its telemedicine technology vendor, administrative issues in the planning and management of a multi-site telemedicine system, and cost issues in achieving the financial viability of a telemedicine project. These issues, like so many others that telemedicine researchers are interested in, are not mutually exclusive. To properly investigate these issues, three telemedicine projects were selected for study. Each case was selected as a particularly exemplary or illustrative case for the specific issue to be studied, with a recognition that other issues are certainly at play. The three cases selected were:

- **Michigan State University Nursing Home Videoconferencing Project:** Researchers at Michigan State University (MSU) partnered with four rural nursing homes to establish a videoconferencing network to help bring clinical consultations from urban specialists directly to the bedside of nursing home residents.

MSU contracted with SBC to provide the hardware and telecommunication services required for this telemedicine application. The evolution of this project from the earliest stages of pre-grant logistics to current status of the system served as an ideal case to study the relationship between a healthcare provider and a telemedicine technology vendor. Subjects for this case were recruited through the author's affiliation with the project. Participants included members of the MSU research team (N=4), nursing home staff (N=3), and SBC employees (N=5). Archival records of the project's history – responses to the project's request for proposals (RFP), e-mails, and meeting notes – were also reviewed as an alternative source of data to the personal interviews conducted. The MSU-SBC case was selected for this project in part because such a partnership is extremely common in telemedicine research, as researchers must partner with technology vendors to implement telemedicine systems; further, problems that occurred during the course of this project make it a particularly useful case to identify issues that arise in such partnerships and determine methods of avoiding such problems in future projects.

- **TeleKidcare:** Researchers from the Kansas University Medical Center's (KUMC) Center for Telemedicine and Telehealth (CTT) established a system to bring acute care consults into Kansas

elementary schools via telemedicine technology. The TeleKidcare project evolved from four pilot sites to its current operation in 31 schools. Investigating how the TeleKidcare team effectively planned the system and managed its growth is a useful case to learn more about what administrators can do to ensure the success of a multi-site telemedicine system. Subjects were recruited through contact with the KUMC CTT manager, and included KUMC administrators (N=5), KUMC providers (N=6), and school nurses (N=12). TeleKidcare project documentation – training manuals, reports, brochures, and reports – were also analyzed as a secondary source of evidence to support the results of the personal interviews. The TeleKidcare case was selected for this project due in part to its structure, as many telemedicine projects are designed to be large, multi-site applications. Additionally, the TeleKidcare project has moved beyond the research phase of operation to successful adoption and sustained usage, something that is relatively rare in telemedicine research. These two factors make TeleKidcare an exemplary case to investigate administrative and management strategies that contribute to the success of such telemedicine projects.

- **Upper Peninsula Telehealth Network:** The Upper Peninsula Telehealth Network (UPTN) is a telemedicine and telehealth network managed by Marquette General Health System (MGHS) in

the Upper Peninsula (UP) of Michigan. The UPTN was established as a research project and supported through grant funds, but has continued to grow and maintain financial viability beyond the research and grant phase of the project. As such, it is a relatively unique and useful case to learn more about how telemedicine projects can succeed as cost-effective methods of providing healthcare. Subjects were recruited through a UPTN coordinator, and included MGHS/UPTN administrators (N=6), providers using the service (N=3), spoke site telemedicine coordinators (N=4), and a spoke site administrator (N=1). Secondary sources of data collected for this case include grant proposals, internal MGHS documents regarding strategic goals and the UPTN, and the UPTN website. The UPTN was selected as a case for this project because of its success in achieving continued growth and financial viability. Since so few telemedicine projects reach such financial viability, study of the UPTN's strategies for achieving success can provide insight into what it has accomplished and provide important knowledge for others looking to replicate its success.

Further details regarding each case are provided in Chapter 4, to provide adequate background for understanding the results and implications of each project.

The primary method of data collection for each case was semi-structured personal interviews. Interviews were customized for a variety of positions

involved with each project, to properly tailor the questions based on the different roles in each project that subjects filled; these interview guides are included as Appendices A-K. Supplementary data was collected in the form of documentation related to these projects – e-mails, grant applications, journal articles, training manuals, strategic plans, etc. This supplementary data served as corroboration for the interviews, working to establish validity in the case studies' outcomes.

Aspects of this research will also come from the personal experience of the author working as a research assistant on one of the projects selected as a case. Baskerville and Myers (2004) describe action research and its benefits in the foreword for a special issue of *MIS Quarterly* dedicated to the practice of action research in the IS discipline. Action research involves a researcher actively taking part in the process of organizational change, in stark contrast to traditional common methods where researchers seek to observe organizational phenomena without changing the organization; in this way an action researcher is actively involved with the participants in the research, seeking to achieve effective organizational change through collaboration among researchers and subjects. Examples of IS action research presented in this special issue of *MIS Quarterly* include achieving sustainable health information systems across developing countries (Braa, Monteiro, & Sahay, 2004) and the process of introducing a new technology to monitor physicians' performance in the provision of healthcare (Kohli & Kettinger, 2004). In the case of this research, the author worked on the MSU side of the project to bring wireless videoconferencing

directly to the beds of nursing home residents. A benefit of action research is the extra insight gained by the researcher as an active participant in the project, in contrast to a more distant outside observer.

Data analysis was conducted first by analyzing the primary data source, personal interviews conducted with individuals involved in each of the cases. A thematic content analysis began by reading through these interviews to identify underlying themes behind their responses and order them into a thematic conceptual matrix, as described by Miles and Huberman (1994). This conceptual matrix identifies the primary themes, ties these themes back to any relevant theory, and can provide examples of the themes in the interviews. The conceptual matrices for these three cases are included as Appendices L-N.

Once the most prominent and common themes were identified, individual interview transcripts for a sub-sample of 10 transcripts were independently coded for the presence or absence of these themes by two coders. Intercoder reliability was calculated using Scott's pi; values of Scott's pi greater than .80 are considered acceptable for most situations (Lombard, Snyder-Duch, & Bracken, 2005). Table 1 reports the values of Scott's pi for each case in this research.

Table 1: Intercoder Reliabilities by Case

Case	Scott's pi
MSU-SBC Partnership	.83
TeleKidcare	.88
UPTN	.79

Achieving proper levels of intercoder reliability is important in such work, as it is an indication of "the extent to which the different judges tend to assign exactly the same rating to each object" (Tinsley & Weiss, 2000, p. 98). This is

important, given the importance Yin (2003b) puts on reliability, the fact that other researchers could reach the same set of conclusions for that case.

Secondary sources of data – e-mails, grant applications, journal articles, training manuals, strategic plans, etc. – were used to corroborate the results of the interview analysis. This is a particularly important step, given the importance Yin (2003b) places on validity in case study research; use of secondary sources of data provides a check on validity, with confirmation coming from a different type of evidence. These secondary sources of data were viewed using the same thematic content analysis strategy used on the personal interview data, comparing these sources of data – where appropriate – to the relevant thematic conceptual matrix. Further, the personal experience of the author as an action researcher involved with the nursing home videoconferencing project could provide another check on validity for that case. These secondary sources of data, and the personal experiences of the author, were considered in light of the thematic conceptual matrix – both to ensure that significant themes were not missed, and that evidence of those primary themes could be found in these other sources of data.

Data for all three cases were collected in a similar manner – primary interviews conducted via telephone, secondary sources of data provided by individuals involved in each of the cases – and analyzed using an explicit set of procedures to ensure adequate validity and reliability in this case study research. Best practices like achieving intercoder reliability and using multiples sources of data ensure the academic rigor of case study research.

Conclusion

Case study research has a proven track record of success in the social sciences, and in telemedicine research specifically. As case studies have evolved, more formal guides and procedures for conducting and reporting this type of research been established. Proven strategies for achieving validity and reliability in case study research improve the case study method, and the results and conclusions that can be drawn from this sort of investigation.

This particular research was conducted using three case studies, each focusing on one of the particular points of emphasis of this research. It is certainly the case that these particular issues cannot be studied in a vacuum in these organizations – these issues, and others, are certainly not mutually exclusive. But in each case the organization and context selected is a particularly illustrative example, and thus ideal for studying the issue at hand. The next chapter continues with a report of the results from these three case studies.

IV. RESULTS

Having already discussed the literature relevant to this project, the case study method in general, and the specific sources of data collection and analysis for this project, this chapter continues with a report of the results for each of the three cases that comprise this work. The report for each case includes general background information about the project of interest and the results for the case. This chapter concludes with a discussion of results and outcomes that cut across multiple cases.

Case 1: Wireless Videoconferencing to the Bedside of Nursing Home Residents: A Study of Vendor Issues in the MSU-SBC Partnership

The case focusing on the relationship between a healthcare provider and a technology vendor looked at the partnership between MSU researchers with SBC. The intent of this project was to provide videoconferencing services directly to the beds of nursing home residents for the purposes of providing remote clinical consultations. This section continues with the background for this case and a report of the case study's results.

Program Overview

This research project began on April 23, 2003, when the MSU research team applied to the Department of Commerce's Technology Opportunities Program (TOP) to receive funding to implement a telemedicine system at nursing homes in Michigan. The specific goal of the project was to bring the expertise of urban specialists into rural nursing homes through videoconferencing services. The videoconferencing services for this project were to be delivered directly to residents' bedsides on Tablet PCs working over a wireless network installed in

each nursing home for the exclusive use of this telemedicine system. This system would have two primary benefits in bringing such specialist services into these rural nursing homes. One would be improved convenience, eliminating the need to transport nursing home residents to distant hospitals, or even special videoconferencing rooms within their nursing homes. The second benefit was the use of a wireless network to provide the videoconferencing services, which could be more cheaply and quickly deployed than a traditional wired network into all residents' rooms.

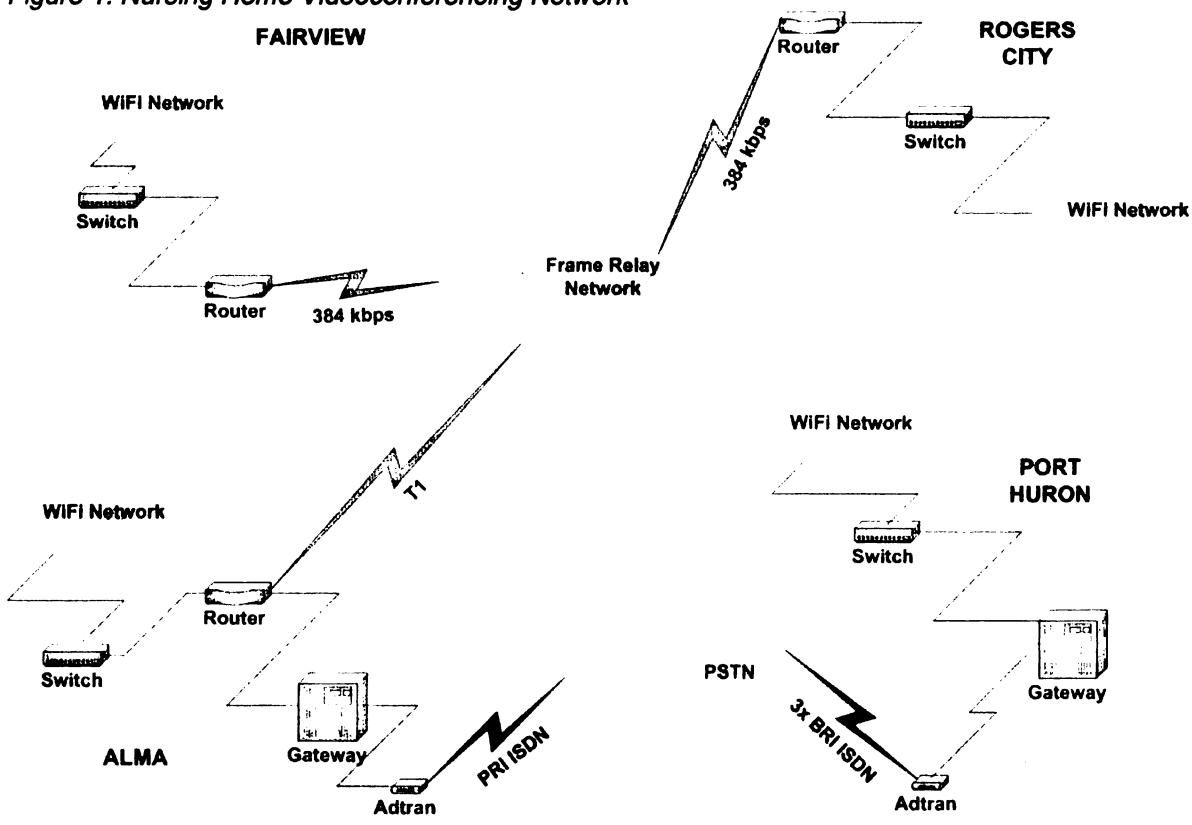
The project was intended to investigate three primary research interests, including access to clinical services and medical outcomes, cost issues related to the ongoing provision of these services, and the satisfaction of providers and patients of the service. The MSU research team organized four nursing homes to take part in the project. Three of these nursing homes – Marwood Manor in Port Huron, Tendercare in Rogers City, and AuSable Valley in Fairview – were intended to be recipients of these videoconferencing services. The fourth nursing home – Masonic Pathways in Alma – is a teaching nursing home that was meant to both provide some specialist services to the other nursing homes and receive other specialist services not available within the facility.

The MSU research team's grant proposal was accepted on August 24, 2003, with the project set to formally run from October 31, 2003, to March 31, 2006. The MSU research team began its search for a technology partner to provide the telecommunication and videoconferencing services for the project, putting out a request for proposal (RFP). Several vendors answered the RFP,

including ACD.net and SBC. After reviewing submissions, SBC was selected as the technology vendor for the project based primarily on their position to provide a turnkey solution – providing everything from telecommunication services to the videoconferencing system sitting on top of the telecommunication network.

The original plan was to have the entire operate via ISDN services provided to each nursing home, based on an original claim from SBC that it could provide ISDN services to all four project sites. In reality SBC could not provide ISDN services to all sites, and was not even the local phone service provider for three of the nursing homes. SBC engineers arrived at a creative network design that would get around these problems and a complete lack of ISDN service at two of the sites. The downside of this network configuration was a more complex system with more points of failure. The network diagram is outlined in Figure 1.

Figure 1: Nursing Home Videoconferencing Network



The MSU team worked with SBC project leaders and engineers to discuss how the system would work and timelines for installation and testing of the system. More than two years after these initial meetings, the videoconferencing network for this project does not function properly. A quick summary of the status of each project site as of April 2006 highlights persistent troubles:

- **Marwood Manor.** This nursing home was the most active project site. Activities with Marwood Manor included weekly Virtual Clinics with a geriatric nurse practitioner and a nutritionist offering services to Marwood residents, a continuing education event put on by MSU for Marwood staff, and a demonstration of the system for a committee of resident advocates. A more effective rollout of services at Marwood was hindered by inadequate wireless coverage that made it difficult to provide videoconferencing services directly to residents' rooms. More often than not residents had to be moved to offices and other rooms known to receive a good enough wireless signal to conduct videoconferences. Continued troubles with the wireless network at Marwood, as well as its ISDN line, eventually brought an end to services at the facility.
- **AuSable Valley.** AuSable Valley was occasionally able to videoconference with Masonic Pathways, though such connections have been fleeting and inconsistent; AuSable Valley was never able to complete a videoconference with a site external to the frame

relay network. It is unclear whether continued troubles at AuSable Valley were the result of troubles with the frame relay network connecting AuSable Valley to Masonic Pathways or something with the gatekeeper at Masonic Pathways not properly registering AuSable Valley's Tablet PCs onto the videoconferencing network.

- **Tendercare.** Tendercare was never able to complete a videoconference, either on the frame relay network or with an external site. It is unclear whether this was a result of troubles with the frame relay network connecting Tendercare and Masonic Pathways, the gatekeeper at Masonic Pathways not registering Tendercare's Tablet PCs onto the videoconferencing network, or wireless network issues at Tendercare.
- **Masonic Pathways.** Masonic Pathways was initially intended to be a provider of services to other nursing homes involved with the project. The fleeting connection with AuSable Valley and complete lack of contact with Tendercare made this virtually impossible. Masonic Pathways completed several videoconferences with Marwood before Marwood's system went offline.

Through the summer of 2005, the MSU research team worked to engage SBC in the creation of a formal, final plan to address all troubles related to the proper operation of this videoconferencing network. The result of this work was a plan that involved establishing remote access to the project's hardware at Masonic Pathways and Marwood Manor, an agreement to send technicians to all

project sites simultaneously to troubleshoot the system, and further evaluation of the wireless network at each facility. A checklist of work to be done for this work to be considered a success was agreed to by MSU and SBC representatives.

One of the final hurdles regarding this work to get the system fixed related to funding this second round of troubleshooting. SBC worked to receive funding through an internal SBC grant program to finance this work, but the process of applying for the grant and its processing within SBC was a time-consuming endeavor. SBC provided a timeline for the work to be completed, dependent on the final processing of funding from the internal grant. When that grant money came through, and with the installation of the DSL lines meant to provide remote access to the network, work to get the system running again was set to begin in May 2006.

Having provided this general overview of the effort to bring wireless videoconferencing into rural nursing homes, it is possible to report the case study's findings.

Findings

Investigation into this case was driven primarily by two primary interests – to achieve a greater understanding of the evolution of the partnership between a healthcare provider and its telemedicine technology vendor, as well as what sorts of governance mechanisms could ensure that such partnerships operate efficiently. Data collected for this project addressed both of these issues, while also generating other unexpected insights.

Evolution of the MSU-SBC Partnership

To address the first issue, the relationship between the healthcare provider (MSU and its nursing home partners, in this case) and SBC went through several distinct phases during the early stages of the : (1) pre-grant work, (2) the RFP process and vendor selection, (3) pre-installation planning, and (4) installation and troubleshooting. These are stages that could be illustrative of many telemedicine implementations involving the partnering of a healthcare provider and a technology vendor, though the extended nature of the troubleshooting process in this case could hopefully be avoided in future efforts of this nature.

The relationship between MSU and SBC truly began before the grant proposal was even submitted to TOP. Researchers from MSU, having had a successful relationship with SBC in previous telemedicine projects, suspected that SBC would be a likely player in the bids for this work. Even if SBC was not selected as the vendor to provide the hardware and software used in this system, given its status as the local phone service provider for the majority of Michigan it seemed likely that SBC would at least be the provider of the telecommunication services required by the project. To ensure that the project as envisioned would be feasible from a telecommunication standpoint, MSU contacted SBC about the availability of ISDN services to the four nursing homes to be involved in the project. SBC confirmed that it could provide ISDN services to those locations, as well as providing a rough estimate of what those services would cost; that information was requested for the purposes of building the project's budget. While its role in the pre-grant process was relatively minimal, such involvement is

something SBC seeks to participate in when possible. As one SBC representative stated:

> *I know _____ was very involved even before the proposal came out. And I know his intention, which is often the case is that we try to engage ourselves within the planning process.*

At this point the MSU team submitted its grant proposal to TOP. Upon receipt of an award of the grant from TOP, the MSU team issued a RFP to invite potential vendors to bid for the contract; the RFP process took place during the fourth quarter of 2003. The RFP process used in this case was straightforward and simple, consisting of a single review of bids by interested vendors. Three vendors responded to the RFP. A submission from Control Room Technologies came in well over the budget specified in the RFP. The response from ACD.net, a local telecommunication company founded by a MSU alum, was not deemed adequate. The SBC proposal was considered the most attractive, due to a lower cost and the ability of SBC to provide a turnkey solution – it would be ultimately responsible for everything from the telecommunication lines to the hardware and software running the telemedicine system. This is not to say that the SBC bid was perfect, however. In hindsight, the nature of the SBC proposal could be viewed as foreshadowing for the troubles the project would come to encounter. From a member of the MSU research team:

> *The [SBC] response, which also was a little unorganized - I didn't like the response - I mean it was all over the place in terms of you couldn't follow it because every input... Inputs were given by all these different divisions within their company and none of them were cohesive.*

Despite this, SBC's track record of successful work on MSU telemedicine projects, as well as its specific bid for this project, made it the clear choice after the RFP process was complete. The MSU team worked to sort out the appropriate paperwork and get the contracts signed. Once the SBC was deemed the winner of the RFP process and signed the contract to begin work, the project entered the next phase – pre-installation planning.

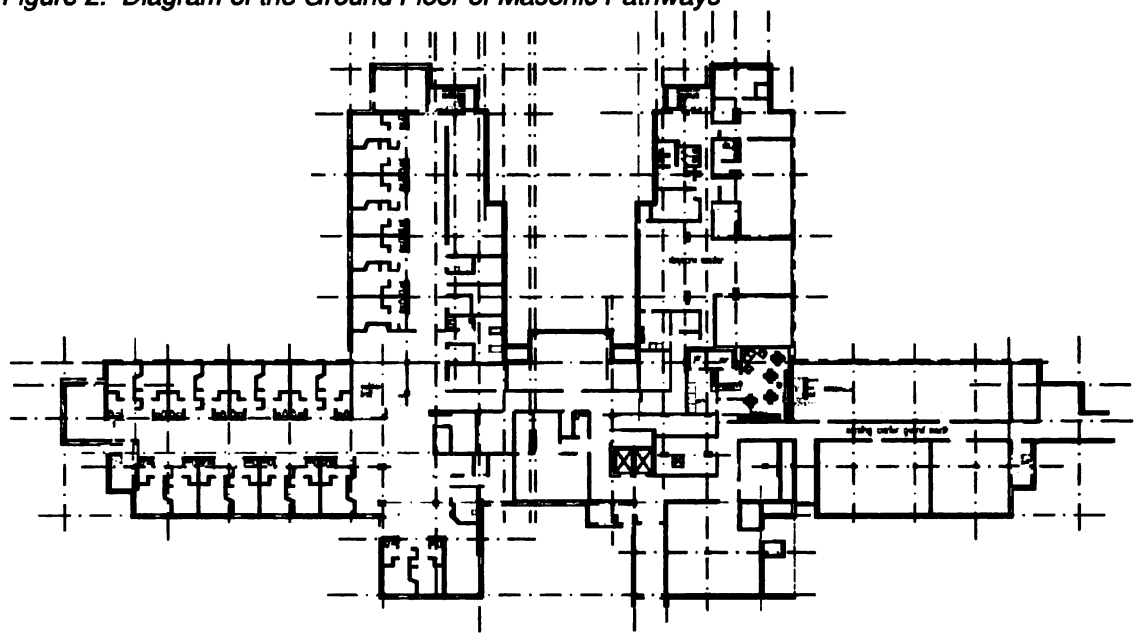
The process of pre-installation planning, which took place largely during the first quarter of 2004, involved a wide array of work. The most significant aspect of this pre-installation planning involved SBC reporting that it could not provide ISDN services to all of the project sites. While SBC could provide ISDN to Marwood Manor, the other three nursing homes were not even in SBC's local service area; Masonic Pathways, Tendercare, and AuSable Valley were all located in areas served by Verizon. Verizon was unable to provide ISDN services to the two northern sites (Tendercare and AuSable Valley), as the provision of such services in those rural areas would not be cost effective. Verizon would be able to provide ISDN services to Masonic Pathways, however. This was a serious problem for the project, as the entire budget of the project was built around ISDN lines and the hardware required to interface the wireless networks in each facility with the ISDN connection.

Recognizing the gravity of this problem, SBC assembled a team of networking engineers to develop an alternative structure for the project's network that would work within the project's telecommunication constraints and budget. The resulting network (shown earlier as Figure 1) was a great deal more

complicated than that originally envisioned. The two northern sites (Tendercare and AuSable Valley) would connect to Masonic Pathways via a frame relay network. In addition to the frame relay connections to those two nursing homes, Masonic Pathways would also have an ISDN line to provide access to external sites. When Tendercare and AuSable would require access to an external site to videoconference, they would be routed through a gateway at Masonic Pathways. In some ways this network layout was considered beneficial, as Masonic Pathways was intended to be a significant provider of services to Tendercare and AuSable; the frame relay connections operated at a fixed fee, so with this network configuration consultations could take place as frequently as necessary with no additional charges. Marwood Manor, being served by SBC, would receive ISDN services as planned and did not require any hardware or telecommunication changes.

With the revised network architecture in place, pre-installation planning shifted to the layout of wireless access points in each facility and the wiring required in each facility. The MSU team, working with staff at each nursing home, provided SBC and its engineers with floor plans of each facility. Figure 2 shows one such floor plan, the ground floor of Masonic Pathways.

Figure 2: Diagram of the Ground Floor of Masonic Pathways



SBC's engineers, working with the relevant subcontractors to be involved in the project, determined the best locations for the wireless access points (APs) and the wiring required for each facility. Equipment for the project – APs, Tablet PCs, videoconferencing equipment, and telecommunication hardware – was ordered and began to arrive at the project sites in April 2004. At this point the MSU-SBC relationship shifted to its fourth phase, that of initial installation and troubleshooting.

The initial timeline for the project, with the equipment arriving at the project sites in April 2004, was set to have the system operational by the end of May 2004. Telecommunication lines were installed in early May 2004, but delays in installing equipment held back full system implementation. This was largely due to problems having the correct Tablet PCs ordered, the original order was placed incorrectly and MSU and SBC had numerous difficulties correcting the

order to receive the proper Tablet PCs. This e-mail from the SBC project manager comments on efforts to get the proper Tablet PCs:

> *We are still awaiting the new tablet PCs from Gateway. We are calling them twice a day. As soon as I have an ETA I will pass it on. Everything else is in in terms of hardware is in.*
>
> *Mike - when you get a moment, would you mind resending the files with the site diagrams. We are positioning the Access Points so we can strategize how we will pull the CAT5e for the Ethernet. Sorry to ask for this again.*

As stated in the e-mail, SBC and its subcontractors were able to continue some of their work on the installation without the Tablet PCs, and by the end of May 2004 the APs and associated wiring were installed at the nursing homes. Given the difficulties getting the proper Tablets PCs ordered, and getting some of the routers and gateways installed, a revised timeline aimed to have the system operational by the end of June or early July 2004. This deadline was also not met, however, as June 2004 ended with SBC still working to schedule installation of various hardware at the project sites and a failure in the frame relay network.

By the end of July 2004, SBC reported that the system – with the single exception of an AP at Tendercare that was not functioning properly – was fully functional. This e-mail from an SBC subcontractor summarized status of the system:

> *1- Fairview is fully operational*
> *2- Rogers City is almost fully operational.. For some reason one of the AP's stop responding. We need to work with their local IT guy to resolve that issue.. Mostly a minor issue.*
> *3- Alma will be done once we talked to their local IT guy to put a web key to their computers.*

And yes we have done video calls.

Final configuration of the gateway at Masonic Pathways took place in early August 2004, and by the end of the month a successful training session took place at Masonic Pathways with numerous calls placed to an external videoconferencing test number. Training sessions in the last week of August 2004 at Tendercare and AuSable Valley were not so successful, however. Tablet PCs at those two sites were unable to place calls to external locations, or even Masonic Pathways on the frame relay network; one of the Tablet PCs at Tendercare was completely unusable, it could not even boot properly.

September 2004 began with troubles with the ISDN lines at Masonic Pathways and Marwood Manor, but these were addressed by SBC. The troubles encountered during the practice sessions at Tendercare and AuSable were also addressed by visits from SBC technicians to Masonic Pathways and Marwood Manor to change settings in the gateways at these facilities. They reported that this work on the gateways would make it possible for Tendercare and AuSable Valley to successfully use the system, but calls attempted at the end of the month proved this was not the case.

The fourth quarter of 2004 involved calls being placed in and out of Masonic Pathways and Marwood Manor with varying levels of success. Tendercare and AuSable Valley were still non-functional, however, and a meeting between MSU and SBC was set to devise a plan to discover the cause of problems getting Tendercare, AuSable Valley, and Masonic Pathways up and running. Marwood Manor finished the quarter with their system working properly,

even beginning to conduct visits between nursing home residents and providers at MSU.

During the first quarter of 2005, the MSU research team was conducting weekly phone calls with SBC* to troubleshoot the issues with Tendercare and AuSable Valley. Getting these problems solved was somewhat delayed as SBC worked internally to clear extra money to pay to send subcontractors back to these sites to work at the actual facilities. An e-mail from the SBC project manager described these delays:

> *My delay has been approving additional Payment for ID solutions to go back on-site to Alma for more trouble-shooting. I am proceeding with scheduling with them today and should have some dates/times when they can be on-site to correct the below issues. I don't want to make excuses, but when ID solutions leaves the sites - they feel things are in working order. Since there was not maintenance purchased, I have to go through this process of getting VP approval on service calls and getting them back on site.*

The second quarter of 2005 was much of the same, as all attempts to get Tendercare and AuSable Valley operational failed. SBC continually claimed to be working on sending technicians back out to these sites, but no visible progress on this could be discerned from MSU's side. Toward the end of the second quarter the MSU team received a new contact within SBC who was assigned to get things back on track from that side of the project; initial optimism from MSU's side soon faded, as this new contact failed to correct the situation and missed scheduled meetings.

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* On January 31, 2005, SBC announced its acquisition of AT&T (SBC Communications Inc., 2005). Not long after that SBC changed its name to AT&T, so from the first quarter of 2005 through the end of the project MSU was dealing with the newly merged company named AT&T. To maintain consistency, the remainder of this report continues to refer to SBC, however.

The third quarter of 2005 included a productive meeting between MSU and SBC to determine what, from MSU's point of view, would need to be done to consider the progress a successful installation. To this end, a formal checklist of tests to be conducted was agreed upon that could verify a successful conclusion to the troubleshooting effort. Most of the quarter was spent with SBC working on finalizing details of the checklist with the subcontractor that would be doing the bulk of the work, as well as securing funding within SBC for this final round of work.

Moving to the fourth quarter of 2005, SBC provided a timeline of its plan to fix the system, based upon the receipt of final internal funding. As the quarter continued SBC was non-responsive in providing details about when the internal funding would come through and technicians could be scheduled. In December 2005, an e-mail sent to the SBC employee who had been the primary contact for the life of this project bounced back with the following message:

> *Effective December 2nd, _____ is no longer an employee of SBC. For all sales related issues please contact your account manager.*

This certainly came as a surprise to the MSU team, who had no idea he was leaving and received no notification until this e-mail. After following up with another SBC employee, a new contact was provided to MSU to serve as the primary SBC representative for the project.

The first quarter of 2006 showed promise, as SBC was able to provide the internal funding to pay for the final work required to get this system working properly. Engineers from SBC and its subcontractors met to discuss what would

need to be done to fix unresolved issues, and DSL lines were ordered for Masonic Pathways and Marwood Manor to provide for remote access and troubleshooting of the gateways at these facilities. As the quarter ended, though, things began to stall again as SBC worked to resolve technical details surrounding this remote access and would not commit to a final timetable for sending its own engineers and subcontractors to project sites to fix the system.

Over the lifetime of this project, the relationship between MSU and SBC certainly ebbed and flowed. During the pre-grant and initial planning phases of the project, the relationship was a very positive one. Even the problems revolving around the lack of ISDN service to Tendercare and AuSable Valley did not dampen things; instead, the MSU and SBC teams worked together to overcome the situation and design a solution. This held true during the early installation of the system, as well. Troubles and glitches installing a complicated telemedicine system are to be expected. But as the troubleshooting process wore on, and SBC was sometimes slow to respond to MSU concerns, the relationship became more troubled. At times, the MSU side had the feeling that SBC might be hoping they could drag the project out long enough that it would simply be considered a lost cause and could end. A representative from the SBC side had a different view on this:

> *I mean I can kind of tell you from the time that I inherited it it was just really more of a situation of this is kind of hanging out there and we need to get it fixed. So I mean that's really been more I think that we viewed it's just something that's open that we need to get closed out.*

As new people would come to the project on the SBC side, the MSU team would have hopes for renewed interest and progress. Sometimes these hopes were misplaced, but other new individuals brought in by SBC to work on this project were certainly able to make things happen and keep the project moving forward.

The MSU-SBC partnership for this project evolved over four distinct phases: (1) pre-grant work, (2) the RFP process and vendor selection, (3) pre-installation planning, and (4) installation and troubleshooting. This particular project never moved beyond the troubleshooting phase, unfortunately, so the investigation of how the partnership between a healthcare organization and its technology vendor by necessity ends at this point. A fifth phase could likely be considered normal operation punctuated by repairs and upgrades when they are required, but this particular system never reached that phase of operation.

Despite the troubles encountered getting this wireless videoconferencing system operational, this project can serve as an initial template of the route that partnerships of this nature might typically follow. Given the history of this project and the evolution of the MSU-SBC partnership, and the concerns that these troubles highlight, it is possible to look at what sort of governance mechanisms might have been put in place to avoid some of these difficulties in future telemedicine projects.

Agency and Governance Issues

Looking at any partnership between two organizations through a TCE lens brings agency and governance issues into focus. These issues are of particular importance when an organization partners with an external technology vendor.

In this particular case between MSU and SBC, the problem begins to arise as an information asymmetry. While the MSU team features talented individuals with an array of skills, it is not possible for MSU to have the same depth of knowledge in terms of telecommunication networks and hardware as SBC. It is also not possible to truly verify SBC's actual expertise, skill, or experience working with any individual technology or piece of hardware. Speaking of the gateway product used in this project, a member of the MSU research team had this to offer regarding SBC:

> *When [SBC] had talked about that product they really talked about it as if they knew what they were doing. And I think that as, and you can probably agree with me, as things progressed, you know, we had a hard time just getting it, number one, and then tech support was nonexistent and it really turns out that they didn't have very much experience with that product at all. And that was quite surprising to me. You know, and there's always a place for beta and field trial and, you know, every vendor is going to work on equipment that they've never worked with before, but they didn't up front, I think, clearly disclose the fact that they didn't have a lot of experience with that product.*
>
> *I wish there was more disclosure along the way to say, "You know, this is really something we're not totally familiar with. You know, we're going to have some more problems. You need to maybe budget in some more time for this thing."*

Though this is an example based on a particular piece of hardware, the idea is broadly applicable to many aspects of this sort of project. This type of information asymmetry made it difficult for MSU to accurately assess SBC's ability to provide the telecommunication services and technology to make this project work. It also made it challenging for MSU to verify SBC's efforts trying to solve problems during the troubleshooting process, as MSU could not independently confirm whether SBC was exhausting its options in attempting to address network and hardware problems.

Compounding this information asymmetry is the fact that it was difficult for MSU to monitor the activities of SBC. This is frequently the case when organizations partner in such a project, the principal (MSU) can often have trouble properly monitoring the efforts of its agent (SBC). Illustrative of this is a comment from a member of the MSU team:

> *If I tell you I can do something, you shouldn't have to get the FBI to check it out. I guess, to make sure someone can do what they say they can do.*

Making this issue of monitoring even more relevant is the fact that this project did not only involve the partnering of MSU and SBC; SBC partnered with subcontractors to complete its work on the project. It thus becomes an issue that SBC may have trouble coordinating with its subcontractors and monitoring their efforts. As a MSU individual present at one of the nursing homes during the installation had to say:

> *When [SBC] would subcontract and someone would show up, they were not well informed what they were there for or what they were supposed to do. It really was quite interesting.*

The issue of monitoring becomes even more challenging as the complexity of the project grows. This project represented a custom system that was built from the ground up for this specific telemedicine application. As such, it was an exceptionally complex project with a great deal of potential for miscommunication, even among parties (like SBC and its subcontractors) that interact on a regular basis. One individual working as an SBC subcontractor on the project offered:

> *I mean if we get into trouble with [SBC] or miscommunication, it absolutely happens, it is impossible not to happen. There is no question about it, but what happened with this project is way more than what miscommunication we have with [SBC].*

This effort to install a wireless videoconferencing system in a nursing home represented a complex telemedicine application. Issues such as information asymmetries between MSU and SBC, as well as difficulties MSU had monitoring the effort of SBC in its work on the project, likely led to inefficiencies and contributed to the project's continued troubles. The question then becomes what could be done to prevent some of these problems.

In situations such as this where a principal has trouble monitoring an agent it contracts with, one possible solution is to have a contract based on agent performance. In this particular case, SBC was awarded the contract when its bid won during the RFP process. The contract was a fixed amount in exchange for completing a working system. In this sort of situation, the agent has little incentive to complete the work in the least amount of time or to operate at the highest level of efficiency. One member on the MSU side said:

> *There needs to be a better way for the MSU purchasing system to allow us to piece products out versus having to pay for the whole thing in one shot. Because what happens is when we order equipment it is typically run through our system here at MSU and the contractor or the source is paid whether or not the equipment actually may or may not function properly.*

Shifting to a performance-based contract would provide incentives for the agent to monitor its own performance, a necessity given the principal's inability to do so. Had MSU contracted with SBC using a contract with performance bonuses or penalties built into the agreement, SBC would have had a larger incentive to do its best work in the least amount of time; as this particular contract was written, SBC had no such incentives to perform at its best.

Another avenue for ensuring agent performance relates to the agent's reputation. It can take a great deal of effort for agents to build a reputation for providing superior service. This can serve as an incentive to ensure proper performance, as the principal can recognize the value an agent places in its reputation and trust that the agent does not want to risk that positive reputation by performing poor work. In this case, SBC had a previous track record of success working on telemedicine projects. As reported by one member of the MSU team who had worked with SBC previously on such projects:

> *I think previous experience warranted SBC as a good fit. And they had shown promise in previous projects. We had a previous hospice project through an organization in Jackson called, we called it the Life Voice Project but other people Telepsychatry project. And [SBC] had worked, we worked with _____ closely on that project, so it facilitated that since they'd done so well with this previous project that obviously good things come from those that work in the past.*

This MSU research team had also worked with SBC on other telemedicine projects, including the installation of a videoconferencing network in southwest Michigan. But the fact remains that due to its monopoly (or near-monopoly status) as a local phone provider, it has less to risk by harming its reputation via a project that goes poorly. It is worth noting that a number of individuals interviewed about this project made the unprompted observation that they have troubles with SBC providing their home phone service. As one example:

> *Personally, even in my own home, I've had lots of problems with [SBC].*

Since SBC has so little competition in the local phone market, this adverse reputation does not significantly harm its business. Also, SBC was selected as the vendor for this project in part due to its position as the only company available to provide a turnkey, end-to-end solution; any company looking to install this videoconferencing system would have had to partner with SBC anyway. Due to the business environment in which SBC operates, its reputation has less of an effect than it might in a more competitive market. As a governance mechanism to ensure the performance of an agent on behalf of its principal, in this case the value the agent puts on its reputation was not a sufficient incentive to ensure proper performance.

Viewing this case through a TCE lens allows one to focus on two big issues that make this partnership between a healthcare provider and its technology vendor – information asymmetries and troubles monitoring the vendor's performance. Two potential remedies for these problems exist in the

form of performance-based contracts and reputation effects. In this particular project, due to the constraints of a federal grant and the market in which the vendor operates, neither was especially feasible or effective.

The governance issues discussed here represent an intended focus of this research project. Through the course of this work, though, other important themes emerged that were not anticipated. The next section continues with a report of important concepts and ideas that came about as unintended insights garnered through this work.

Key Points for Success and the RFP Process

While this research was meant to focus on two primary topics – an exploration of the evolution of the healthcare provider-technology vendor partnership over time, and the governance issues that arise in this partnership – other significant findings emerged that are worth further discussion.

Several of these points relate to the importance of communication in this sort of project, particularly given the number of parties involved – MSU research staff, individuals at the four partner nursing homes, SBC managers and engineers, and a variety of SBC subcontractors. Given the complexity of this project, it was suggested by one of the subcontractors that weekly meetings among all of the involved parties would have been beneficial:

> *And one other position that I may have is the fact that, you know, projects like this it maybe a good idea to have like a recap meeting once a week or you know, depending on the project, once a day or whatever. To include everybody that is involved.*

While a variety of meetings were organized by SBC during the pre-installation, installation, and troubleshooting phases of the project, it was typically only those thought to be directly involved in that particular aspect of the project that were invited. This was a decision made to simplify the logistics of planning these meetings, but at times this resulted in miscommunication among the MSU team, the nursing homes, SBC, and the SBC subcontractors.

Also related to communication, members of SBC consistently mentioned the fact that expectations about their work on the project could have been managed more effectively. One SBC representative stated:

> *The only thing that needs to be done in a situation like this is there has to be, what we did a poor job of, setting the expectation. We probably could have identified that, you know, quoting an RFP based on, you know, solely just what's given to us in an RFP and not taking the time to dig into it and build our own solution or be creative enough to build our own solution that we feel might better meet the needs. You know, if we can do that more often in situations like this we're gonna end up either one, losing the deal and not - we wouldn't be the root cause of dissatisfaction, but - or two, win the deal based on merit. And you know build overall customer satisfaction in the long run.*

This was a frequent comment on the part of SBC representatives, and from the MSU side of the project it certainly would have been beneficial if SBC managed expectations more effectively. One of the great frustrations that caused strain on the relationship from MSU's point of view was ambiguity about what SBC was doing and what it was even capable of. A better job of SBC managing expectations of its work could have helped MSU adjust to troubles as they emerged and understand SBC's capabilities.

Another frequent comment from SBC representatives was the fact that it lacked a dedicated project manager for this project. The individual who served as the primary contact on SBC's side for this project took on the role as project manager essentially free of charge, since the tight budget of the project did not allow SBC to formally dedicate a portion of a formal project manager's time to this project. An SBC representative put it this way:

> *We would usually try to follow up and you know, kind of another piece of that is in the absence of a project manager that would have been their job. You know, following up on all the components and that was probably one of the other issues is that we had the network component, the wireless component, the video equipment component and no really one single point of contact was responsible for all of it. When we were cutting costs, that was one of the things we cut was the project manager.*

It was also possible to see the results of this from MSU's side of the project. At times the SBC manager of the project took a great deal of time to respond to e-mails and phone calls from MSU inquiring about the status of work on the project or reports of problems. It also seemed that the group this individual worked with might not have had the appropriate resources within SBC to address problems in a timely manner. As an individual on the MSU side of things stated:

> *And I'm not quite sure if he had the depth of knowledge or even people within that group to bring all the pieces within [SBC] together. And I think that - I think that group is a little too sheltered. And I don't think they have access within [SBC] and also just the technical knowledge of the way that the networks function.*

Given the importance individuals on both sides placed on having a project manager dedicated to this work is, the project suffered as the SBC employee working as the "project manager" was essentially serving that function as a side job. Future projects of this nature need to ensure that the proper budget is available so that the vendor can dedicate at least a portion of a project manager's time to the work.

As frequently as people on both sides of the project discussed the importance of having a dedicated project manager, the importance of site surveys was stressed to an even greater degree. In this case site surveys were not feasible given the budget of the project. As a result of this:

> *And I think that was probably the biggest frustration is you know, we kept hearing back from the installers and the programmers that this was just a big guessing game. Nothing was specific, nothing was laid out before hand. And they were just kind of, with the best of their ability and the knowledge of similar situations or kind of going from that framework.*

The importance of site surveys for the placement of wireless APs is certainly understood. Site surveys are useful for other work, as well, such as providing sufficient information about the structure of facilities and the work to be conducted in wiring networks within these buildings. An SBC subcontractor reported:

> *Absolutely, I mean, there were certainly unexpected stuff, they walk in like there is one side basically it was a cement wall. There was, I mean, there was no run way, no strobe ceiling nothing like that so we had to even run some cables up in the open. And I guess the material wasn't what was told to us or what wasn't expected. I don't know, I don't want to be playing words here because, like I said, I am not recalling*

everything exactly. But like some of the cable and we had to run was up in the open and it wasn't a good job done by us because we weren't prepared for it.

It would seem that the lack of site surveys contributed to issues faced by SBC and its subcontractors in this particular project. While this was done for budget reasons, and SBC engineers did their best given the constraints placed upon them, future work would be well-served to make site surveys a part of the pre-installation planning if at all possible.

A final, common theme from SBC representatives was that the RFP process used for this project was not ideal. A single round of submissions, with a winner selected off that initial proposal, prevents companies from adequately responding. One SBC employee said:

I think the thing that we probably find makes things go, you know better generally is if the RPF process kind of more specifies, you know, just some general characteristics that you'd be looking for in order to kind of partner with somebody on the project. And then the design becomes a little bit more collaborate in terms of, you know kind of both sides sitting down as we're doing the design and just working through exactly what the applications are and you know being able to kind of interact and say, "Ok, here's your choice. If you want to do, you know if wanted to move this speed here's what we'd recommend. If you wanted at this speed here's what we'd recommend."

This particular process also creates a more significant barrier to entry, requiring a full proposal as a response to the RFP. A likely result of this is a lower number of responses to the RFP than otherwise could be expected. An MSU team member provided:

You know there are some other companies in the Lansing market like G Communications, which is a

huge, you know, one of the top system integrators in the state, you know. And I don't even know if they even got a copy. I don't know. I don't know. And I can say I work with them a lot so I know that they exist, but, you know, to give everyone a fair shake. The problem with an RFP is that, you know, where do you stop?

You know, so you have to just sort of maybe put out some feelers into the market place, you know that there's four or five top companies, so you make sure you send them to bat and then if other ones hear about it you - you know, through a public process, you know, then they get it.

But you're always gonna miss someone, but I just - in my opinion I'm not quite sure if there was a wide enough net cast to cover some potential companies - some smaller companies that could maybe not compete completely on price, but you know you can always award contracts - you know price is important, but there's a lot of components that go into awarding a contract.

A possible solution to this problem would be having two rounds of submissions to the RFP. A first round would be a small, simple proposal from companies to express their interest, a rough idea of their proposed solution, and a rough budget. From this first round a number of finalists could be selected to put forth full proposals. Vendors selected as finalists could then provide more detailed plans about their proposed system and budget. This sort of system would also make it possible for vendors to work more closely with the contracting organization in the process of crafting their response. As one SBC employee said:

I think a generic request for proposal to request the insights of potential vendors is a good thing. I think when you're asking for somebody to come out for a half a day or you know a short period of time and sit

down with for some degree for a, this is a smaller project dollar value. And the consultative type of work on the front end what would be expected free versus for fee. Though in industry you'll generally get something relative to the value of the total sale on the back end.

It would not be reasonable in my opinion, for MSU to say, "Ok 15 vendors I want you to come out and I want you to give us you know 10 days of consulting on the front end and visit all the places. Do reviews, do interviews with people. That type of thing." For the project. ON the other hand come out and brainstorm for, you know a couple of hours or something like for a project of this size is pretty reasonable.

A final improvement that could likely be made to the RFP process in this case would have been greater flexibility in meeting its requirements. Providing freedom to vendors to meet the requirements of the contracting organization makes it possible for vendors to compete on more than just price. An SBC representative offered:

Do an RFI, let's say, and say this is what we have, we have no idea how many access points we're gonna need to cover each building, we expect you to come in, tell us what's gonna work so we can get a vision of what's gonna work in this environment. That way when you see the RFPs coming back, when people are trying to compete on cost you know specifically whether or not someone's slimmed it down so much that you might stranded without proper coverage.

Providing a more open-ended RFP, allowing for vendors to be flexible and creative in their responses, would also make it more likely that vendors could express concerns about the project and the feasibility of what the contracting organization requests. Using this particular project as an example, a vendor could have proposed cutting the number of sites down to three, with the extra

money used to conduct site surveys and other work that the vendor might view as necessary for its work to succeed.

Summary

The early stages of this partnership between MSU and SBC to establish a telemedicine network serves as a template for the evolution of the relationship between a healthcare organization and its telemedicine technology vendor. Any healthcare organization looking to establish a telemedicine network would likely move from pre-grant consultation (in an academic research environment), to selecting a vendor, to pro-project planning, to installation and initial troubleshooting. A successful telemedicine deployment would then progress to a final stage of normal operation, punctuated by instances of upgrades and addressing malfunctions.

Problems encountered in this particular project emphasize some of the issues, centered around information asymmetries and difficulties monitoring another organization, that are frequently encountered in this type of technology outsourcing project. Avenues for addressing these problems, including contractual mechanisms and reputation effects, are available given the proper institutional and market conditions.

Finally, certain keys to success – sufficient communication among all interested parties, managing expectations, the importance of a dedicated project manager and site surveys, and improvements in the RFP process – were mentioned by a number of individuals on both sides of this project and merited discussion. Organizations looking to conduct projects of this nature in the future

would be well-advised to address these topics. To summarize the results, Table 2 below provides the frequency of key themes for the case.

Table 2: MSU-SBC Partnership Thematic Frequencies

Theme	Frequency
Principal Has Challenges in Monitoring Agent	17%
Reputation Effects	42%
Communication Issues	67%
Revisions to RFP Process	50%
Manage Expectations	33%
Dedicated Project Manager	33%
Site Surveys	33%
Information Asymmetries	33%
Performance-Based Contracts	33%

Case 2: Planning and Management Issues of a School-Based Telemedicine System: A Study of the TeleKidcare Project

The case focusing on administrative issues in a multi-site telemedicine project investigated the development and growth of a school-based telemedicine project in Kansas. The report of this case proceeds with an overview of the TeleKidcare project and a discussion of the case results.

Program Overview

The TeleKidcare system was a project of KUMC's Center for Telemedicine and Telehealth (CTT), which was formally established in 1995. The TeleKidcare system itself was a response to growing concerns among school nurses in Kansas City that school children in Unified School District (USD) 500 were not receiving proper access to medical care for routine ailments (United States Department of Health and Human Services, 2003). A number of barriers to proper healthcare contributed to the situation suffered by some of these students, including language, lack of sufficient transportation and economic resources,

limited information about the medical community and services available, and citizenship status. KUMC, working with the Kansas City public school system and pediatricians, developed TeleKidcare to address these problems. The TeleKidcare system makes use of interactive television systems located in the school health office to let school nurses interact with KUMC physicians to provide quick consultations for sick children. The TeleKidcare system also incorporates a digital otoscope and an electronic stethoscope to help the school nurses provide more information to KUMC physicians. This helps the KUMC physicians treat a wide array of ailments, from ear and strep infections to asthma.

The initial primary goal of the TeleKidcare project was to reduce the time children spent outside of the classroom recovering from acute illnesses (United States Department of Health and Human Services, 2003). A significant side benefit to grow out of the project was reducing the amount of time parents spend away from work dealing with ill children. Another unexpected advantage of the TeleKidcare project was the enhancement of the role of the school nurse and a greater appreciation for the school nurse among parents, teachers, and administrators.

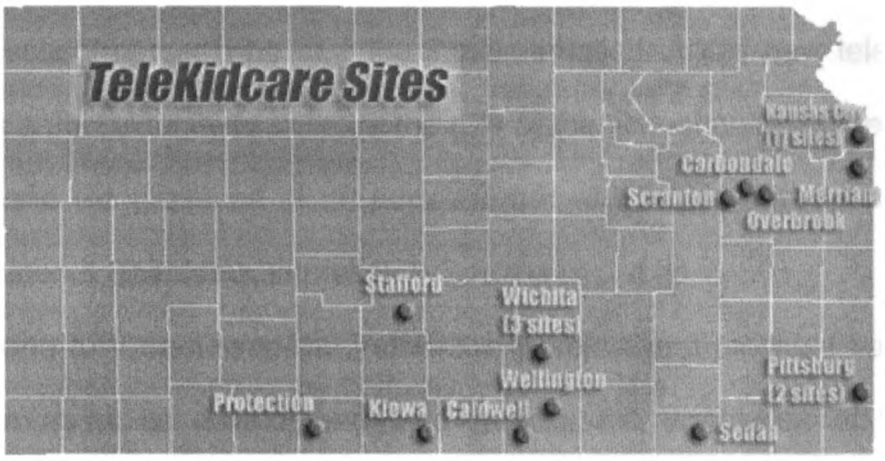
It is useful when considering the TeleKidcare project to understand the basic model for services offered via the project, described in detail in numerous research articles (United States Department of Health and Human Services, 2003; Whitten & Cook, 1999; Whitten & Spaulding, in press). TeleKidcare consults began with a child's routine visit to the school nurse. If the school nurse decided that a consultation with a physician was necessary, the child's parent or

guardian would be contacted to obtain consent for a TeleKidcare consultation; the nurse would explain the TeleKidcare system to the parent or guardian, if necessary. If the guardian or parent consented to the TeleKidcare consultation, the school nurse would schedule a consultation with a KUMC physician and encourage the parent to attend the consultation if possible. Relevant medical history and consent forms would be faxed to the KUMC pediatrician prior to the actual consultation. At the scheduled time, the school nurse – with the child and parent or guardian – would call the KUMC pediatrician to conduct the videoconference consultation. The school nurse would operate the digital otoscope or stethoscope, if necessary, and provide other information to the physician as requested. Based on the child's medical history and the TeleKidcare assessment, the KUMC physician would develop a treatment plan; if a prescription was required, the physician could fax the prescription to the school or have it sent directly to a pharmacy.

TeleKidcare began offering services with a pilot project in February of 1998. In the first three months of the pilot project, 187 children received school-based telemedicine care. This early pilot work helped establish the efficacy of the services being offered through the TeleKidcare system, as well as address troubles with the way the system operated within the schools. TeleKidcare services were gradually introduced in other schools, such that by 2004 there were thirty-one schools in fifteen school districts with more than 11,000 students that had access to this telemedicine service; Figure 3 shows the location of the schools offering TeleKidcare services. Over the course of the project from the

pilot in 1998 through 2004, almost 2,500 visits were conducted via the TeleKidcare system.

Figure 3: TeleKidcare Sites



A great deal of research has been published regarding the TeleKidcare project, including the types of services provided via the system, the perceptions of school employees, and issues related to the implementation of TeleKidcare across the state of Kansas. Regarding services offered via the system, after several years it has become clear that the most significant portion of consults are for ear, nose and throat concerns (47%); other common uses of the system included behavioral health concerns (31%) and eye-related complaints (10%) (University of Kansas Medical Center, 2005). Extensive interviews with teachers, nurses, and administrators showed that they believed TeleKidcare was a positive service that had a future in the schools, though some expressed concerns about ongoing funding; additionally, focus groups with nurses at the start of the project and several years later showed that nurses shifted from doubts and concerns about the project to focusing on the benefits and potential of TeleKidcare (Whitten, Cook, Kingsley, Swirczynski, & Doolittle, 2000). Interesting lessons

learned during the implementation of the system highlighted particular criteria that lead to success of a TeleKidcare site – elementary schools with 70% or more of the students qualifying for the federal Free and Reduced Lunch Program, school nurses who saw the implementation of this new telemedicine system as an opportunity to improve the role of the school nurse in the health of students, and the presence of an administrator who would support the school nurse (Whitten & Spaulding, in press).

Having fully discussed the TeleKidcare project and provided background information about its development and growth, the discussion of this case proceeds with a report of the project's findings.

Findings

Guided by four research questions, two primary themes emerged through the course of this case study – those topics that relate specifically to planning a multi-site telemedicine system and those related to building a telemedicine system that sees sustained usage across site and adoption beyond the research phase of the project. Discussion of these broad themes continues in the next two sections.

Planning a Multi-site Telemedicine System

Adequately planning the deployment of a telemedicine system helps ensure a project's success, and this is particularly true when looking to rollout telemedicine services in a multi-site project. Multi-site projects provide for unique concerns that must be addressed by those managing such a telemedicine implementation.

One particularly important aspect of bringing a multi-site telemedicine project online is to recognize the differences that might exist between sites and accounting for these contextual differences. Such variation can result in the individuals involved at different sites bringing telemedicine technology into their work in different ways. Proper research about each site thus becomes important. Speaking of the importance of researching project sites, a KUMC administrator stated:

> *But it takes an extensive amount of planning. But it takes a lot of research and actually going out and doing site visits and seeing what's gonna work. What works in Kansas City, Kansas does not work anywhere else. What works in one community does not work in the next. So, I think it's a lot of planning and a lot of interviewing. A lot of seeing what resources are out there.*

Sufficient research into the differences between sites can help administrators recognize how individuals at different sites might react differently to telemedicine and the process of bringing it into their work. Administrators can then work with these sites in different ways to customize the system to meet users' needs. Such research is particularly important as TeleKidcare has spread across Kansas, because KUMC does not want to encroach on the practices of local physicians in communities across the state. Instead, KUMC has attempted to identify these local providers and work with them in bringing TeleKidcare services to these areas. One TeleKidcare administrator offered:

> *I think another big thing with TeleKidcare is you've gotta realize that those resources are scarce. There are certain cities that have resources and if we come in as [KUMC] offering competitive services, they're not gonna receive that very well.*

Enabling customization of the TeleKidcare process was viewed as particularly important both in the initial development of TeleKidcare, as well as when administrators are planning to bring TeleKidcare to a new school. One of the TeleKidcare administrators described their strategy of providing a rough or skeleton framework for how TeleKidcare can operate in a school, and then letting the nurses at each school take the basics of the system and adapt it to meet their needs. As he stated:

> *So, we've got to do is kind of make a skeleton kind of template. How to do things. And say, "You know what?" "This is how we do things up in Kansas City. This is, so far, what we have seen be the best working process." So say for scheduling. Or now we're introducing Bellingham, which is a whole other process. We go through and we plan these things out and we go to these communities and say, "This is what we currently do." We might have to adapt it a little bit to that community or have them take our template and use it for themselves. It just depends on if the community is using our resources or they're using the local ones.*

The TeleKidcare administrators have done an excellent job of recognizing that the schools making use of TeleKidcare services vary on any number of dimensions – rural vs. urban, elementary vs. secondary, etc. Even neighboring communities that would seem quite similar on the surface require dramatically different adaptations to TeleKidcare. The TeleKidcare project manager repeatedly stated that this is one of the big reasons the system has been such a success, the flexibility provided for nurses to bring the technology into their work in a way that makes sense given the school and situation in which they operate.

Making sure that TeleKidcare could be built into school nurses' everyday work was a major concern during the pre-project planning. Effectively planning how TeleKidcare would operate, the rough framework, was viewed by those involved in the early stages of the project as a key to TeleKidcare's success. A conscious effort was made to involve as many stakeholders as possible, from KUMC providers to school nurses to CTT staff. Stated by one of the TeleKidcare administrators involved in the early planning process:

> *Interviews with people up and down the school districts, interviews at each school, meetings with the principals, meetings with the teachers, I can't exaggerate how many meetings there were.*
>
> *It was strategic in terms of who we included, in the early planning _____ and I sat down to talk about who all should be involved in the planning, who should be on the planning team, we had a few big meetings with everyone and then smaller meetings. We had a pediatrician and a nurse and someone from psych and someone from telemed and someone from billing and someone from the school district.*

This type of pre-project focus on getting input from as many individuals as possible, particularly users of the system, helped ensure that the rough TeleKidcare framework was something that could easily be brought into schools and adapted by school nurses to become a part of their practices. Getting users involved in the planning process also had the benefit of getting buy-in to the TeleKidcare system from nurses, as they felt like they had a real part in the project's development. As one KUMC administrator put it:

> *The second thing would be the school nurses, they bought into this big time! If you don't have partners who think that you can do telemedicine. We did a lot of training, brought in all of the school nurses to do*

pediatric training – which they got CME credit for. The training was epecially geared toward telemedicine nurses.

It was evident from the beginning that there were nurses that were more involved right from the start, and they would be most active. This wasn't a surprise, it might have been better to start even smaller than we did, start with the two that we knew would be best.

When nurses were involved with the project's planning, it certainly helped create a system that could easily be adopted in their normal work. But this also made nurses care about the system and embrace its introduction to their work, as opposed to a system developed by researchers and forced upon them.

While the school nurses' role in planning the TeleKidcare system was certainly viewed as invaluable, the project could not have been brought online successfully if the nurses were not comfortable actually using the technology for the project. Because of this, TeleKidcare planners made every effort to sufficiently train the school nurses in the equipment to be used for the project. Said one administrator speaking of the early planning efforts:

There was a lot of pre-planning that went into the project. There were a lot of meetings with school board officials, a lot of meetings with nurses, a fair amount of training just to get the systems installed and up and running and showing nurses how to use them. Absolutely - and I can just say from my own experience that with all of our telemedicine service the training has to be ongoing, because people forget how to use the equipment, they forget how to present a patient, they forget the procedures. It just has to be ongoing. With the mental health piece there was kind of a transition away from using the - some of the equipment that you would normally use for the urgent care clinic to just using the video piece, just talking to kids, and maybe there - I think there were some new

forms that they had to fill out, just a few new procedures to follow. So, yes, all of that required pre-planning and training.

A number of nurses also commented on the importance of this early training in helping them become comfortable with the system. The combination of formal training at KUMC and scheduled sessions for nurses to practice with the videoconferencing systems and associated equipment helped nurses feel comfortable with the technology and embrace it as another way of providing care for their children. One school nurse commented on the early training while TeleKidcare was first getting started:

At the beginning, we had weeks of orientation with TeleKidcare, just weeks, and just it was wonderful, and it did teach the nurses that were the pilot nurses about managing time and all that stuff.

In addition to the extensive training provided by KUMC for the TeleKidcare nurses, the CTT's expertise in telemedicine work was a huge help in providing technical support for school nurses when they had troubles using the technology or when technical errors occurred. KUMC's technical support was repeatedly mentioned as a positive in helping the system succeed and become just a part of normal work for these nurses. When asked if KUMC provides good technical support, a school nurse replied:

Yes, they are. They are very good about that. I have, since we have had the Polycom system I haven't really had any issues.

Prompt technical support provided by KUMC's CTT helps ensure that the vast majority of the time that the TeleKidcare system "just works." While it might seem like an obvious point, the fact that the TeleKidcare system tends to operate

without significant technical interruptions is a big part of helping nurses bring it into their schools and use it seamlessly in the provision of healthcare to their students. If TeleKidcare was consistently up and down, with slow responses from KUMC when troubles were reported, it could not become a true part of "business as usual" for these nurses. The technical expertise of the CTT, particularly during the early stages of the project, helped successfully bring TeleKidcare into these schools. Because of this existing expertise, KUMC administrators planning TeleKidcare were not required to establish a technical support unit explicitly for this project; other organizations looking to start a similar telemedicine system might need to take such steps, if an existing telemedicine technical support infrastructure is not already in place.

Effectively planning the TeleKidcare system seems to have hinged on two primary facts that were mentioned by a variety of KUMC administrators and school nurses. First, a recognition that each TeleKidcare site was different and providing just a rough framework for the system that could be customized for each site, and bringing in a variety of stakeholders to establish that framework, helped administrators design a flexible system that could be brought to different contexts in a successful manner. Second, it was extremely important to make sure that users were comfortable with the technology and that it function smoothly in the hectic everyday work of a school nurse – extensive training efforts and a reliable technical support structure helped ensure that the school nurses using TeleKidcare could feel at ease with the technology and trust that it would operate effectively.

Building a Successful System and Sustained Usage

Shifting to the second primary theme coming out of this case, several key factors seem to have driven the system toward sustained use and complete adoption by school nurses.

First and foremost, an effective working relationship among the school nurses and providers using the system was mentioned by almost every individual interviewed about their experience working with TeleKidcare. From the provider side, they value the nurses' skills and recognize the importance of the work that they do. When asked what makes TeleKidcare work, one KUMC provider replied:

> *I would say the school nurse. They do a good job kinda triaging who it's gonna be a good fit for 'cause even with it being Telemedicine, it still has to be a family that a parent can participate – or a parent or guardian can participate some. It's not just a drop-off service where it's just the kid. It's the same as other psychology services where the parent has to participate, and the school nurse does a real – or most of them do a real good job kinda triaging who can participate, who would benefit and then just supporting the families. Like, if you have a recommendation that the kid's do a behavioral plan, the school nurse usually is real helpful in working that out with the teacher and making it work.*

Perhaps even more importantly, though, is the view that nurses have of their relationship with the KUMC medical staff. The nurses universally praised the providers and viewed them, accessed through TeleKidcare, as an invaluable resource for caring for the children in their schools. They also viewed the relationship as a partnership, as nurses worked in conjunction with the providers to care for these children; the nurses' role is more than simply to operate the

telemedicine equipment, they are active participants in the process. One school nurse put it this way:

> *And I would say it's definitely a two-way street. You know, they listen to the feedback that we have and, you know, they also provide feedback to us, and we - you know, we do the give and take bit kind of like a marriage.*

Related to this effective working relationship, the skills and abilities of school nurses became a key success factor for TeleKidcare at each school. Nurses with the proper set of skills could do a better job recognizing instances where TeleKidcare could be successfully employed; skilled and engaged nurses could also do a better job working with providers. When discussing the role that skills and attitudes of school nurses place in the success of TeleKidcare at different schools:

> *Even within some of the schools - maybe you've heard this - some of the school nurses are so much better at it than others. I think there are a lot of issues there, too. Some may see it as more work, some may see it as they just don't have time. Some may see it as a hassle that they're not supposed to deal with sore throats; maybe kids just go home or something like that. There are others who hey, any health care we can give the kids her at school is better than at all.*

Some nurses appreciated the extra requirements placed on them by TeleKidcare. This was especially true of nurses who came had more challenging work experience in their work history – as an emergency room nurse, for example – as this work with telemedicine system helped them use a wider assortment of their abilities and knowledge. One school nurse's thoughts on this provide the proper insight:

The doctor is relying on me to do a very through assessment sometimes. So it is a little, I think that part is a little more advanced than just your regular nursing assessment. I enjoy that.

The introduction of TeleKidcare to schools definitely placed a different set of demands on the school nurses using this system. While some nurses did not embrace these extra duties in their work, nurses who were major users of the system viewed this change as a positive. Administrators thus attempted to target schools with nurses that had the right set of skills and would be more likely to embrace the extra challenges and rewards of providing care via TeleKidcare.

Related to TeleKidcare administrators trying to target schools having nurses with proper skills and mindset to make full use of TeleKidcare in their work, they also attempted to focus on schools that had a full time nurse present in the building. Due to budget cutbacks, many schools in Kansas were forced into sharing school nurses among buildings. Schools without full time nurses, in general, tended to be less frequent users of the TeleKidcare system. One school nurse stated:

Like I said, it's not for everybody, you know, and like, we have a nurse right now that's a preschool, and she has an opportunity to go to Telemedicine School, and she said she doesn't want it, so it's not for everybody, and I think – the nurses that are interested and do believe in it are the ones that really, that see the outcomes are the ones that are really more involved, and I have one nurse right now that has Telemedicine, and she's split between schools, and it's too much work. You know, it just – I think it just depends on that individual. You know, how much she believes in it, and how much work she's willing to put into it.

Having recognized the importance of a full time nurse for TeleKidcare to achieve significant utilization, the presence of a full time nurse becomes one of the major considerations when looking at a new potential TeleKidcare site. TeleKidcare administrators' awareness of the importance of a full time school nurse can help them avoid bringing telemedicine to schools that would not use the system to its full potential.

One of the most important keys to the success of the TeleKidcare system was brought about by a fundamental way in which this telemedicine application changed the way care is provided for these children. TeleKidcare makes it possible for all of the important individuals involved with a child's wellbeing – parents, school nurses, providers, teachers, etc. – to get together at one time to discuss the child's health. While it was most commonly mentioned in relation to the provision of mental and developmental healthcare services, the same concept was also applied to the acute services which TeleKidcare initially targeted. A school nurse stated it as:

> *The same way with my behavior children; if you would just go with what a parent - the child - well, the doctor is not really getting a clear picture of what's going on in school, because sometimes I'll bring in - I'll bring the teacher, I'll bring the - and the doctor may be asking questions about testing. Well, sometimes I'll bring in the Special Ed teacher, sometimes I'll bring in the speech pathologist, and sometimes I bring in the psychologist. So all of these people - this doctor has all these inputs from all of these different experts and they can get this big picture.*

This represents a serious change in the work of school nurses (and KUMC providers) in their work. While this was a rather radical change, it was viewed as

a tremendous benefit that truly improved the ability of everyone involved to provide healthcare services to these children – issues of miscommunication between providers, nurses, and parents were largely eliminated as a result of TeleKidcare.

Finally, and perhaps most significantly, the TeleKidcare system has been fortunate to see several significant unintended, yet useful, appropriations of the technology. As a first, simple example of this, some school nurses report using the telemedicine equipment as a diagnostic aid in their offices – using the system locally to see things on the television screen using the otoscope, for example. A school nurse recalled this example:

> *Yeah, I don't actually - sometimes I don't use the - I don't actually have a consultation, but the equipment I want to say I use, like, once or twice a day. I use it just to look at an ear or look at a mouth or - yeah, I don't have to actually call in for consultation in order to use the equipment. Actually, even the audiologist when she does her screening she was even using my equipment too to look at it, because like I said the equipment is very advanced as compared to what I have myself.*
>
> *Well, just for example, I was looking in an ear and I just couldn't really decide what was in the child's ear, but this child was really screaming about "I have a bad earache." Well, when I used the scope in telemedicine I brought the parent in and we both - it was obvious it was an insect inside the ear. It was so magnified that we could actually see the insect.*

Other school nurses report having used the TeleKidcare system to contact other school nurses to receive a second opinion about a particular case. Sometimes these second opinions relate directly to the care of the child, as one nurse consults another about the best course of action for a particular student's

care. Another, more innovative use involved contacting another school nurse to consult about a provider for a KUMC provider to be able to properly diagnose a case using TeleKidcare. One school nurse who had used the system in this way described this as:

> *Yeah, but it is good sometimes to get that second opinion and to call them and say, can you see this and they are like, you know, I really cannot see that. You better have them go directly to the doctor instead of using telemedicine.*

With this appropriation the school nurses are able to avoid going through the trouble of setting up an appointment with a KUMC provider only to discover during the actual consultation that video resolution is not sufficient to provide a diagnosis. Another interesting use of the technology was reported by a nurse who would contact a KUMC provider knowing that the doctor would not be able to provide a diagnosis using the system. Instead, the purpose of the call was simply to bring the student and parents into the school and speak with the doctor via videoconference, so that the physician could personally explain to the parents the importance of bringing their child in for an in-person visit. This was reported as:

> *And also we - we also have Telekid for those hard cases where we - where maybe they can't - they're not able to diagnose a child and I know that - I know sometimes their limitation is that this child probably can't be diagnosed with telemedicine, but I'll bring the parent in so they can have consultation with the physician. That way sometimes they need to hear it from the physician that this child has an issue, has medical issue that needs to be seen by a doctor.*

As a last example of school nurses appropriating the technology for unintended uses, TeleKidcare administrators did not necessarily plan on having school nurses use the system a great deal to communicate with one another beyond the initial pilot testing of and practice with the system. Over time, though, an informal mentoring network of TeleKidcare nurses has emerged so that more experienced nurses can talk to newer users about the use of the system, help them become more comfortable with its use, and advise them of ways to make TeleKidcare a part of their work. One school nurse said:

> *But now there is a bit of a mentor system going on, helping new nurses get up to speed. I think initially the TeleKidcare people wanted us calling each other, just to use the equipment and get comfortable. I think the other part has come about as a need, and they know we can use it to help other school nurses at other facilities.*

All these types of appropriation of the TeleKidcare system have helped school nurses employ telemedicine in ways that work for them. Open-mindedness and flexibility on the part of administrators has made it possible for nurses to take ownership of the system and use it more fully than they otherwise might have.

Summary

The TeleKidcare system serves as an exemplary case of what administrators can do to help a large, multi-site telemedicine project succeed. Administration efforts begin during the planning phases, involving actual users and a variety of stakeholders in the design of the system; such involvement on the part of users helps ensure that the system will actually work in the "real

world" of their work and increases user buy-in to the system's success. Putting sufficient resources into the proper technical training of users, as well as putting a technical support infrastructure in place if it does not already exist, are other important steps that must be addressed during the planning phase of a multi-site project of this nature. Most importantly, though, administrators must recognize that each individual site in a multi-site project is a unique context. Providing a general framework for how the system can work, with the intention that individual sites will customize the process to meet their needs, helps ensure flexibility in the system's deployment that can contribute to full utilization in varied situations.

It is clear that for a large scale project like this to be a success, providers and users must have an effective working relationship based on mutual trust. Recognition on the part of administrators that certain sites – due to the skills of certain users or even the basic availability of users – are more likely to succeed can help provide focus to efforts of growing a multi-site system. Openness on the part of administrators toward users appropriating telemedicine technology can also help a system achieve higher levels of adoption; such appropriations lead to more frequent use of the system and help users bring the technology into their work in ways that make sense to them – not in ways that administrators might *think* make sense. To concisely overview these results, Table 3 below provides the frequencies of key themes from this TeleKidcare case.

Table 3: TeleKidcare Thematic Frequencies

Theme	Frequency
Appropriation of Technology	43%
Rapport Among Providers and School Nurses	78%
Effective Training	91%
Brings Together All Key Players	39%
Effective Technical Support	52%
Involving Users in Planning Process	39%
Achieving Buy-In	43%
Stability (Or Lack of Stability) in Nursing Staff	35%
Nurse Skills	48%
Adjust to Specific Situation at Each Site	26%

Case 3: Investigating Long Term Success of a Telehealth Network: A Study of Cost Issues in the UPTN

To investigate cost issues in telemedicine, and more specifically focus on a successful system that achieved long term financial viability, the operation of a telehealth network in Michigan was studied. The report of this case provides an overview of this system and the findings that came about through a study of the project.

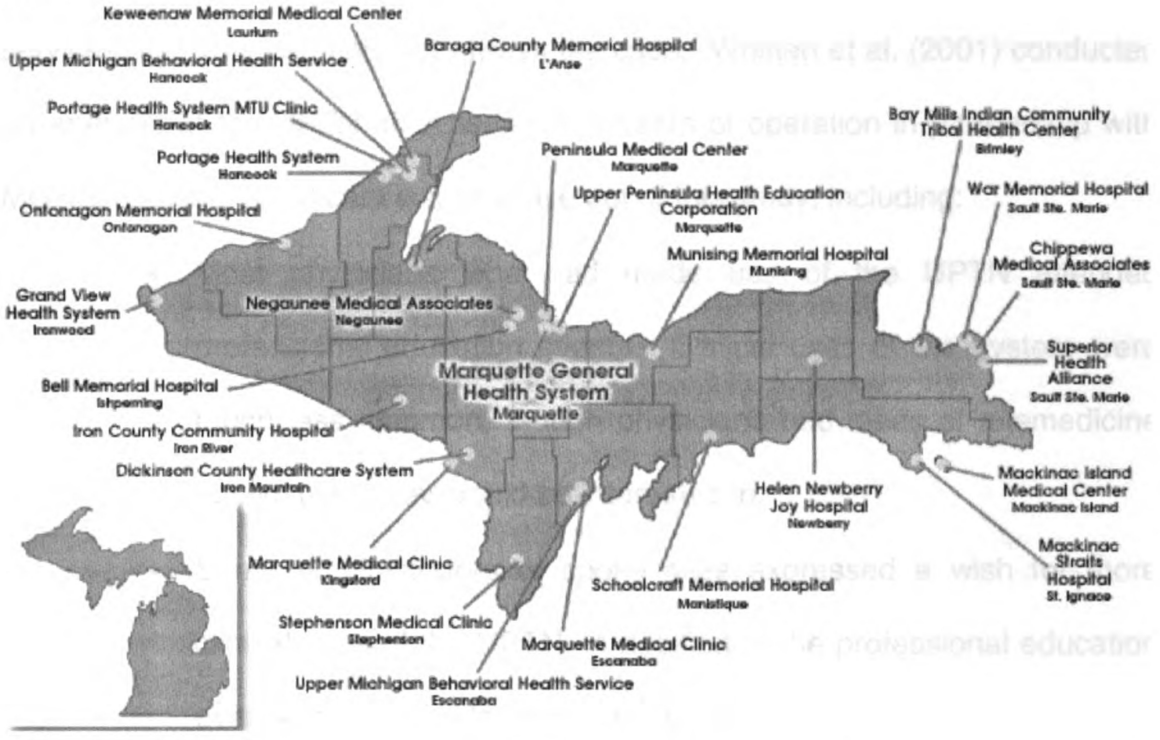
Program Overview

In many ways the UP of Michigan is an ideal setting for a telemedicine program to succeed – an aging population, geographical isolation, transportation challenges, and harsh weather conditions. All of these factors contribute to the challenge of providing quality healthcare to the residents of the UP. MGHS is the primary provider of healthcare services in the UP, working in conjunction with many other smaller independent clinics and healthcare service providers.

The initial concern that started MGHS thinking about a telemedicine program in 1994 was a concern over lost work days for providers traveling to hospitals across the UP to attend educational events; MGHS staff, in the earliest

stages of planning the UPTN, discussed the possibility of a telemedicine network with potential spoke sites (Whitten, Adams, & Davis, 2003). Over the course of ten years, the UPTN has grown to include 38 sites and provides over 6,000 annual connections (Marquette General Health System, 2005). A map of the current network is provided as Figure 4.

Figure 4: UPTN Sites



The UPTN, as managed by MGHS, provides a wide array of services to members of the telemedicine network. Services provided via the UPTN include: professional education, clinical consultations, administrative meetings, deployment of telehealth home-care systems, community education, videoconferencing services for community groups and businesses, teleradiology, and telepathology (Marquette General Health System, 2005). In addition to coordinating the provision of actual telemedicine services via the UPTN, MGHS provides other administrative and support functions for the network: coordinating

network members in the provision of telemedicine services; serving as an advocate at the state level for the advancement of telemedicine reimbursement and policy; providing technical support; provision of educational programming for videoconferences; and assistance in the application for research and government grants (Marquette General Health System, 2005).

While the network as it stands today is viable and provides a wide array of services, this was certainly not always the case. Whitten et al. (2001) conducted an analysis of the UPTN after its first five years of operation in partnership with MGHS. Several significant issues arose out of this study, including:

- Most physicians who had made use of the UPTN attended professional education events. Clinical uses of the system were much less common, though physicians had ideas of telemedicine applications they would be interested in.
- Some administrators of spoke sites expressed a wish for more clinical uses of the UPTN, in addition to the professional education events that tended to dominate usage.
- Staff devoted to UPTN at MGHS had redundant and overlapping job duties, resulting in inefficiencies in their work.
- Telemedicine coordinators at spoke sites, as well as administrators, stressed the need for improved education for providers about what the UPTN could do for them.

A follow up study showed a significant increase in clinical uses of telemedicine, including teleradiology, telepathology, and telehomecare (Whitten,

Adams, & Davis, 2003). Videoconferencing for professional education and administrative meetings was such a common occurrence that MGHS staff began to assume that any work to be conducted with distant sites for professional education or administrative meetings would be available via videoconference. More staff at MGHS were dedicated to UPTN, and their roles formalized, to improve operation of the network. There were still problems to be addressed, such as telemedicine becoming more aligned with strategic goals of MGHS, but ten years after the project started there is little doubt that UPTN has become a sustainable and valuable component of MGHS healthcare services.

Having provided sufficient background about the UPTN project, its initiation and growth, the report of this case proceeds with a discussion of the project's findings.

Findings

The findings for this particular case, guided by three research questions, fell into two broad themes. The first theme centers on a telemedicine network, the UPTN in this case, achieving financial viability beyond the grant phase of operation. The second revolves around how telemedicine has been tied to the strategic goals of MGHS and its partners in the UPTN. Report of these findings continues in the next two sections, each dedicated to one of these major themes.

Achieving Financial Viability

While many telemedicine projects and networks fail to achieve financial viability over the long haul, the UPTN has continued to grow and succeed. Any investigation into how MGHS administrators have managed to achieve this must

logically begin with investigation into what pre-project planning focused on long term financial health of the UPTN. Surprisingly enough, such long term planning did not take place. The original grant that served as the initial funding for the UPTN was actually applied for mostly on a whim by the eventual project manager, against the better judgment of MGHS administration. One of the MGHS administrators involved in the initial project recalled:

> *In fact the hospital really wasn't even in favor of me writing that first grant. I had requested to write the grant and they didn't really know if they wanted to let me write the grant, and then finally it went to the board and they said, "Yeah, go ahead and write the grant, but don't spend any money. And if it gets approved then we'll decide whether or not we want it." So I tried real hard to stay under the radar.*

While future grant work did involve the formation of a formal budget, this is not something that truly affected the day-to-day operation of the UPTN. Instead, such a budget was created as a requirement of applying for various grants, and largely disregarded in the everyday operation of the network. An individual from MGHS involved with the process put it this way:

> *And I almost felt like, okay, I'm gonna do this and it's kind of cool, but don't anybody ever notice. So then we got the second grant within that next year, which was a very significant three year grant, and with staffing and it expanded more. So then it started to become recognized, but even then we still didn't really have a business plan. We didn't really have a formal business plan until the old grant forced us to do one.*

Given the value that is typically placed upon the creation of a formal budget, the lack of such a plan for long term financial sustainability comes as a surprise. But when one considers that the UPTN was essentially established as

a test, to see how telemedicine and telehealth might work for MGHS, it is less counterintuitive. The initial grant was viewed as an opportunity to pilot a new technology, so effort spent planning for long range success could have been considered wasteful. Such an attitude – trying to just see how things might work, with slow and sustained growth – has helped the UPTN succeed when a similar network operating in the UP and other parts of Michigan that started with a large number of sites and significant funding has seen lower and lower levels of utilization in recent years. An MGHS administrator articulated this strategy, comparing it to the other telemedicine network operating in northern Michigan:

> *They went away on this big retreat all and they had their little strategic planners and they came back and they said, "Telemedicine. We're going after telemedicine." So that one came from the top down. They started writing grants and they started going for it. And that happened at the same time I'm going, okay, I'm going to write this grant, but don't anybody notice. And you know, the two systems - they developed - they started big. "Let's go big T1 lines. Let's put in this whole network. Let's charge people all this money to be part of it." And I kept going, "Okay, we can only afford 1 ISDN line at each site."*
>
> *So we kind of like grew up and they started like big time. And if you look at the difference between the two networks right now, where we have 40 sites and we have, you know, over 80 systems, and they have ten sites and they're dropping.*

Throughout its history the UPTN has grown within its means, slowly but consistently adding sites and services to its range of offerings. The alternative strategy – attempting to do too much, too quickly – could be more prone to the network collapsing if usage is not sufficient to justify the high costs of such a system when grant funding is removed.

Another issue that would logically merit attention would be how MGHS and UPTN spoke sites monitor ongoing costs of their telemedicine system. Again, the counterintuitive and surprising answer is that for the most part they do no such monitoring. When asked how ongoing costs associated with the UPTN are monitored, one individual from a UPTN spoke site said:

> *No direct access to the actual costs of running the system, I'm hoping to upgrade the equipment here within the next year or so – definitely have to research costs and what it will mean to the clinic.*

While individuals at these spoke sites are certainly aware that the actual videoconferencing equipment costs money, there seemed to be little or no recognition that the telecommunication lines used for the UPTN cost money.

Such an attitude makes more sense, however, when further investigation reveals that MGHS and its partners in the UPTN have done a superior job of leveraging existing resources to help the UPTN operate in a cost effective manner. The best example of this, discussed frequently by those involved with the project, has been the shift of the UPTN from ISDN lines to an IP-based videoconferencing network. One individual dedicated to the day-to-day operation of the UPTN described this transition:

> *We have pretty much converted almost all of our ISDN lines over to IP already so we have very, very few ISDN lines in our network any more. And we looked at that from an efficiency perspective as there were already data networks going across to the hospitals, why not just jump on those since they're paying for them already any way? And eliminate the monthly ISDN phone line bills.*

Facilities that participate in the UPTN already have IP-based T1 lines that are used for a variety of data needs. Enabling the UPTN's operation on this existing infrastructure has made the leap into participation with the UPTN a less significant financial risk for potential spoke sites considering telemedicine activities. Since its switch to IP networks, the UPTN has only caused one site to purchase an additional T1 line, and that instance was more about the particular health system opening another clinic – it likely would have needed the additional T1 line even if it were not participating in the UPTN.

Another factor contributing to participation in the UPTN is a recognition on the part of administrators and providers that healthcare in the UP cannot afford *not* to use telemedicine and videoconferencing. In many ways the UP, a rural area with a sparse population and inclement weather, represents a "perfect storm" that contributes to the value placed upon telemedicine and telehealth. Regarding the necessity of the UPTN, a provider stated:

> *I think certainly in terms of patient and family time involved to come for a clinic visit. You know, we're clearly a rural area up here. We don't have freeways so even taking the main roads are two lane highways, or two lane blacktops. You know, it can be easily upwards of a six hour round trip to come from our farthest reaches of our system up here, you know, for them to come home to the visit and then back home again. They've really invested an entire day in what is sometimes a relatively straightforward office visit.*

The fact that administrators and providers, from MGHS and the spoke sites, recognize the inherent value of the UPTN has resulted in the hospitals involved in the project being significant supporters of the system. The UPTN actually operates in part on funding from an internal grant supplied by a network

of hospitals and healthcare systems in the UP and northern Michigan. This was described as:

> *In regards to distance education and the technical support out of our department to the whole Upper Peninsula Healthcare Network, it has been nice to see that the network has embraced this, as, like, the CEOs of all of the hospitals because the hospitals across the Upper Peninsula are independently owned and operated; it's not one big corporation, but they do have a network, Upper Peninsula Healthcare Network, and that network, the Upper Peninsula Healthcare Network CEOs have embraced Telehealth and are definitely champions of it, driving it at the sites.*

The fact that the telemedicine and telehealth efforts that comprise the UPTN are viewed as such a necessity, and the support of hospitals in the region, contribute significantly to the impression that the success of the UPTN is mostly a foregone conclusion. From the point of view of critical mass theory, this fact that sites considering potential adoption view the UPTN as likely to continue its success makes it more likely that sites will join the network. The more sites that join the UPTN, the better is its financial health. This leads to a snowball effect and is evident in the sustained growth that the UPTN has experienced since its inception.

Also contributing to system growth and financial viability is the fact that there is a telemedicine team at MGHS dedicated to the UPTN and related activities. This group performs a variety of services, from coordinating UPTN services to helping spoke sites apply for grant funding that subsidizes the costs of T1 lines used for the network. One of these individuals on MGHS' telemedicine team listed these functions:

> *We're in charge of scheduling every piece of equipment that we have, and we have 76 pieces of equipment. We maintain them, troubleshoot them, we train the staff how to use them, make recommendations on purchasing, we do all the installs, we run all the programs that are on the bridge, we administer the bridge. We keep the - I keep the network statistics. Our basic role we handle all of the operations - the day-to-day operations, making all the connections, anything to do with the equipment.*

This represents the type of sponsorship that critical mass theory views as a key to success of technologies with significant network effects. The fact that MGHS sponsors the network, making it easier for new sites to join and handling a variety of management functions, contributes to the success of the project and simplifies the process of new sites joining the UPTN. The sponsorship of the UPTN by MGHS is a significant reason why the network has continued to operate and grow beyond its initial grant funding.

Tying Telemedicine to Strategic Goals

The second broad theme to emerge through the investigation into the UPTN relates to how the network ties to the strategic and financial goals of MGHS and the spoke sites. This generally happens through looking at how the UPTN impacts both providers and patients.

Looking first at providers, individuals from MGHS and the spoke sites discussed the benefits the UPTN brings to providers – increased opportunities for continuing education events via videoconferencing, less time spent traveling to remote clinics, greater productivity, and a chance to work with advanced

technology. One provider, speaking of these benefits as it relates to saving costs, commented:

> *I believe so, I don't know the costs offhand, but if you count in not only transportation costs, but professional time, it has to be [cost effective].*

Given these benefits, the presence of the UPTN at MGHS and spoke sites can make these facilities more attractive to providers looking for employment. A spoke site administrator made that very point when discussing how the UPTN is used as a recruiting tool in conjunction with strategic goals of acquiring new providers and improving the work environment in the facility:

> *Right now for our strategic goals are physician recruitment - we have some physicians here that are gonna be retiring - actually some of them call themselves semi-retired already - and we only have a couple that are on-hand. So we're doing a lot of physician recruitment, expanding - we have a few rural health clinics, so we're looking at expanding into rural health clinics.*
>
> *Obviously, we want to get some of our, like, specialty doctors to come here and visit, so - and then if we can utilize even a surgeon that's, you know, from out of town or something they could come here, like, one day a week or one day a month, and then they can follow-up with their patients and they don't have to travel here for another day of clinic and they can do, like, post-op surgical visit via telehealth, just that kind of stuff.*

Looking at the patient side of things, the UPTN brings a variety of benefits to the healthcare that patients receive. The two most frequently discussed benefits to patients include increased convenience and reduced travel time, though the provision of services through the UPTN that otherwise might not be

possible is also discussed. One provider described the benefits for patients in this way:

> *I think because of that it allows us to see patients in a more timely manner than they would otherwise. Again, especially the elderly patients and their elderly spouses. You know, saving them driving in through the winter. They may simply go to an emergency room rather than, you know, their local emergency room or walk in clinic rather than seeing their specialist because they just can't physically get here.*

Again, this ties to the strategic goals of MGHS and spoke sites, as providing superior healthcare services is typically viewed as one of the keys their strategy for growing their businesses and improving the patient experience. Both MGHS and the spoke sites also recognize the value of the UPTN in providing these services in the most cost effective manner possible. Speaking of the ability of the UPTN to aid in the provision of excellent healthcare in an economical manner, a MGHS administrator said:

> *I would have to think about that, and their vision is to provide quality and cost-effective patient-care services and strategic goals do include Telehealth in that, especially from a cost-effective standpoint. Well, it certainly makes it cost effective in that it eliminates the need to travel, and so it's cost effective because of a mileage standpoint and also wind shield time. You're totally eliminating both the wind shield time, which is non-productive time, and the quality, it allows the patients to have access to their specialists in instances – for instance, there's a patient from an outlying site who is on dialysis who needed to see another specialist here, and because of the dialysis schedule couldn't schedule a visit here with the specialist. Using Telemedicine, he was able to do that because it was right after or before a dialysis run. So by providing that access, it certainly affects the quality of the patient care.*

The case of MGHS, as the sponsor of the network, provides a particularly interesting example of how the UPTN ties to its strategic goals. As mentioned in the previous section, the original grant submission that initiated the UPTN was approved with reservations by a MGHS CEO who felt that it was not worth spending time on. Looking at archival records, MGHS' strategic vision from that period of time does not consider the UPTN or telemedicine. As the value of the UPTN become clear, a newer strategic vision built telemedicine into organizational goals and objectives in a variety of ways – the case had been made, and the UPTN was considered a valuable tool to be used in reaching MGHS' goals. As the system has progressed and become mostly "business as usual" the situation has changed again, as the most recent statements of MGHS' strategic goals do not include specific references to the UPTN or telemedicine; instead, its presence and value is simply understood at this point and is beyond mention. A MGHS administrator closely involved with the UPTN from its inception through the present discussed this process:

> *So what has happened through the course of our history is a total, "Well, let's ignore this, it's not gonna happen - oh, look, it's happening." Then there was one year where our five year strategic plan came out and in all of the - we had our goals and in our objectives there was some mention of telemedicine and in the activities to meet those objectives throughout the whole plan there was stuff about telemedicine, and I went wow, this is really cool. So now we've almost evolved a little more and it's - it's not really mentioned in the strategic plan or the objectives or the activities, but there's an assumption.*

This evolution of the role the UPTN plays in meeting the strategic goals of its sponsor MGHS parallels the growth and development of the network. It is

clear that MGHS, as well as the spoke sites, have come to view the UPTN as a valuable tool to be used in meeting organizational objectives. This is a great leap from its initial status as a pilot project to see if telemedicine and telehealth was something that MGHS might want to investigate.

Summary

Given the long term success of the UPTN in achieving financial viability, it is surprising that things one might consider necessary for success – an initial budget and business plan, as well as ongoing monitoring of costs – are lacking. But looking at the UPTN from the perspective of critical mass theory, the sponsorship of MGHS and the view that the UPTN is a virtual requirement to continue providing healthcare in the UP, it becomes clear that spoke sites considering joining the UPTN view the network's continued success and viability as a virtual certainty. Add to this the fact that MGHS' telemedicine team has done an excellent job of helping spoke sites leverage existing infrastructure to keep costs of joining the UPTN to a minimum, and it becomes clear that the costs associated with operating the UPTN are kept low and ongoing monitoring costs and a formal business plan are not necessarily a requirement for success. In reality, it would appear that with the UPTN telemedicine has essentially become a utility like electricity or phone service – something that is so necessary and cost effective that it no longer merits attention.

The benefits that the UPTN brings to providers and patients makes it a valuable tool to be used by MGHS and the UPTN spoke sites in meeting their organizations' strategic goals. The UPTN helps improve patient care in a cost

efficient manner, while creating an attractive working environment that helps UPTN members recruit talented healthcare professionals. The MGHS case in particular is interesting, to watch the evolution of the UPTN as a project that was largely unnoticed, to a point of emphasis, to so commonplace as to not even merit further discussion. Table 4 summarizes the key themes from the UPTN case and the frequency with which these themes occurred in the interviews for this case.

Table 4: UPTN Thematic Frequencies

Theme	Frequency
Leverage Existing Infrastructure	36%
Sponsorship	57%
Improving Patient Care and Services	100%
Human Resources Tool	36%
Perceived Necessity	57%
Provider Benefits	100%
Hospital Support	43%
No Formal Business Plan/No Concept of Costs	50%

Cross-Case Lessons

The three cases in this research were selected as particularly illustrative of the issues this work was interested in. The MSU-SBC relationship was a prototypical example of the phases such a partnership progresses through over time, while the problems that arose during the project made it a useful study of the governance and contractual mechanisms that could be used to avoid such troubles in future partnerships of this nature. The TeleKidcare project serves as an ideal project for studying the strategies employed by administrators in the planning and ongoing management of a large, multi-site telemedicine system. The UPTN, given its relatively unique character as a telemedicine network

surviving beyond the grant phase of funding, is a useful case for investigating how such a network can achieve long term financial viability.

The fact remains that none of these issues can truly be studied in isolation, of course. While each case focused on a specific issue that was particularly salient for that project, the topics central to each case are affected by a host of other factors. Some of these other factors were present in all three cases, other issues emerged in only two of the cases.

As an example of an issue that cut across multiple cases, the importance of a good working relationship among users of a telemedicine system cannot be overstressed. The strong relationship between KUMC providers and school nurses was already discussed as a factor that contributed to the success of the TeleKidcare system. While the intended focus of the UPTN case was on financial viability of the network, the strong working relationship among individuals at the spoke sites and the MGHS telemedicine team was discussed repeatedly. Given the opportunity to voice general thoughts and concerns about the UPTN, individuals from the spoke sites consistently praised MGHS and the individuals coordinating the telemedicine and telehealth projects that comprise the UPTN. Even in the MSU-SBC case, which was plagued by technical troubles, several nursing home employees commented on the positive relationship they had with members of the MSU research team; efforts by the MSU group to keep nursing home staff informed about status of the project and work being done to correct technology troubles helped the nursing home staff maintain a positive attitude toward the project.

Related to this, it is clear that many of the individuals working on these projects have a tremendous sense of pride in what the work they are doing. This was most clear in the case of school nurses using the TeleKidcare system, as there was a strong belief among a number of the nurses that they were making a real difference as a result of TeleKidcare – bringing healthcare to kids who otherwise may not have received any adequate healthcare at all. The sense of pride in making a difference was certainly present among TeleKidcare providers and administrators, too, along with a desire among many that the system will continue to spread and improve the healthcare of children across Kansas. Pride in the UPTN was extremely prominent among the MGHS team championing and organizing the network, as well. These individuals saw the value in the UPTN and the benefits it creates for patients and providers. Such pride in their work, and the good things they accomplish through successful use of telemedicine, help these individuals deal with budget cuts, staff turnover, and other frustrations they face in the course of providing healthcare.

Another topic that came up unprompted across cases was the importance, and potential benefits, of starting small and allowing systems to grow over time. While the TeleKidcare system started with just four pilot sites, one administrator involved in early work with the project as a provider stated a belief that it may have been simpler and more effective to start with just two pilot sites – focusing on the two sites with the nurses most likely to have used the system extensively. The success of the UPTN can be attributed to the fact that it grew slowly within its means, which seems to be a particularly reasonable strategy given the failure

of similar networks that attempt to start with too many sites. Even in the case of the MSU-SBC partnership, an individual on the SBC side of the project commented that it might have been more effective to get a single site operational before moving on to the other nursing homes. Such a strategy would have allowed SBC to focus more effectively on a single project site before moving onto the next. This also could have made it possible for MSU and SBC to jointly agree to pour more resources into a particular site to get it up and running, potentially sacrificing the original target of a network of four sites to achieve a working system with two or three locations.

A last issue that came up across cases was a general desire to continually improve these systems and how telemedicine is used to provide healthcare. The TeleKidcare managers consistently engage the school nurses about ways the paperwork and use of the system could flow more effectively, and the recent push to expand the mental and developmental health offerings available through TeleKidcare have provided the impetus for refining the project's operations to an even greater degree. The UPTN group within MGHS has gone through several reorganizations, and there was a stated emphasis among those individuals that they are continually looking at new services, new ways of making use of telemedicine that can benefit MGHS and the spoke sites. This constant focus on continual improvement, which certainly is not hurt by the fact that these people believe so strongly in what they are doing, helps keep the systems growing and avoids stagnation.

Again, none of the three issues explicitly targeted in this research can be studied in a vacuum. A specific case was selected for each issue, where that particular point of interest was especially salient. The fact that individuals from different projects often made similar comments, unrelated to the focal issues of any of these cases, highlights the fact that these are complicated systems which are affected by an array of concerns. These varied issues are present to differing degrees in any healthcare organization considering telemedicine as a tool to improve patient care and provide efficient healthcare services. Researchers and practitioners are well-advised to consider as many of these factors as possible. Case studies allow for a researcher to focus on a particular issue, disentangling it from other factors and teasing out consequences related to the topic of interest. In an applied setting, though, this is often not possible or even desirable. Instead, the insights gained from focused investigation into individual topics can help researchers and practitioners identify the most important factors at play in their specific situation and address them accordingly. The next chapter concludes this report with a discussion of the implications of this work for researchers and practitioners, directions for future research, and limitations of the project.

V. Discussion

The purpose of this work was to investigate three issues that significantly influence the success or failure of a telemedicine system that have been understudied in the literature. Looking at the partnership between MSU and SBC to implement a telemedicine system, results focused on the evolution of this relationship, as well as governance mechanisms that could have been used to avoid the problems that plagued the project. In the TeleKidcare case, broad themes related to the successful planning and ongoing management of a multi-site telemedicine system emerged. And in the case of the UPTN, strategies for ensuring the long term financial viability of a telemedicine network, as well as a description of how healthcare organizations tie telemedicine to their strategic goals, were the major findings.

This chapter continues with a discussion of the implications of this project for researchers and practitioners planning and managing telemedicine systems. Directions for future research, as well as the limitations of this work, are also discussed.

Implications

Effective telemedicine research can result in implications that affect an assortment of individuals – from telemedicine researchers to policymakers to practitioners in healthcare organizations interested in telemedicine applications. This section discusses a variety of implications that come to light through this research project, with a primary focus on these cases and implications related to

telemedicine practice and research; it also includes comments on how the results might be of interest to fields beyond telemedicine.

In looking at the MSU-SBC partnership, the first missteps occurred during a rigid RFP process that included a single round of submissions and the award of a contract that was not based on the technology vendor's performance. Ongoing work from installation through troubleshooting was complicated by an information asymmetry between MSU and SBC, as well as a market structure that did not include the proper incentives for SBC to supply superior service. A number of implications spring from this case's outcomes.

First, and perhaps most significantly, a more effective RFP process would have dramatically improved the likelihood of success of the project. A better strategy for researchers or practitioners undertaking such a process should focus on (1) open requirements in the RFP and (2) a multi-round format leading from semifinalists to a final vendor selection. A RFP process utilizing these two strategies would have a number of benefits:

- More open requirements in the RFP would make it possible for vendors to be more creative in their solutions, focusing on innovative uses of technology and competing on the quality of the submission instead of simply costs.
- A multi-round process, with the first round of submissions comparatively simple, would encourage a greater number of vendors to submit responses.

- A closer relationship between the contracting organization and the vendor during the RFP process, leading to systems that more closely meet the contracting organization's needs and increased opportunities for the vendor to properly manage expectations of what can their system will be capable of.
- Improved communication between the contracting organization and the vendor, allowing for the vendor to emphasize the importance of key components of a response to the RFP and tradeoffs to be made in removing such components.

The success a healthcare organization has contracting with an external technology vendor to implement a telemedicine system begins with an effective RFP process. The evolution of the MSU-SBC project, and the problems encountered during the installation and troubleshooting process, highlight a few key elements for success that were noted by a variety of individuals from both the MSU and SBC sides of the project. Among these keys elements for success:

- The presence of a project manager cannot be understated, so the dedication of at least a portion of a project manager's time should be a requirement when looking at a vendor's proposed solution. A contracting organization should not accept an employee fulfilling such a project management role as a side job.
- The importance of site surveys was repeatedly remarked upon by members of the SBC team. Healthcare organizations would be well-advised to build the costs of conducting a site survey into the

budget when planning a telemedicine application that will require the use of wireless networks or additional wiring throughout a facility. The lack of adequate site surveys turn the installation and troubleshooting process into a guessing game, resulting in unnecessary troubles, inconsistent performance, and wasted labor and costs.

- Meetings on a regular basis among all parties involved with the telemedicine implementation – the contracting healthcare provider, the vendor, and subcontractors involved in the work – can ensure that everyone is aware of what is going on and work stays on track. Such regular meetings become more important as the complexity of the project increases, as the presence of all key stakeholders can help everyone maintain a clear vision of the overall project's progress and operation.

Any healthcare organization looking to contract with an external technology vendor in the provision of telemedicine services should ensure that these three key points are addressed. These are vital to the success of such projects, and were discussed as by a variety of individuals from SBC, as well as MSU.

Another implication is that a contracting healthcare organization, particularly if lacking technical expertise, should consider hiring an independent technology expert to work on the healthcare provider's behalf throughout this process. In the MSU-SBC partnership, the MSU team had talented individuals

who understood the technology involved, but at times had to consult an expert with particular expertise in the operation of telecommunication networks. Contracting with a technology expert independent of any selected vendor that can help with the RFP process and on through installation of the telemedicine system can help alleviate the information asymmetry that might exist between the healthcare organization and its technology vendor.

While it is possible for researchers and practitioners to discern lessons from the outcome of the MSU-SBC partnership in this project, there are implications beyond the level of the organization that are worth noting.

The first such implication is that for reputation to serve as an effective incentive for technology vendors – SBC in this case – to provide quality work, there must be sufficient competition in the market. In this particular case, SBC was selected in part due to the fact that it was the only company capable of providing an end-to-end, turnkey solution. Any other vendor selected would have had to contract with SBC for the telecommunication lines required to operate the network. With no other company capable of providing the total solution SBC can offer, SBC has less to risk if its reputation is hurt as a result of poor performance on a project of this nature. More competition in the telecommunication market would make increase the likelihood that SBC could lose future business as a result of its reputation being damaged. Policymakers must work to promote competition in the telecommunication market, so that other companies can properly compete with SBC and similarly provide end-to-end solutions. Without

this sort of competition, it is the end users of telecommunication services that ultimately suffer.

The second significant implication from a policy point of view is that public and private agencies providing grant research funding to telemedicine projects should not restrict the type of contracts that can be awarded to technology vendors. Restrictions placed upon grant recipients in terms of the types of RFP processes to be used, and the kinds of contracts that can be paid with grant funds, tie the hands of researchers to utilize the most effective types of contracts and RFP strategies. Instead, such agencies should encourage grant recipients to use performance-based contracts and multi-round RFP systems, perhaps even requiring such strategies. This would help increase the likelihood of success in telemedicine projects and avoid the waste of research funds. Universities that might be involved in telemedicine research should also ensure that institutional requirements do not preclude the use of superior contracting and RFP strategies.

Assuming the technology to be used in a telemedicine system is functioning properly, it is possible to shift attention to strategies in the planning and ongoing management of a telemedicine project that contribute to success and ongoing use of a telemedicine application.

Here it is important to recognize the importance of gathering information from as many individuals and potential users of the system as possible during the planning process. The administrators charged with planning the TeleKidcare system made an effort to consult school nurses, school principals, school district

administrators, and providers from numerous specialties to get a full range of viewpoints about how a school-based telemedicine system should operate. This is important for two main reasons. First, the end result is a system that is designed by the users to be something they can actually use in their real work, increasing the likelihood that the final product will fit into their work in a reasonable manner and achieve sustained usage. Second, it creates buy-in to the telemedicine system; potential users sufficiently involved in the planning process feel that they have something invested in the system's success and become more likely to accept bugs and troubles early in the application's deployment.

Also related to planning, due diligence researching potential sites for a telemedicine system is a necessity. The proper mix of context, users, and patients must be present for a new telemedicine system to achieve sustained usage. The TeleKidcare administrators worked to ensure they were providing a useful service in schools that had the proper administrative support and personnel to properly utilize the system. Success of the TeleKidcare system hinged on the selection of proper sites, something that adequate research about targeted schools and communities made possible. Further, this makes it possible for administrators to make adjustments to the system and its processes to fit the needs of each site. Customizing a telemedicine system to fit within a facility's normal flow of operation makes it more likely to succeed, when compared to a "one size fits all" strategy and expecting a site's staff and work processes to shift and adapt to the presence of telemedicine. Researchers and

practitioners implementing new telemedicine systems must build flexible frameworks for how the system is to be used, then let sites make adjustments and customize it to fit their needs.

A final implication regarding planning a new telemedicine system is the importance of ensuring the proper resources are in place for providing sufficient training to users and support when the system encounters technical difficulties. TeleKidcare nurses, providers, and administrators repeatedly discussed the importance of the training process and the presence of technical support for the initial success of the system and continued operation of TeleKidcare. A healthcare organization bringing a new telemedicine system online should not try to start delivering services via the technology as soon as it is operational. Instead, setting aside time for training helps users become comfortable with the system and use it in their work. Sufficient technical support is particularly important in the early stages of a deployment, when users are more likely to make mistakes and bugs are more common; a quick turnaround time by technical support personnel can prevent users from becoming frustrated with the system during the earliest stages of learning and use.

Considering implications in the ongoing management of a multi-site telemedicine system, the most important result that practitioners and researchers should focus on is the benefit of having an open attitude to users appropriating the technology in ways that were not originally intended. Some extremely innovative uses of the TeleKidcare system came about as nurses took the technology and used it to meet their needs. The TeleKidcare managers were

open to this sort of behavior, so nurses were free to explore the full capabilities of the technology. Any organization bringing a new telemedicine system online should ensure that the requirements of the system – in terms of paperwork, research requirements, or protocols for use – do not hinder the ability of users to appropriate the technology and use it for new and unexpected tasks.

Not necessarily related to the planning or management of the TeleKidcare system, a sense of pride in the work accomplished via TeleKidcare certainly contributed to the success of the project – users felt like they were doing something that truly contributed to the well-being of these schoolchildren. Such pride in their work helps these school nurses tolerate the challenges in providing care via telemedicine, something that they freely admit takes extra time and introduces new challenges to their work. Practitioners and researchers bringing new telemedicine systems online could improve the pride that users might feel in the system's operation by promoting successful usage of the system. Newsletters and updates provided to staff using a new telemedicine system can focus on positive outcomes achieved using the new technology to encourage the belief that successful usage of the system can have a significant positive impact on patient health.

Once a telemedicine system is successfully up and running, attention must shift to achieving financial sustainability. There are a variety of lessons to be learned there from the experience of the UPTN, particularly for any healthcare organization looking to start a hub-and-spoke telemedicine network.

First, any network that is dependent on network effects, like a centralized hub-and-spoke model, is much more likely to succeed if a network sponsor drives the initiative. In the case of the UPTN, MGHS' telemedicine team championed the effort, helped spoke sites apply for grant money to subsidize joining the UPTN, and performed a variety of other functions intended to make joining the UPTN a simpler process. This has two major outcomes – each potential spoke site can consider joining the network a less painful endeavor, as well as recognizing that the simplified process makes it more likely that other sites will join the network, too. Any healthcare organization starting such a network must be willing to sponsor its success as MGHS did – it creates the perception that the network will be a success, which makes it more likely that sites will join with the end resulting in a self-fulfilling prophecy. Administrators and managers starting such a network must effectively manage expectations of growth and long term health of the system, so potential spoke sites will believe in the future success of the system and feel comfortable making the upfront investment required to participate.

Related to this is the importance of leveraging existing infrastructure to defray the costs of providing telemedicine services. The UPTN initially operated on ISDN lines, but has since shifted to an IP-based network using T1 lines that the healthcare facilities in the UP of Michigan already had running for other data needs. Such a decision to make use of existing infrastructure made joining the UPTN a less significant financial obligation, and further increases perceptions that a significant number of facilities will join the network and make it a success.

Practitioners and researchers initiating a new telemedicine service should perform an inventory of existing IT infrastructure that might be used to provide these services.

There are a variety of benefits to the use of telemedicine systems related to healthcare providers – improved efficiency in the provision of care, access to underserved populations, and better working conditions. For any organization looking to recruit superior healthcare professionals, administrators can use telemedicine as a tool to entice top recruits and retain talented employees. Exploring ways of bringing telemedicine into a healthcare organization can also serve as a signal to potential and current employees that the organization is committed to providing quality healthcare and keeping up with technology. While telemedicine's first beneficiaries are the patients receiving care via such systems, healthcare organizations can make use of the technology to improve the working conditions of its providers and remain competitive in hiring new professionals.

In many ways the UP of Michigan is the perfect context for telemedicine to succeed – a rural area, with a disperse population, and inclement weather that can make travel difficult. Given this, numerous providers and administrators voiced an opinion that telemedicine was a virtual necessity to continue providing healthcare in the UP. As healthcare costs continue to increase, complicated by the rising costs of transportation, telemedicine will become a more and more vital component to the healthcare system in coming years. The perceived necessity of telemedicine in the UP will likely become a more common sentiment in a growing number of areas. One of the reasons the UPTN succeeded was this

perceived necessity contributed to support from the member hospitals to providing financial support to the network when necessary. Other healthcare networks looking to implement telemedicine, having recognized the necessity of using telemedicine to provide healthcare, must be willing to provide financial support to the network to support it until such a system becomes self-sustaining.

A final lesson to be drawn in achieving financial viability is that a formal budget or business plan for telemedicine is not necessarily an absolute requirement. Instead, it would seem to be more important to simply focus on slow, sustained growth within the means of the network. While it can be tempting to "go big" right from the start, the slow growth of the UPTN and TeleKidcare both point to the benefits to be had from focusing on gradual expansion of the network to sites that make sense and have the proper resources in place to achieve sufficient levels of usage.

Shifting attention to the broader impact of this research on fields beyond telemedicine, the most direct application of this work is likely to the IS field. Many of the lessons learned through the MSU-SBC partnership would be highly relevant to researchers and professionals with an interest in IT outsourcing. One such lesson would be the importance of a useful RFP process – any organization partnering with a technology vendor to implement an IT solution must have an effective process of selecting the vendor or the system is less likely to succeed. Given this, administrators in any type of organization would be well-served to focus on the importance of the RFP process. Also, keys to success discussed in the MSU-SBC partnership – the importance of a project manager, site surveys,

and adequate communication among the project's players – would be applicable to any sort of IT project. IS researchers and professionals could also draw useful lessons from the TeleKidcare case, as the value placed upon pre-project planning and involvement of actual users in the process could be useful in any sort of technology implementation. The management strategies of providing a general framework for IT implementation and an open attitude toward appropriation of the technology would also be worth considering in any large organization implementing a new technology across a variety of sites. Finally, several key outcomes of the UPTN case would also be useful to general IS research. The large role that leveraging existing infrastructure played in the in the success of the UPTN could serve as a useful reminder to IS managers that new systems should build on existing infrastructure whenever possible to achieve cost savings. The importance of a system sponsor to the success of a technology with significant network effects could be of note to IS researchers with a variety of interests.

While the IS field is certainly the most obvious area that would be interested in the results of this research, there are other research fields that could derive value from this work. Economists could be interested in the application of the TCE framework to telemedicine, a field that has made little use of TCE to this point. A number of items of interest to economists in this area – information asymmetries, agency and monitoring issues, and governance mechanisms used to encourage performance – are certainly present and highly relevant to the project's outcome. Also, telecommunication policy researchers could be

interested in the role that SBC's monopoly (or near-monopoly status) in the local phone market played in its behavior in this project. The lack of competition for SBC in many of the markets in which it operates, and the role that this played in the project's continued troubles, could be viewed as an exemplary case of how monopoly telecommunication providers might not be an ideal situation. Researchers with a significant interest in AST or critical mass theory could also make use of this work, as such theories have seldom been investigated in the telemedicine field; researchers involved with either theory could discern useful insights from application of these theories to a new research area.

The implications of this research are varied, and can be helpful both to telemedicine researchers and healthcare practitioners considering bringing such technology into their organizations. While the lessons learned here are most directly applicable to telemedicine, some of the insights can be transferred to the general efforts of individuals to bring new technology into an organization. The results of this research also point to directions, discussed in the next section.

Future Research

Having highlighted important implications of this research, the influence of this work on future research merits further discussion. Results of this research will likely have the most significant impact within the telemedicine field, but lessons learned here are broadly applicable to other fields.

First, it is important that the results of this research be replicated in other contexts. Each issue of interest in this project was studied with a single case, in a single context. Investigating these issues in other projects – both successful

projects and ones that have failed – would make it possible to learn more about these issues and how they can impact the success or failure of a telemedicine project. Addressing these topics in other contexts would also make it possible to learn more about how these specific issues tie to other external factors that were not prominent in the three cases selected for this project.

As more is learned about these issues across a variety of contexts, it should also become possible to construct survey instruments to measure key variables. The introduction of standardized instruments would also ease efforts to compare results across studies, improving research into these issues. This is a particular strength of the IS research field, the existence of proven research instruments that make it possible to compare results across studies more effectively. Given the relative similarity between some of the topics studied in IS and issues central to telemedicine research, replicating the success IS researchers have had with standardized instruments would strengthen the telemedicine field significantly.

Aside from replicating the results of this project across contexts, and the resulting knowledge easing the creation of standardized instruments to improve study of these issues, a number of interesting directions for future research in telemedicine come from this research.

There are several logical extensions of the work conducted into the healthcare organization-technology vendor partnership. First, MSU and SBC representatives commented on several keys for success that could have helped the project significantly – the presence of a dedicated project manager on SBC's

side, site surveys, frequent meetings among stakeholders to improve communication, and a revised RFP process. While telemedicine researchers have not previously chosen to explicitly focus on these issues, a survey of telemedicine project managers could investigate the role that each of these factors may have played in past projects and deployments. Such a survey, cutting across a broad spectrum of telemedicine applications and contexts, could confirm (or deny) the importance of these factors discussed by MSU and SBC representatives. The results of such research would be especially useful as practitioners and researchers start new telemedicine projects, highlighting those keys to success that are mostly commonly thought to influence a project's outcome.

Second, it would also be useful to more broadly apply the TCE concepts to telemedicine as a field. The issues that arise as telemedicine continues to develop as a method for delivering healthcare are complex. TCE is particularly well-suited to study the governance, agency, interpersonal, and interorganizational issues that arise through telemedicine deployments. Looking at these topics through the lens provided by TCE can help organizations ensure that its telemedicine systems work within their own organization, as well as that partnerships with other healthcare organizations and technology vendors progress as smoothly as possible. Insights garnered through a TCE-colored view of telemedicine will also have interesting implications for policymakers, as the institutional and governmental regulations that govern the healthcare field will continue to play a strong role in the continued growth of telemedicine

applications. Continued investigation into telemedicine using TCE will contribute to the success of individual projects, as well the field as a whole.

An interesting direction for future research springs from the role that users appropriating technology played in the success of the TeleKidcare system. The fact that users were free to take the technology and adapt it to their own work and uses, some completely unintended by those planning TeleKidcare, seems to have contributed to the comfort users felt with the technology and the overall acceptance and continued use of the system. Work in this area could start by looking at the differences between telemedicine projects that had strict guidelines for use of the system compared to those that were more open to user experimentation. Impacts on utilization and user satisfaction would be specific outcomes meriting attention. Further, assuming that systems which allow for users to appropriate the technology does in fact lead to more successful telemedicine applications, research could outline successful strategies for encouraging users to play with the technology and experiment with the full capabilities of a telemedicine system.

The role of user buy-in to the success of a telemedicine project could be another fruitful direction for research. The role of buy-in, created by involvement in the planning process and a belief in the good work accomplished via telemedicine, was certainly discussed as a contributor to the success of the TeleKidcare and UPTN systems. Deeper research could focus on how buy-in contributes to system success, from users' greater willingness to deal with technical difficulties to increased enthusiasm in using technology that they

participated in creating. Research into strategies for developing buy-in would also be useful in guiding telemedicine project managers as they rollout a new system. The more effective strategies researchers can discover, the more likely managers will be able to find a selection of strategies that will work in their specific situation.

Looking at issues surrounding long-term financial viability of telemedicine networks and projects, future research would be well targeted at the differences that might exist between projects that are funded internally within a healthcare organization for business reasons versus those that are funded with "artificial" money supplied by a government or foundation grant. It is possible that administrators and project managers would make very different decisions in these two cases, as losing the organization's money might be viewed as a more significant issue than potentially wasting grant money. Such future research could start with a survey of telemedicine projects, comparing the strategies and outcome of projects funded via internal money versus those funded by grant dollars. To dig more deeply into the reasons one form of funding might result in more successful projects, it would also be worthwhile to conduct interviews with administrators and project managers to see how the funding source might affect the decision making process. The results of such research might provide significant guidance to healthcare organizations and granting agencies to structure awards and programs more appropriately to ensure optimal decision making and make the success of projects more likely.

Related to the differences that source of funding might make, another useful direction of future research might be a deeper comparison between telemedicine networks that opt to start small and focus on sustained growth versus those that go big right from the start. In the case of the UPTN, starting small and focusing on continued growth resulted in a successful system what a nearby system taking the alternate strategy has been trending in the opposite direction regarding growth and utilization. It would be useful to more broadly investigate these strategies, and see what role other factors might play in causing one strategy to succeed over the other. It is possible that the proper strategy might depend on factors specific to a particular region or country, the primary source of network funding (private companies making the investment versus a government grant), or characteristics of the organizations taking part in the project. While the strategy followed by MGHS in starting and growing the UPTN worked in that specific situation, the same success might not result in a radically different context. More research into these two strategies, and in what situations each might be superior, would be useful to those considering starting a large-scale telemedicine network.

While the results of this research do point to interesting directions for future research, it is worth noting that there are limitations to this research as well. The following section continues with a discussion of the limitations of this work.

Limitations

Even well-designed research suffers from limitations, due to the specific method used in conducting the research, decisions made through the course of the study, or a variety of other factors. This project is no exception, and recognition of these limitations can help other researchers adequately assess the results and implications that can be drawn from this work.

First, some researchers have a problem with the case study as a method of research. Those who are less familiar with the method believe that it could allow a researcher to draw conclusions that match pre-conceived notions of what the results "should" be, and that results of case studies cannot be generalized to other contexts.

There is certainly the potential for a case study researcher to take the data collected in a case study and twist it to meet pre-project concepts of what the final results would be. This can largely be eliminated through the use of theory to guide case study research, as theoretical propositions used to guide data collection and analysis forces a researcher to think about the issues more critically, as well as rival explanations for the outcomes that are discovered in the case.

Another method of proving the reliability and validity of case study research is through replication. The three cases in this project could have all been selected to focus on a single issue, with the results of the three cases serving as points to compare and contrast and confirm one another. The benefit to this, of course, is improved reliability and validity – and perhaps more

confidence in the study's results. But such a strategy would not have made it possible to address three different – and equally important – issues in this project. A decision was made to select three cases, each focusing on a different issue. The resulting lack of cross-case comparisons could be considered a limitation of the work; this is one of the primary reasons that repetition of this work in other contexts to confirm the results of these cases was discussed in the previous section as a direction for future research.

Another limitation of this work is the purely qualitative nature of the data collected and analyzed. While some might have the notion that case study research is purely qualitative in nature, this is not the case. Case study research, when possible, can also incorporate quantitative data. The particular issues investigated in this project have received relatively little attention in the telemedicine literature, so the data collection and analysis by necessity relied on qualitative methods. Further research into this area will result in greater knowledge about the issues involved, allowing researchers to craft quantitative instruments (surveys in particular) that could be used in future investigation of these issues. The introduction of quantitative methods would ease the process of comparing results across cases focusing on the same topics, as well as provide another method of confirming the results of qualitative data collection and analysis. Again, it was for this reason the introduction of quantitative methods was discussed in the previous section as a direction for future research.

Finally, a frequent criticism of case study research is that it is not generalizable. This criticism often comes from researchers more familiar with

inferential statistics and quantitative methods. It is certainly true that case study research cannot be broadly generalized in the same manner as survey results conducted on a sample can be applied to an entire population. In case study research, the burden of determining what aspects of the results can be generalized to some other specific context falls to the reader. A practitioner or researcher reading case study results must decide whether or not the lessons learned in the reported research apply to their own specific situation. A great strength of the case study method is that it makes it possible for researchers to dig into complex issues that cannot be completely removed from the context in which they are studied. While the lack of broadly generalizable results could be considered a limitation of the research, it is a limitation that is a byproduct of the method's most significant strength. The point to be remember is that case study results *can* be generalized – the burden simply shifts to the reader to decide what can or cannot be applied from the reported case study research to other contexts of interest.

Researchers must make decisions and tradeoffs in the design and ongoing work in any research project. A decision to use the case study method for this research, which could be considered a limitation of the project, was made given the lack of previous work in this area and the complicated nature of the issues to be studied. A tradeoff was made to select three cases, with each focusing on one of three primary issues of interest, rather than selecting three cases to focus on a single topic. While this hindered the ability to conduct cross-case analysis, it made it possible to explore a wider breadth of issues. In spite of

the limitations acknowledged in this research, the results are useful to practitioners and researchers in guiding future telemedicine projects and research.

Conclusion

It is possible to criticize any effort at research for a range of limitations, ranging from the method used to specific decisions that were made by researchers during the planning, collection, and analysis phases of the project. Recognizing the limitations of any research project is important to determining what results, implications, and future work might be derived from the effort.

This particular research project focused on three telemedicine projects, each case selected to focus on a specific issue of interest that required further study to help advance the field of telemedicine. The results of this research have a variety of implications for telemedicine practitioners working in the "real world" and researchers investigating issues surrounding telemedicine. The results are also important for policymakers, as those conducting telemedicine work are forced to work within the institutional and legal systems that influence healthcare and their work. Possible improvements to these systems springing from this research could make it easier for those interested in telemedicine to conduct fruitful work – both in providing healthcare services and developing new uses of telemedicine.

It is important to recognize that the results of this work are relevant to more than those interested in telemedicine, though. The findings of this work are more broadly relevant to any organization implementing technology. While

healthcare organizations face certain challenges and have concerns specific to healthcare – patient privacy, for example – the lessons learned concerning project planning, management, contracting with vendors, etc. are all applicable to other contexts. Because of this, the findings of this research are valuable to professionals and researchers beyond the domain of telemedicine.

The results of this research are also important when looked at through the theoretical lenses selected for each case. Healthcare in general, and telemedicine in particular, presents unique relationships, agency issues, and governance concerns that TCE can help investigate. While the application of TCE to such topics can help telemedicine researchers learn more about the field, use of this framework in telemedicine can also help researchers garner new insights about the range of situations in which TCE can be applied and discover the full potential of the TCE concepts. Application of AST to telemedicine research results in similar benefits to both fields. Telemedicine researchers can leverage the success of AST in related fields to explain how technology becomes a part of an organization's operation. Utilization of AST in telemedicine research can also help researchers learn more about how AST ideas can be applied to a new field; telemedicine research could be viewed as an especially ideal setting to study the social construction of technology, as telemedicine systems are frequently implemented to enable communication and ease the social interaction necessary for the provision of healthcare. Bringing critical mass theory to telemedicine research is equally important. The concept of network effects can help explain the benefits to be had in telemedicine applications as the size of

networks increase. The importance of system sponsorship, and the possible benefits of shielding users from the costs of using telemedicine systems in the early stages of operation, can also help practitioners and researchers better understand why given systems might succeed or fail.

The three cases discussed in this research were each selected as an exemplary case ideally suited to study a particular issue. It is important to note, though, that the issues raised in each case are certainly relevant – to one degree or another – to each of the other cases. Concepts of critical mass theory could certainly be applied to TeleKidcare and the role that KUMC has in sponsoring the system, for example. It is important in reading each of these cases, and any report of telemedicine research, to recognize that a vast number of issues truly contribute to the success or failure of a given telemedicine system. Reading such reports critically can help researchers and practitioners take lessons learned in one telemedicine effort and apply it to their own work.

Finally, one of the cases included to this research – the partnership between MSU and SBC – centered on a telemedicine application that after three years of effort has not yet achieved functionality. While it is frustrating to all involved that this project has faced such difficulties, it is important to remember that even in projects that face significant problems a great deal of new knowledge can be discovered. The problems encountered in this project, and the thoughts of those involved in how such problems could be avoided in the future, makes this project immensely useful to any organization looking to implement telemedicine in the future.

Telemedicine will continue to grow as a field, driven by factors such as rising costs of healthcare and travel. Telemedicine is ideally suited to help alleviate costs associated with travel, as well as issues related to geographic disparities and other issues to be faced by healthcare professionals and policymakers in coming years. As researchers learn more about what can make or break a telemedicine system, through study of successful and failed projects, telemedicine as a field will grow stronger and become a powerful tool for providing healthcare in the future.

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APPENDIX A: MSU RESEARCH TEAM INTERVIEW GUIDE

1. What was the original goal of this research project? What sort of needs drove interest in this project?

2. What was your role with this project?

3. What was the original plan for the design of the telemedicine network to be used in this project? Was the feasibility of the original network design checked at any point?

4. How did the RFP process for the project work? How was SBC selected as a vendor? Were other vendors seriously considered?

5. How did the earliest work with SBC progress, what were the first steps once SBC was selected as the project vendor? How was the relationship early on in the project?

6. How did the initial installation and testing of the system progress? How was the relationship with SBC during this process?

7. At what point did problems start to occur in the installation and testing of the system? How did the MSU team try to address these problems? What was SBC's response?

8. Did the relationship with SBC change during the course of troubleshooting the network? How?

9. What is the current status of the project?

10. How would you characterize leadership on SBC's side of the project, from the initial planning phases through the current time?

11. What could have been done, contractually or otherwise, to ease the interaction of the MSU research team and SBC?

APPENDIX B: NURSING HOME PERSONNEL INTERVIEW GUIDE

1. What was the original goal of this research project? What was this facility's primary interest in the project?

2. What was your role with the project?

3. To the best of your knowledge, what was the original design of the network? What is the current network layout?

4. What was your impression of both the MSU researchers in charge of the project and SBC during the earliest phases of installation and testing?

5. Did your opinions of either group change as problems occurred with the system?

6. What do you think could have been done differently to avoid the problems that arose getting the network properly installed, tested, and operational?

7. What is the current status of the project?

8. What steps could have been taken, in your opinion, to ease the process of putting this system in place?

APPENDIX C: SBC REPRESENTATIVE INTERVIEW GUIDE

1. What was the original goal of this research project?

2. What was your role with this project?

3. How did SBC go about replying to the original RFP?

4. What were SBC's first steps upon being selected as the technology vendor for this project?

5. What was the original network design for the project? What was the final network design? Was SBC comfortable with the change in network design?

6. How was the relationship with MSU (and its nursing home partners) during the early planning and installation phases of the project?

7. How did problems during the installation and testing phases of the project unfold? Did the relationship with MSU and its partners change during this period? How?

8. What is the current status of the project?

9. What could have been done, contractually or otherwise, to ease the work on this project with MSU?

10. What do you think could have been done differently to avoid the problems that arose getting the network properly installed, tested, and operational?

APPENDIX D: KUMC ADMINISTRATOR INTERVIEW GUIDE

1. What was the original goal of this research project? What sort of needs drove interest in this project?

2. What was your role in this project?

3. What sort of planning went on before the Telekidcare project started to ensure the proper resources were in place?

4. How much pre-project planning went into training and procedural concerns?

5. Did pre-project planning focus on putting education in place for KUMC providers, school nurses, and parents?

6. Who was involved in the planning process? Was a conscious decision made to include as many different groups of people as possible?

7. Looking back, is there a group or individual that should have been included in the planning process that wasn't?

8. What are some of the more significant issues that have arisen that are unique to a multi-site project like Telekidcare? Were these problems that you foresaw while planning the project? How have they been handled?

9. What issues have arisen as the Telekidcare project has spread to new sites and new contexts? How have they been handled?

10. What are some of the key administrative and management strategies that have helped schools adopt the Telekidcare system?

APPENDIX E: ELEMENTARY SCHOOL ADMINISTRATOR INTERVIEW GUIDE

1. What was the original goal of this research project? What was this school's primary interest in the project?

2. What was your role in this project?

3. Were you involved in the planning process before Telekidcare began operation? What kind of input did you provide?

4. What sort of relationship does the school have with KUMC now that Telekidcare is up and running?

5. What do you think are some of the keys to the success of Telekidcare at this school?

6. What has helped Telekidcare achieve state-wide success?

7. How much contact do you have with other schools that are Telekidcare sites?

8. How do parents tend to feel about Telekidcare services when they first hear about it as something that is available in the school? What about once their child has been seen through the system?

9. How does the school nurse feel about the Telekidcare system?

10. What do teachers think about Telekidcare?

APPENDIX F: ELEMENTARY SCHOOL NURSE INTERVIEW GUIDE

1. What was the original goal of this research project? What was this school's primary interest in the project?

2. What was your role in this project?

3. Were you involved in the planning of the Telekidcare project? If so, how? What kind of input did you provide?

4. What sort of relationship do you and the school have with KUMC now that Telekidcare is up and running?

5. What do you think are some of the keys to the success of Telekidcare at this school?

6. How has Telekidcare changed your job? Were you adequately prepared for Telekidcare being part of your duties?

7. How much contact do you have with other schools that are Telekidcare sites?

8. How do parents feel about Telekidcare services when they first hear about it as a service? What about after their child has been seen through Telekidcare?

9. What do teachers think about Telekidcare?

10. How do school administrators feel about Telekidcare?

APPENDIX G: KUMC PHYSICIAN INTERVIEW GUIDE

1. What was the original goal of this research project? What sort of perceived medical needs drove interest in the project?

2. What was your role in this project?

3. Were you involved in the planning of the Telekidcare system in any way? What kind of input did you provide?

4. What sort of relationship does KUMC have with Telekidcare sites?

5. What have been some of the keys to the success of Telekidcare, from a provider's point of view?

6. Were you adequately prepared for your role a provider of Telekidcare services?

7. How do school nurses tend to feel about Telekidcare?

8. How do parents feel about Telekidcare?

APPENDIX H: MGHS ADMINISTRATOR INTERVIEW GUIDE

1. What was the original motivation for starting the UPTN?

2. What was your role in this project?

3. Was any sort of formal business plan for telemedicine written prior to initiating the UPTN?

4. Was long-term financial success of the UPTN considered during the pre-project planning?

5. Are ongoing costs of the UPTN monitored in any way? How?

6. What kind of services are offered via the UPTN?

7. What services are planned for UPTN in the future?

8. Does information about the costs of different UPTN services help guide decisions about what services are to be offered and which might be discontinued?

9. What are strategic goals for MGHS over the next five years?

10. What role does the UPTN play in meeting these strategic goals?

APPENDIX I: UPTN SPOKE SITE ADMINISTRATOR INTERVIEW GUIDE

1. What was the original motivation for starting the UPTN?

2. What was your role in this project?

3. Was any sort of formal business plan for telemedicine written prior to initiating the UPTN?

4. Was long-term financial success of the UPTN considered during the pre-project planning?

5. Are ongoing costs of the UPTN monitored in any way? How?

6. What UPTN services does your facility make use of?

7. Are there services you would like to see as part of the UPTN that are not currently offered?

8. Does information about the costs of different UPTN services help guide decisions about what services are or are not offered?

9. What are strategic goals of your facility over the next five years?

10. What role does the UPTN play in meeting these strategic goals?

APPENDIX J: UPTN TELEMEDICINE COORDINATOR INTERVIEW GUIDE

1. What was the original motivation for starting the UPTN?
2. What was your role in this project?
3. Was any sort of formal business plan for telemedicine written prior to initiating the UPTN?
4. Was long-term financial success of the UPTN considered during the pre-project planning?
5. Are ongoing costs of the UPTN monitored in any way? How?
6. What UPTN services does your facility make use of?
7. Are there services you would like to see as part of the UPTN that are not currently offered?
8. Does information about the costs of different UPTN services help guide decisions about what services are or are not offered?
9. What are strategic goals of your facility over the next five years?
10. What role does the UPTN play in meeting these strategic goals?

APPENDIX K: UPTN PROVIDER INTERVIEW GUIDE

1. What was the original motivation for starting the UPTN?
2. What was your role in this project?
3. How have you personally used the UPTN as a provider?
4. How do other providers use the UPTN?
5. Do you think the UPTN is a cost effective way to provide healthcare?
6. Does information about the costs of different UPTN services help guide decisions about what services are or not offered via telemedicine?

APPENDIX L: MSU-SBC PARTNERSHIP THEMATIC CONCEPTUAL MATRIX

Theme	Description
Principal Has Challenges in Monitoring Agent	A principal (MSU) can have difficulty monitoring the performance of its agent (SBC) in situations where there is a significant information asymmetry.
Reputation Effects	A company's reputation can serve to build or hinder trust in its ability to complete a project in a satisfactory manner. The value a company places on its reputation can serve to ensure it provides its best efforts.
Communication Issues	Coordination among the organizations involved in this project – MSU, nursing homes, SBC, SBC subcontractors – had communication issues that led to misunderstandings.
Revisions to RFP Process	Changes in the RFP process could have possibly improved the selection of the technology vendor, as well as the design of the network for the project.
Manage Expectations	It is important for a tech company to properly manage expectations of what it can do, the timeline, and what can be accomplished within a project's budget constraints.
Dedicated Project Manager	On the tech vendor side of this, a project manager dedicated to the project is vital to success.
Site Surveys	Site surveys are extremely important to a project like this, the lack of site surveys (for budget reasons) was a significant problem.
Information Asymmetries	It is possible that two parties involved in a transaction have very different levels of knowledge about one another or a particular issue.
Performance-Based Contracts	Contracts should be based more on rewarding performance than simply an upfront award for winning the RPF process.

APPENDIX M: TELEKIDCARE THEMATIC CONCEPTUAL MATRIX

Theme	Description
Appropriation of Technology	Appropriation of technology relates to the way users take a technology and adapt its use to meet their own needs – which might not necessarily be the same uses the system designers had in mind.
Rapport Among Providers and School Nurses	A solid working relationship between the providers and school nurses is evident among TeleKidcare users.
Effective Training	School nurses were trained extensively in all aspects of TeleKidcare – use of the system itself and paperwork associated with the project.
Brings Together All Key Players	The TeleKidcare system brings together parents, school nurses, and doctors in the care of elementary school children – something that is virtually impossible in a traditional setting.
Effective Technical Support	Having the proper technical support in place helps ensure that when problems do arise with the system they are addressed in a timely manner.
Involving Users in Planning Process	Providers and nurses were brought into the planning process, to make sure that the system would flow well with their normal work.
Achieving Buy-In	Part of getting users (mainly on the nurse side) to use the system is achieving buy-in. Methods for achieving buy-in included involvement in the planning process and pride in the TeleKidcare system and what it does.
Stability (Or Lack of Stability) in Nursing Staff	Having a dedicated school nurse full time in a facility (or the lack of a full time nurse) plays a big role in TeleKidcare success.
Nurse Skills	The skill sets of nurses plays a significant role in helping them adopt and fully use TeleKidcare, or fail to use the system to its fullest potential.
Adjust to Specific Situation at Each Site	It is important to provide a basic framework for a service like TeleKidcare and then let individual sites adapt it to their specific situation. Properly researching potential TeleKidcare sites is key to successfully adapting the system to new communities and situations.

APPENDIX N: UPTN THEMATIC CONCEPTUAL MATRIX

Theme	Description
Leveraging Existing Infrastructure	It is possible when implementing a new telemedicine technology to make use of existing technology and telecommunication services already installed in the healthcare organization.
Sponsorship	A central champion or core group of users can help a technology with significant network effects achieve the critical mass necessary to achieve sustained feasibility and use. This could include things like making the system easy to adopt, apply for grants, etc.
Improving Patient Care and Services	Telemedicine in the UP can help improve patient care and services, as well as making healthcare more convenient for patients.
Human Resources Tool	The presence of telemedicine, the convenience and educational opportunities it provides, can be a tool used in the recruitment of healthcare providers to work at UPTN sites.
Perceived Necessity	There is a belief among many that there is no way some of the things that go on with the UPTN (administration meetings, continuing education events, etc.) could occur without the UPTN. It is a virtual necessity at this point to use telemedicine in the UP.
Provider Benefits	There are a variety of benefits for providers, including improved educational events and less travel, greater productivity.
Hospital Support	Hospital administrators at the UPTN sites see the value of the UPTN and support it effectively.
No Formal Business Plan	There was no significant formal business plan written for the UPTN.