Digital Diffusion in the Clinical Trenches: Findings From a Telemedicine Needs Assessment

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ABSTRACT

Broadly stated, this dissertation focuses on how practitioners and provider organizations integrate the computer and web into healthcare delivery. The opportunity that afforded this research was a Telemedicine Needs Assessment commissioned by a Massachusetts-based provider organization, consisting of two hospitals and 29 community group practices (CGP).

The Telemedicine Needs Assessment incorporated qualitative and quantitative research programs to include: 1. cross-sectional, institution-wide, in-depth interviews; 2. participant observation at administrative and clinical day-to-day operations, and lastly, 3. a 68 item, closed-ended survey distributed to all 586 clinical practitioners to assess the access, use, and perceived needs of current computer, web, and telemedicine technologies.

Data from the survey, (72% response rate), established a computer and web enablement baseline against which the success, failure, or potential usefulness of any future medical informatics implementation would be evaluated. Findings included: 1. Computer and web enablement within the organization is not ubiquitous. Access is high, use is low; 2. Practitioner status, practice location, and gender affect enablement. Non-MDs, CGP-based practitioners, and female practitioners report lowest access and use. 3. No differences were reported specific to home access to computers and use of e-mail. 4. Hospital-based practitioners report greater access and use. CGP-based practitioners report greater perceived needs for teletechnologies. 5. Hospital-based and CGP-based male MDs emerge as the most polarized subgroups due to differences in computer and web use and perceived needs. 6. Female practitioners are more successful than male practitioners securing tech support at home and at work. 7. With regard to technology uptake, female MDs constitute a more homogeneous group than male MDs.

Also, four products emerged from the Telemedicine Needs Assessment: 1. a needs assessment theory and methodology derived from Process Architecture which promulgates that discussions specific to the end users' work must always be inextricably linked with their work practice; 2. a typology of barriers to the integration of computer and web-based technologies into healthcare delivery stratified by practitioner, administration, organization, and industry; 3. a framework which defines and integrates real and virtual healthcare delivery services, products, and technologies, and finally; 4. a systems-based model of clinical and telecommunications integrated delivery networks providing IS, IT, and administrative infrastructure support for the framework.

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I am deeply indebted to John Coller M.D., who managed the Telemedicine Needs Assessment database and tirelessly executed endless analyses on the Telemedicine Needs Assessment data. Simply stated, without his enthusiasm and dedication to the integration of computer and web technologies into medical practice, this research would not have taken place. For his innumerable contributions, encouragement, collaboration, and steadfast support, I am eternally grateful.

Similarly, I would like to thank the anonymous individuals of the equally anonymous provider organization where the dissertation fieldwork took place. It is my hope that their insights and generosity have been made manifest in the breadth and depth of this endeavor.

Also, I would like to thank Gigi Hirsch M.D (who coined the phrase, *Digital Diffusion in the Clinical Trenches*), Geoff Evans Ph.D., and Stephen Porter M.D., all of whom graciously assisted in clarifying my thoughts early on in the writing process.

Too, I would like to acknowledge the American Medical Informatics Association for allowing me to feature, in Chapter four, the substance of a paper titled, *Virtual Healthcare Delivery: Defined, Modeled, and Predictive Barriers to Implementation Identified*, previously published in the AMIA Annual Meeting Proceedings, 2001.

Finally, and with great warmth and fondness, I would like to thank: the Department of Architecture's Renée Caso who administered this interdisciplinary degree with admirable aplomb; my learned committee members, Isaac Kohane and Mike Fischer; and finally, my advisor Professor William L. Porter who kept a steady hand on the helm, and who, by example, indicated that he never expected less than the quest for perfection.

DEDICATION

This dissertation is dedicated to my family, to include: my father, Cedric Harrop, who encouraged me to pursue and then finish this degree; my mother, Laurel Harrop, who continues to provide an exemplary role model; my three siblings and four children who perceived my five years at MIT as a family undertaking; and last, and most importantly, my darling, patient editor-husband, Paul Steffler, whom I will now support so he can retire.

PREFACE

Before turning to the dissertation I want to review the somewhat unusual academic and research programs that sustained this interdisciplinary degree in the field of medical informatics.

Background

In 1996 I was admitted to the two-year Masters in Architectural Studies Program in Design Technologies, offered by the Department of Architecture, at MIT. After completing the masters, I embarked on a three-way interdisciplinary Ph.D. in Design Technologies; Science, Technology and Society; and Medical Informatics. Throughout my masters and Ph.D. programs at MIT, my academic advisor, in Design Technologies has been Professor William Porter, Muriel Leventhal and Norman Leventhal Professor of Architecture and Planning.

One of the applied research groups in Design Technologies was the Space Planning and Organization Research Group (SPORG) found at www.sporg.mit.edu. This committed group of researchers, which includes Turid Horgen, Mike Joroff, William Porter, and Donald Schön (deceased), together with their graduate students, studied how the workplace interacts with work practice. Grounded in *Process Architecture Theory* and concepts, "researchers and stakeholders collaboratively rethink the dynamic relationship between work processes and the spatial, technological, financial, and organizational environments within which they occur. Action Research serves as a means of intervention and organizational learning. This situated approach to workplace design is particularly suited to organizations in flux --- organizations undergoing: a merger, transformation in core business, or systems–wide changes to its telecommunications infrastructure." (Horgen, Joroff, Porter, & Schön, 1999) In other words, precisely the kind of work environments that medical infomaticians call home.

During my masters and Ph.D. programs I was a research assistant, first on a departmental project, subsequently with SPORG, and finally with an independent healthcare provider. Throughout, my research has focused on investigating how practitioners and provider organizations integrate the computer and web into healthcare delivery. A brief overview of the research undertaken over the past five years will establish the background I'll be drawing on throughout this document. As well, the overview will establish the scope of the graduate research undertaken, namely, that I experienced barriers to and motivators for integrating the computer and web into medical practice from both the bottom up, that is through the eyes of the individual practitioner, and from the top down, namely, from the provider organization's senior management perspective.

Graduate research program

From September 1996 - January 1997, my first term at MIT, I was a Research Assistant on a National Healthcare Project jointly undertaken by DARPA and the MIT Department of Architecture. The project focused on developing an interdisciplinary vision for national healthcare delivery. I also worked on two related pilot projects called *The Operating Room of the Future* and *Hyacinth*. The former investigates how successive and cumulative generations of technology are integrated into surgical environments; the latter was a framework for a web-based, patient-centered electronic medical record. While working on the National Healthcare Project I met the contact for my Ph.D. fieldwork, John A. Coller, MD, Assistant Clinical Professor of Surgery, Tufts University School of Medicine; Senior Staff Surgeon, Department of Colon and Rectal Surgery, Lahey Clinic.

January 1997 - August 1997 I became a SPORG research assistant to Turid Horgen, an MIT research associate working on the *Opening up the Practice Project*. This project was a subset of a larger project, *The Model Teaching Practice*, supported by the PEW Trust Fund. The project was directed by Gordon Moore M.D., Director of Teaching Programs for Harvard Pilgrim Healthcare. In the capacity of research

assistant, I carried out an in-depth ethnography of the practices of five primary care physicians in a staff-model health maintenance organization's internal medicine department. Data gathered during the fieldwork was analyzed for "Best of Breed" practices within that working environment. Results of the analysis were reflected back to the physicians who used the profiles to address systems problems and challenges posed by unproductive individual practice patterns. Subsequently, one of the five practitioners commissioned a case study.

September 1997 - May 1998, I carried out an extensive ethnography of a single primary care physician's practice and developed the findings into a case study. The case study, titled *Primary Care Practice: By Default or By Design,* was submitted as my masters thesis in Design Technologies. In essence, this successful primary care physician reported that he did not have enough support for his practice, and predicted that the incoming electronic medical record would decrease his efficiency. In order to understand why successful electronic medical record implementation is so elusive and to develop a better understanding of why failure is so common, a detailed understanding of the practitioner's work practice and practice environment is required. The four aims of the ethnography were to: 1. produce an in-depth profile of the functional status of the practitioners' primary care practice; 2. develop descriptive and analytical tools to determine the functional status of this primary care practice; 3. generate a theory relating the functional status of this primary care practice environment to the success or failure of electronic medical record implementation; and 4. identify a strategy for improving the functional status of primary care practice. Research results supported the hypothesis that the overall efficiency of a healthcare unit prior to implementation has direct bearing on the success or failure of electronic medical record implementation, and confirmed that the health maintenance organization's current infrastructure supported administrative practice not clinical practice.

September 1998 - March 1999, I became a Principal Researcher for a senior clinician in a provider organization. (This same provider organization was, some months later, to become the field site for my dissertation research.) In the capacity of Principal Researcher, I carried out an in-depth comparative analysis of three telemedicine programs. Initially, I developed an overview of five telemedicine programs in the greater Boston Area and one telemedicine program in Vermont. Then, I selected three programs and profiled them in depth. The three programs included: 1. Fletcher Allen Health Care in Vermont (a statewide primarily rural program networking physicians to physicians and physicians to specialists), 2. Partners' Telemedicine Program (a research program focused on delivering health care directly to patients in their homes), and finally, 3. New England Medical Center's Telemedicine Program (does pioneering work in international telemedicine). The purpose of the profiles was to assist the provider organization in determining its own strategic telemedicine trajectory, and the requisite technology and administrative planning required to implement it. This overview of the five telemedicine programs led the provider organization to commission a formal Telemedicine Needs Assessment.

August 1999 - February 2000 I became senior consultant to the same provider organization's Telemedicine Task Force. Under the joint direction of a senior administrator and a senior medical staff member, I conducted a Telemedicine Needs Assessment for the provider organization's two hospitals and its 29 community group practices. Findings from in-depth cross-institutional interviews were distilled into a 68-question survey covering five domains: 1. computer access and use; 2. web access and use; 3. remote monitoring and management; 4. information, education, and training; and 5. technology and innovation. Of the 586 practitioners surveyed, 423 (72%) responded. The Telemedicine Needs Assessment constitutes my dissertation research and is the primary focus of this document.

Since February 2000, work related to my dissertation has included designing telehealth evaluation plans for the Canadian Federal Government's *Canadian Health Infostructure Partnership Program* (CHIPP) grant submissions. These extensive evaluation plans focus on electronic medical records and remote monitoring and management applications for acute and chronic disease patient populations. A sample

evaluation plan for a telemedicine program proposing remote monitoring and management of chronic heart failure patients is attached as Appendix A.

To summarize, the breadth and focus of these Masters and Ph.D. research programs has resulted in a grounded and scaleable understanding of the issues specific to integrating the computer and web into healthcare delivery. I have investigated technology-enablement issues from the individual practitioner's perspective as well as from the viewpoint of the single provider organization. The masters program focused on the single practitioner charged with the task of integrating an electronic medical record into his work practice; the Ph.D. research program focused on how a single distributed provider organization evaluates a potential telemedicine implementation across its two hospitals and 29 community group practices.

Finally, this work has benefited from a complementary program of qualitative and quantitative methodologies. The Masters thesis was based on ethnographic fieldwork; the Ph.D. fieldwork leveraged that ethnographic tool set into designing and carrying out a survey. Findings from the survey led to thinking statistically about many of the same computer and web enablement issues that emerged from the Telemedicine Needs Assessment's qualitative data: namely, interviews, observation, and participant observation. Deploying qualitative and quantitative methodologies in concert allowed me to toggle back and forth between the perceived needs of the individual and the perceived needs of the provider organization.

Academic program

The underlying strength of this academic program is that it has been interdisciplinary. The Ph.D. program has three foci: Design Technologies with Professor William Porter; Science, Technology and Society with Professor Michael Fischer; and Medical Informatics with Dr. Isaac Kohane. Understanding how the computer and web are assimilated into healthcare delivery requires: a theory for understanding the relationship between work and work practice (SPORG's Process Architecture principals and concepts); qualitative and quantitative methodologies (the ethnography); and most importantly a subject, namely, computer and web enablement (the Telemedicine Needs Assessment). The combined application of these three disciplines has proved key to understanding the issues confronting computer and web enablement in the healthcare delivery sector.

Having established the thrust of my interdisciplinary program and identified the research projects specific to my Masters and Ph.D., the Introduction will now present the subject that connects them, namely, the technology needs assessment.

Excerpt from field notes based on an interview with a community group practice-based physician:

Dr. Snow loves to go and wander around Home Depot. His wife calls it "ToysRus for men." Dr. Snow says that the physicians' use of the computer is analogous to his Home Depot meanderings. "Sometimes you don't know what you want and have to see what there is before you can think of a use for it. Sometimes you have to be led."

Excerpt from life:

Having bagged my groceries, Mr. Belbin Senior, well into his seventies, walked me to my car. En route, I commented how glad I was to return home to St. John's where the quality of life is high. "It's the little things," I continued, "like having your groceries carried out to your car that make all the difference." "Yes," Mr. Belbin said thoughtfully, "Small will get you anywhere you want to go in life."

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1. INTRODUCTION

1.1 Background

Broadly stated, this dissertation focuses on how practitioners and provider organizations integrate the computer and web into healthcare delivery. Specifically, this document reports qualitative and quantitative findings from a provider organization's Telemedicine Needs Assessment. The four products that emerged from the Telemedicine Needs Assessment and constitute the body of this dissertation are:

1. the development of a needs assessment theory and methodology;

2. a typology of barriers to the integration of computer and web-based technologies into healthcare delivery;

3. a framework which defines and integrates real and virtual healthcare delivery; and,

4. a model for systems-based clinical and telecommunications integrated delivery networks that supports real and virtual healthcare delivery.

However, prior to embarking on the dissertation proper, I want to establish what a *technology needs assessment* is and, similarly, define *telemedicine.* Also, I want to address why I chose to focus my dissertation research on a telemedicine needs assessment, and establish the potential contribution this work can make to the field of medical informatics. The introduction concludes with a thumbnail sketch of each chapter.

1.2 Technology needs assessment

Presently there is considerable pressure on practitioners to integrate communication and information technologies, such as computers, the web, on-line electronic medical records, decision support systems, evidence based protocols, telemedicine, and so on, into clinical practice. In order to respond to these pressures and expectations there must be a greater understanding of the computer and web access, use, and perceived needs of both practitioners and provider organizations. Although medical informatics researchers agree that the first step towards greater understanding is a thorough Needs Assessment (Aas, 1999; Anderson, Aydin, & Jay, 1994; Field, 1996; Friedman & Wyatt, 1997), there is confusion over what exactly a needs assessment is and consequently, how to carry one out.

It cannot be stated plainly or often enough how important it is for a provider organization to conduct a technology needs assessment. The purpose of even the most basic needs assessment is to establish the provider organization's computer and web access, use, and perceived needs baseline -- a baseline against which the success, failure, or potential usefulness of any future medical informatics implementation is evaluated. Ideally, a medical informatics implementation would proceed as follows: first, a provider organization would carry out a needs assessment. Second, the organization would implement the appropriate technology as determined by the needs assessment. Third, as previously noted, the success, failure, or potential usefulness of that implementation would be measured against the needs assessment baseline.

The greatest barrier to carrying out a technology needs assessment is the nature of the needs assessment itself. Unlike technology evaluations, supported by a substantive and growing body of medical informatics literature on how to conduct them (Bashshur, 1995; Field, 1996; Friedman & Wyatt, 1997; Heathfield, Pitty, & Hanka, 1998; Lewin Group, 2000; Perednia, 1995; Scott, Coates, & McCarthy, 1999), information on how to conduct a technology needs assessment remains unrealized. To elaborate, a technology evaluation is a post hoc process: dimensions to be measured are established a priori, for

example: decreased costs, increased production, or the removal of certain barriers. Furthermore, the evaluation tools themselves are becoming standardized (Cork, Detmer, & Friedman, 1998; Field, 1996; Nykanen et al., 1999; Talmon et al., 2000; VATAM, 2001). In contrast, the needs assessment, like the practice of medicine itself, is an art form. The needs assessment process is analogous to the practitioners' response to the patients' complaint, "*I don't feel well*!" Protocols and tools abound, but the art is to discern the patient's, or provider organization's true needs, and titrate the analytical framework, tools, and protocols accordingly. As in the case of a particularly challenging clinical case, new needs assessment tools and analytical frameworks may even be requisitioned on-the-fly. Clearly, the needs assessment modus operandi "*I don't know what I'm looking for but I'll recognize it when I see it*", is hard to justify on a grant proposal, rationalize to senior management, or delegate to others.

1.3 Telemedicine Defined

The Institute of Medicine defines telemedicine as "*the use of digital information and communication technologies to support and deliver healthcare when distance separates the participants*". (Field, 1996). This definition of telemedicine, which is synonymous with telehealth, encompasses the following teletechnologies: analogue, digital, and cellular telephones; faxes; video teleconferencing; radio; and all web based communications and services including, but not limited to: web portals, e-mail, nurse triage, expert advice, training and educational material, web-casts, on-line support groups, chat groups, list servs, interactive assessment tools, and so on. In other words this definition of telemedicine accommodates all forms of on-line healthcare delivery, and the requisite integrated clinical and telecommunications delivery networks to support them.

As these technologies continue to converge and become increasingly web-based, the now somewhat antiquated term *telemedicine*, may well give way to *virtual* or *web-based healthcare delivery*. Regardless of evolving nomenclature, the point is convergence. To elaborate, many of the challenges and issues that telemedicine has articulated and struggled with over the past 60 years, specific to healthcare delivery over phone lines, have direct relevance for effecting healthcare delivery over the web. In both instances, healthcare delivery over phone lines and healthcare delivery via the web conform to the Institute of Medicine's definition of telemedicine wherein "*digital information and communication technologies are used to support and deliver healthcare when distance separates the participants*". Envisioning the real-virtual healthcare continuum and its requisite clinical, administrative, and technological infrastructure -- not to mention a business model -- poses a titanic challenge to the healthcare delivery sector.

1.4 Dissertation research: focus and importance

This challenge brings us back full circle to the dissertation research, which investigates how practitioners and provider organizations integrate the computer and web into real and virtual healthcare delivery. The research questions driving this dissertation mirror the scale and potential of the computer and web technologies themselves: "*What would a big-picture integrating real and virtual healthcare delivery look like? How can clinical and telecommunications integrated delivery networks be configured to support computer and web-based real and virtual healthcare delivery? How can we help practitioners and provider organizations integrate the computer and web into clinical practice? What are the barriers to integration? What are the steps that a provider organization can take towards computer and web enablement*", and so on? These are the very questions that directed the research program reported in this document.

The value of this research to fellow medical informatics researchers is that answers to these research questions are generalizable. Moreover, the findings are of particular interest to provider organizations and researchers alike, because of the setting where this research took place -- a provider organization consisting of two hospitals and twenty-nine community group practices distributed throughout the State

of Massachusetts. In comparison, prior research on practitioners' computer and web enablement has been carried out, for the large part, within academic settings (Cook, Hartman, & Russell, 1998; Jerant & Lloyd, 2000; Tierney, Overhage, McDonald, & Wolinsky, 1994; Weiner et al., 1999), or across professional organizations (Latcher, Nelson, Bylsma, & Spena, 2000). Access to a single, distributed, provider organization, and for such an extended period of time, is highly unusual. In a nutshell, this dissertation research provides a robust snapshot of "Digital Diffusion in the Clinical Trenches."

1.5 Overview of the chapters

To conclude, chapter One presents a Needs Assessment Theory derived from Process Architecture and provides a detailed account of the needs assessment methodology that has been developed. Chapter Two presents the quantitative data, namely, findings from the Telemedicine Needs Assessment survey. Chapter Three presents the qualitative data resulting from the interviews, observation, and participant observation. In effect, Chapter Three proposes a typology of barriers to computer and web enablement. Chapter Four offers an emergent framework integrating real and virtual healthcare delivery. Chapter Five proposes a systems-based telemedicine model to provide the administrative, clinical, technical, and telecommunications support required by the framework for real and virtual healthcare delivery. The document concludes by proposing possible *next steps* for fellow researchers.

Please note that throughout the document every attempt has been made to ensure the anonymity of both the individuals and provider organization. Names, when used, are factitious

2. NEEDS ASSESSMENT THEORY AND METHODOLOGY

2.1 Introduction

This dissertation investigates how practitioners and provider organizations integrate the computer and web into healthcare delivery. The opportunity that afforded this research was a Telemedicine Needs Assessment commissioned by a Massachusetts-based provider organization. As the Telemedicine Needs Assessment process unfolded, a needs assessment theory and a needs assessment methodology emerged. What distinguishes the needs assessment theory and methodology presented here are their generalizability. To elaborate, the needs assessment theory and methodology are not specific to telemedicine but rather can be adapted and applied to any medical informatics technology under consideration for implementation.

Material in this chapter is presented in five sections. Section One introduces the site, sample, and the provider organization's rationale for commissioning a Telemedicine Needs Assessment. Section Two presents Process Architecture's espoused theory, namely, that work cannot be conceived of and discussed separate and apart from work practice. The section then establishes how the theory was assimilated into the combined qualitative and quantitative methodological research design. Section Three details the qualitative and quantitative ethnographic tools used. Section Four identifies process architecture concepts, namely; dynamic coherence, uneven development, design inquiry, and finally, collaborative engagement, all of which can potentially inform the needs assessment tool development and data analysis. Having established the site, sample, and tools, Section Five differentiates between the Telemedicine Needs Assessment that culminated in a report for the client, and my dissertation research resulting in this document. This chapter lays the groundwork for chapters, Two and Three. Chapter Two offers the quantitative data from the Telemedicine Needs Assessment, namely, findings from the survey. Chapter Three presents the qualitative data resulting from the interviews, observation, and participant observation.

2.2 Section One: the site, sample, and provider organization's rationale for the needs assessment

A clinician and champion of telemedicine, whom I met back in 1996 while working on the National Healthcare Project during my first term at MIT, facilitated my entry to the fieldwork site. This senior clinician commissioned PHASE I: A Profile of Four Telemedicine Programs, January - June 1999. Subsequently, the same clinician, together with the provider organization's senior administration, jointly commissioned PHASE II: A Telemedicine Needs Assessment, August 1999 – February 2000. This dissertation document focuses primarily on the PHASE II Telemedicine Needs Assessment.

The provider organization, where both the PHASE I Profile of Four Telemedicine Programs and the PHASE II Telemedicine Needs Assessment both took place, consists of two hospitals and 29 community group practices located throughout Massachusetts. This physician-run organization serves 350,000 active patients, and processes 1,000,000 patient visits per year. Presently, the provider organization attracts 120 new patients per day. The two hospitals are established tertiary care facilities located 18 kilometers from each other. The 29 community group practices range from two to fifteen person practices and are distributed across the state. The provider organization purchased the majority of community group practices four years earlier (1996), in the wake of managed care; the rationale being to secure market share. At the time of this study, the community group practices' primary concern was that their autonomy and independence not be subsumed by the provider organization, perceived to be resident in the two hospitals. The hospitals' primary concern was to "make good" on their investment in buying the community group practices by receiving increased specialty referrals from the community group practices' practitioners.

The provider organization's reasons for commissioning the Telemedicine Needs Assessment were fourfold. The provider organization wanted to:

1. establish its practitioners' computer and web access, use, and perceived needs baseline -- a baseline against which the success, failure, or potential usefulness of any future medical informatics implementation would be evaluated;

2. identify the factors influencing practitioners' computer and web enablement. Establishing these factors would assist the provider organization in determining and aligning its strategic clinical and administrative business trajectories with its information systems and information technology needs;

3. project realistic timelines for moving towards a paperless environment and an electronic medical record -- goals requiring ubiquitous computer and web enablement; and finally,

4. determine if telemedicine, particularly the web-based remote monitoring and management of acute and chronic disease populations with call-center support, would complement the organization's extensive in-patient and out-patient case management program.

It would be misleading to infer that, from the onset, the provider organization knew exactly why it was commissioning the telemedicine needs assessment and the specific aims it expected the needs assessment to address. In fact, at the onset, only the goal was clear -- the provider organization wanted to commission a telemedicine needs assessment. In contrast, the four aims of the Telemedicine Needs Assessment, listed above, emerged over time and out of the needs assessment process. This provider organization's quandary, knowing that they needed something but not knowing exactly what that something was or how to achieve it, is the norm and underscores the purpose of a needs assessment.

The purpose of any medical informatics needs assessment is to help the client articulate, from multiple stakeholders' perspectives, precisely what the clients' needs are, then assist the client in determining the most appropriate means of addressing those needs. As noted earlier in the preceding chapter, the most important product resulting from a thorough needs assessment is the establishment of a clients' technology access, use, and perceived needs baseline -- a baseline against which the success, failure, or potential usefulness of any future medical informatics implementation is evaluated. Boldly stated, without the baseline, an evaluation of a medical informatics technology is meaningless, and furthermore, strategic clinical, administrative, and technological trajectories specific to medical informatics implementations are unfounded. In other words, a provider organization must have a needs assessment baseline in order to say, with authority, this is where the organization is right now, these are realistic goals, and this is how we are going to achieve them.

2.3 Section Two: Process Architecture informs needs assessment methodology and design

In recent years, researchers have used established theories from other disciplines to better understand and predict the role that telemedicine plays in healthcare delivery. Researchers have deployed *Systems Dynamic Theory* used to describe the relationship between quality of care, accessibility, and cost effectiveness (Valero et al., 2001); the *Theory of Reasoned Action*, a predictive model to predict practitioners' attitudes towards implementation (Araugo, Paiva, Jesuino, & Magallaes, 2000); *The Theory of Planned Behavior* to investigate technology acceptance by physicians in practice (Hu & Chau, 1999); the *Theory of Knowledge Barriers*, to explain why diffusion remains low (Tanriverdi & Iacono, 1999); and finally, a familiar face to Process Architects, *Innovation and Network Theory* to develop hypothesis about conditions that will hinder or facilitate sustained use of telemedicine (Wells & Lemak, 1996). Although the deployment of these theories is valuable, none of the above, individually, offer a seminal guiding construct or grounding principal, as it were, for the field of medical informatics.

There are, however, two research groups that have made important contributions to our knowledge about *use* specific to telemedicine. The first research group uses *Gidden's Structuration Theory* to develop a theory of *use* versus physicians' *perceived needs* for communication and expert advice systems (Lehoux, Sciotte & Lacroix, 1999). The second body of work proposes a methodology for developing and implementing *Best Practices*, in telehealth and telemedicine (Picot, 1999). Although both of these parties promote applied theories, which sustain and in effect underwrite development within the field of medical informatics, I propose that medical infomaticians would be well served to investigate a theory or set of professional constructs that guide and inform on-going *processes* rather than after-the-fact analysis. Simply stated, technology needs assessments are a series of overlapping processes, and as such need a guiding theory and constructs that will inform these processes.

A thorough needs assessment is, in effect, an ethnography. An ethnography, by definition, refers to the collection of data, quantitative and or qualitative, that describe a culture (Bernard, 1995). The ethnography presented here, albeit atypical due to the emphasis on analysis rather than description, is of a provider organization and its culture of computer and web enablement. Ethnography is a longstanding research methodology in the social sciences and has much to offer the field of medical informatics. This is particularly true when the ethnography is informed by Process Architecture constructs and processes. Process Architecture, developed by the SPORG Research Group at MIT in the Department of Architecture's Design Technology Division, maintains that "work cannot be studied or understood separate and apart from work practice (Horgen, et al., 1998)."

This seminal Process Architecture belief, that "work cannot be conceived of and discussed separate and apart from work practice" underscores medical informatics greatest vulnerability: our downfall, as researchers and developers, has been conceptualizing *work* separate and apart from *work practice*. The past quarter of a century bears witness to medical informatics technologies and software products, decision support systems and electronic medical records, to name two, that work in the computer lab but struggle or even fail repeatedly in the workplace. The needs assessment, I propose, is the first step in ensuring that *work* and *work practice* remain inextricably linked. In other words, the relationships between work and work practice cited in the needs assessment set the groundwork for maintaining that work/work practice relationship throughout iterative cycles of a medical informatics tool's design and development, implementation, and evaluation.

Maintaining the link between work and work practice requires a combined qualitative and quantitative research program. Throughout this needs assessment, the qualitative methodology included cross-sectional, institution-wide, in-depth interviews, and participant observation at administrative and clinical meetings and during day-to-day operations at the provider organization. The quantitative research program focused on the telemedicine needs assessment survey distributed to all clinical practitioners to assess current computer, web, and telemedicine technology usage and needs.

There are direct parallels between work and work practice and quantitative and qualitative research methodologies. When we talk about work we are using an abstract term, just as quantitative data, numbers, are an abstraction. In contrast, when we talk about work practice and qualitative data, both are specific to *being there*. Although the differences between abstractions and being rooted in the reality are interesting to explore, what is of particular importance to researchers and developers here are the advantages of deploying complementary quantitative and qualitative research programs when examining work/work practice.

The advantages of deploying complementary quantitative and qualitative research programs when investigating work/work practice are threefold:

1. Complementary qualitative and quantitative methodologies inform one another. For example, during the interview process, numerous practitioners voiced negative feedback about the provider organization's public internet site for health information: "It's useless. It doesn't have anything worthwhile on it." This qualitative data-point subsequently informed the design of the following survey questions: A. "Do you refer patients to the provider organization web site for health information?" and B. "Name the web sites for medical information that you recommend to your patients." Survey respondents' answers to these questions determined that only 4% of practitioners referred patients to the provider organization's web site for medical information, and furthermore, that the majority of practitioners referred patients to their specialty website for medical information. Based on these survey findings, the obvious follow up interview questions are, "Why do you refer patients to your specialty site for medical information?" and "Describe the kind of site you'd like to refer your patients to for medical information." -- and the cycle of one methodology informing and building on the other continues.

2. Complementary qualitative and quantitative methodologies allow the researcher to generalize from the particular. For example, the inadequacies of the provider organization's intranet, from the practitioners' perspective, emerged during interviews with individuals: the prevalence of those individual practitioners' views was determined by the survey.

3. Finally, and as importantly, a combined research methodology for needs assessments allows researchers to quantify a provider organizations' computer and web enablement baseline. Although comparative descriptions of qualitative data are useful, provider organizations are acculturated to comparisons using quantitative data. Provider organizations want to be able to say, for example, in 2000, 75% of the provider organization's practitioner population stated that training on the institution's e-mail handler was "inadequate or non-existent"; by 2001, x% reported the same finding, and so on.

Before concluding this section, I want to identify a contemporary principle driving architecture and propose a principle to guide developments within medical informatics. Researchers and developers have produced a growing body of literature confirming that the medical informatics tools we create will only be used if those tools make practitioners' work practice more efficient (Tang & Patel, 1994). Unfortunately, medical informatics technologies can, depending on work practice, make a practitioner less efficient. A case in point is the practitioner I observed during his three and a half hour office session.

My observations of the practitioner's work practice confirmed that prior to the electronic medical record implementation there was already a lack of fit between the practitioner's idiosyncratic work practice needs and the existing computer interface: the log-on process took too long and he couldn't access the other practitioners' appointment schedules. The practitioner predicted that the incoming electronic medical record would make his work practice even less efficient on two additional accounts. At least initially, there was some question of how accessible the electronic medical record would be from home, at night, and on the weekends -- times when he presently logs on from home to catch up on paper work. Also, the incoming electronic medical record will require him to access the computer more often than he is presently doing.

The following excerpt from my observation notes substantiates his frustration and illustrates how the lack of fit between his work practice needs and the current technology directly influences his efficiency. "*The next challenge is a walk-in patient who wants to be seen but Dr. Harris has a full schedule. He points out the limitations of the current computer interface, in that every time he wants to use the machine he has to go through the time-consuming process of logging on. He repeats this time-consuming security measure*

an estimated 15 times a day. Once logged on, there is no way for him to query if there is a practitioner in internal medicine A or B who has an appointment opening and can see the patient."

Without question, the more efficient a technology potentially makes us, the more predisposed we are to using it. Prosaic as the reality is, medical informatics technologies are subject to these same laws. In Architecture an oft quoted touchstone, erroneously attributed to architect Louis Sullivan is: *"form follows function"* (Van Zanten, 2000): a comparable principle for those of us working in medical informatics might be *"fit follows efficiency"*.

To summarize, it is imperative that medical infomaticians assimilate and internalize the Process Architecture belief that work cannot be conceptualized separate and apart from work practice. Furthermore, work/work practice is best understood using a combined qualitative and quantitative methodology. Finally, the successful uptake of a medical informatics technology depends on its ability to increase the end users' efficiency, and efficiency is increased in direct proportion to the fit between the medical informatics technology and work practice.

Having described how Process Architecture beliefs can inform a needs assessment, and having underscored the importance of a combined qualitative and quantitative methodology, I will now describe the qualitative and quantitative ethnographic tools used to operationalize the needs assessment.

2.4 Section Three: qualitative and quantitative ethnographic tools

The ethnographic tools used throughout included: interviews, observation, participant observation, and a survey. There was also a crucial ongoing relationship with a key informant. This section provides background information on these tools and demonstrates how they are used to gather data. The specifics of how these quantitative and qualitative tools were deployed during the Telemedicine Needs Assessment, the data they generated, what analysis revealed, the implications of the findings, and last but not least, the tools' inevitable shortcomings, are detailed in Chapters Two and Three.

2.4.1 Interviews

The interviews were unstructured and lasted, on average, from forty-five minutes to an hour and a half. Following the methodology described by Weiss (1994) in his Book *"Learning From Strangers: The Art and Method of Qualitative Interview Studies"*, the sessions were conducted as follows: I introduced myself as the consultant for the Telemedicine Task Force and stated that I was also a Ph.D. candidate pursuing an interdisciplinary degree in the field of medical informatics at MIT. I then went on to note that my dissertation research focused on how practitioners integrated the computer and web into medical practice and that the research that I was conducting for the Telemedicine Needs Assessment Task Force might also form part of my dissertation. It is important to note that permission to use the Telemedicine Needs Assessment data for my dissertation was included in my contract as senior telemedicine consultant to the provider organization's Telemedicine Task Force.

Having introduced myself, I then initiated the interview by asking the interviewee to tell me about their own computer and web use and experiences at work; what worked well and more importantly what didn't; what made their work practice more efficient; what they found particularly frustrating; what they would like to see in the future; and finally, what computer and web technologies, if any, would really address their needs. Almost without exception this opened the floodgates. The predominant interview technique was silent probing. At the end of the interview, if appropriate, I asked if there was someone in particular that I should talk to or a particular medical event that I should observe. In some cases, if access looked like a potential barrier, I would ask the interviewee to make a telephone call or e-mail introduction on my behalf.

Interestingly, practitioners, and in particular the community group practice practitioners, were highly averse, and in some instances overtly hostile, to having interviews taped. Reasons for the resistance to being taped coalesced into three categories: practitioners were sensitized to litigation; respondents did not want the information shared with administration; and finally, community group practice-based practitioners felt certain information would jeopardize their relationship with the hospitals. Consequently, I took extensive notes throughout the interview and augmented those notes immediately following the interview session. If a particularly sensitive issue was covered, then a copy of my interview notes was delivered to the interviewee who was encouraged to review them and augment, revise, or correct the content. Anonymity was guaranteed.

Immediately following an interview I organized the subject matter that the interviewee covered under topic headings, for example, *"e-mail", "referral patterns", "tech support"*, and so on. Topics or issues were flagged if they were what I call *hot buttons* -- issues or topics that were likely to strike the *resonant chord* with fellow practitioners. These *hot buttons* were subsequently distilled into potential survey questions or tagged as issues to raise in follow-up or future interviews. Data was also flagged if it related to barriers to the integration of the computer and web into medical practice. The typology of these barriers is the subject of Chapter Three. Following in Figure 1, is an excerpt from an interview with a community group practice practitioner. The *hot buttons* are underlined. Text that relates to the typology of barriers to computer and web enablement has been bolded.

Figure 1: Excerpts from an interview with Dr. Snow, a community group practice practitioner

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- *Colleagueship cited as fundamental building block:* The Wintergreen Internal Medical Associates Community group practice is located approximately 70 miles from the primary tertiary care hospital. Presently, the Wintergreen physicians can't put faces to those hospital-based physician's names. Dr. Snow maintains that video teleconferencing for grand rounds and educational sessions would impact directly on referral patterns and cement the practice's relationship with the provider organization: *"It would make a huge difference to call a guy and see his face"...." Sometimes it is the singer and not the song that saves the day"*. Dr. Snow wants to attend grand rounds, medical meetings, and lectures in cyberspace. Dr. Snow maintains that if you can make the community group practice practitioners feel part of the provider organization community, then everything else will fall into place. The community group practice practitioners are aware that the provider organization wants them to send all their interesting patients to them but the reality is that collegiality is the drawing card for doing so.

- *Existing referral patterns:* Convenience is a big issue for patients because the provider organization's primary hospital is 140 miles round trip. Even more important are the relationships that the community group practice physicians already have established with their colleagues at the local hospital. These relationships are convenient and historical. If Dr. Snow has a dermatology consult that he is curious about, then he can just pick up the phone and his colleagues will get right back to him. Feedback is instantaneous. *"Collegiality is an instant consult."* Presently, this level of service is also provided in radiology and orthopedics.

- *Existing tech support:* Dr. Snow says that the tech support at the local hospital (where he is Medical Director) is excellent. *"They will come to your office and even your home to get physicians up and running."* Presently, the **Wintergreen practice is not on the provider organization's intranet.**

- E-mail: The provider organization originally used Pegasus because it was free. "**Microsoft Outlook which is replacing Pegasus is not intuitive like the MacIntosh interface**. This is a problem. The **e-mail should also be secure**. If it is easy to use it will hook people.

2.4.2 Observation and participant observation

In the case of observation and participant observation, the tool to be deployed is the researcher. Bernard (1995) says "*participant observation involves establishing rapport in a new community; learning to act so that people go about their business as usual when you show up; and removing yourself every day from cultural immersion so that you can intellectualize what you're learned, put it in perspective, and write about it convincingly.*". The distinction between observation and participant observation is debatable. I've differentiated between the two because, on the one hand, certain tasks that I participated in were clearly related to my role as a telemedicine consultant to the Telemedicine Task Force. On the other hand, a significant amount of the field research had less to do with the report for the Task Force and more to do with the events I was observing specific to the dissertation.

The modus operandi that the researcher brings to these tasks, of observation and participant observation, is of utmost importance. Once again, there is a mindset used in the practice of Process Architecture that is useful in our work as medical informatics researchers and developers. In Process Architecture, the modus operandi is that of the *reflective practitioner*. The *reflective practitioner* is a term coined by the late Donald Schön, Ford Professor Emeritus, and a Senior Lecturer in the Department of Urban Studies and Planning at MIT. In his seminal text, *The Reflective Practitioner*, Schön (1987) describes the *knowing-in-action* that practitioners bring to their everyday lives. Inherent in *knowing-in-action* is the iterative process of *reflection-in-action*. In other words, "skilled practitioners often think about what they are doing while doing it in situations of uncertainty, uniqueness, and conflict." This reflective practitioner skill set is analogous to the process researchers goes through when they discover themselves stepping back from a situation and asking, *What's wrong with this picture?*. To elaborate, the researcher experiences a level of cognitive dissonance between the subject's espoused theory (what they are really doing) versus the theory in action (what they say they're doing). For example, the provider organization espoused that they were investigating telemedicine as a means of effecting cost savings and improving quality of care. However, as negotiations with the telemedicine progressed it became apparent that the provider organization was concerned that telemedicine's potential for savings would negatively impact the provider organization's ability to generate revenue.

"It is this capability for *reflecting-on-knowing* and *reflecting-in-action*, that allows practitioners to formulate and criticize their action strategies and their ways of framing problems and roles (Argyris & Schön, 1995)." As seen in Figures 2 and 3, this modus operandi, or mindset, of the *reflective practitioner* is integral to the path of a successful ethnographer engaged in observation and participant observation. Once again, the mindset and methodology complement one another. Moreover, together they reinforce the conceptualization of work with work practice, and provide a process for ferreting out discrepancies between the two.

Following in Figure 2 is an excerpt from a participant observation session. It is an excerpt from my notes describing a presentation that the telemedicine champion gave to the community group practice representatives at one of the representatives' monthly administrative meetings. The purpose of the presentation was to provide an overview of telemedicine technology and its potential applications within the provider organization. Additionally, this was the occasion were I was introduced to the community group practice community as the consultant/Ph.D. student from MIT, who would be contacting the community group practice practitioners on behalf of the Telemedicine Task Force. The text in Figure 2 captures what Geertz (1973) refers to as a "thick description" of the event (Geertz, 1973).

Figure 2 Participant observation notes: the telemedicine champion introduces telemedicine to the community group practice practitioners

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The Chair opened the meeting by polling how many directors had read the meeting's minutes and agenda on their e-mail. Of the 30 persons present, only one had. In fact, the thirty-something female physician sitting next to me confided that she didn't have e-mail. The chair then went on to emphasize that the directors themselves had decided that e-mail usage was a priority for the group and therefore they had better get with it. The Chair then turned the meeting over to the telemedicine champion who presented an overview of telemedicine technologies and their possible applications within the provider organization.

Following a telemedicine technology overview, the potential involvement of the affiliates was broken down into two phases. PHASE I entailed a *store and forward* asynchronous technology allowing the remote physician to send a digital image as an e-mail attachment to the specialist for consultation. PHASE II entailed videoconferencing for consultation, education, and administrative purposes. Unlike the former, the latter requires a significant investment both in terms of technological, and administrative infrastructure. The purpose of the Telemedicine presentation was to actively encourage community practice physicians to test drive the former, the relatively simple *store and forward* e-mail attachment technology.

When the presentation concluded, the Chair thanked the presenter, then pointed out to the attendees that patients were turning to alternative medicine because they were not getting the caring, human touch in medicine, and therefore one should be very cautious about incorporating these technologies into practice.

The detailed description of the event and concomitant *reflective practitioner* process produces data that, when analyzed, identifies the tensions between the community group practices and the hospitals. Identifying these tensions underscored the need for, and subsequent decision to carry out, an in-depth Location Analysis of the survey data. The purpose of the Location Analysis was to determine differences in computer and web access, use, and perceived needs between hospital-based and community group practice-based practitioners.

As in the case of the interviews, following each session of participant observation, a more formal account of the session is distilled from "scratch notes" (notes taken during the session). Once again, in the process of analyzing the data *hot buttons* are flagged and contributions to my growing typology of barriers to computer and web enablement are noted in bold. Over the course of the Telemedicine Needs Assessment and dissertation research, data from observation, participant observation sessions, and interviews were analyzed and reanalyzed in light of emergent themes.

The observation session presented in Figure 3 is an excerpt from fieldwork conducted during my masters program. The observation session profiles an internist's practice patterns during a typical three and a half hour office clinic. I've chosen to augment my dissertation research with this sample for two reasons. The first being, I want to balance the preceding qualitative data at the administrative provider organization level, with qualitative data collected at the level of the individual clinician. Second, I want to demonstrate the level of granularity, to mean the level of detail that must be observed in order to think meaningfully about aligning a medical informatics technology with work/work practice. The data captured and reported in Figure 3 exemplifies the relationship between work and work practice. Moreover, this example underscores the profound challenge posed when aligning a medical informatics technology, in this case an incoming electronic medical record, with a clinical practitioners' perceived work practice needs. Once again the sample is descriptive in that it recounts what I'm observing, and at the same time the sample is

analytical in that I'm realizing the applied skill set of the *reflective practitioner*, on-the-fly (private thoughts).

Figure 3. Observation notes: excerpt from observations of Dr. Harris's work/work practice pattern

What is happening:

- I arrived at 8:30 a.m. and Dr. Harris was already with a patient. On principle he does not double book, so he extends his office hours and has patients come in before and after his scheduled sessions. The computerized appointment system interface does not allow for this, so the appointments are noted either in Dr. Harris's head or on a piece of paper. These extended hours also mean that Yolanda the medical assistant often has to extend her working hours to complement his. As it turned out, the patient was in the examining room but Dr. Harris was nowhere to be found. None of the support staff knew that, in fact, he had gone to another department to get information on the patient that he was seeing (**2**)(**3**).

- Dr. Harris's office, especially his desk, is a spectacle to behold. There are stacks of blue slips (phone messages) everywhere and the paperwork is already two inches thick on his desk. The organization is not transparent but over the course of the morning his *system* is revealed. He has a red file for things that can only be attended to during office hours, such as getting in touch with colleagues. He *fingers* this file several times a day. There is also a blue file, which contains calls that can be made from home after hours and on weekends. There is a pile of prescription forms, which he keeps stacked in front of the computer screen. There are several mysterious piles on floor, some to be shredded, some to be returned to record keeping. He also re-prioritizes his blue slips several times in the course of the morning, very few of which are delegated to support staff. When the staff deliver blue slips to his room, they put them in three different places: the box on his door, his chair, or his black stacking files on top of the filing cabinet. The labels that were on the stacking trays have been removed causing further confusion. The windowsill is also full of files (**6**).

- Dr. Harris has to assess in between patients if the next one is coming or has cancelled. Because he has a tendency to fall behind, it becomes difficult to assess if the 'slippage' is to be attributed to him or the patients. There is no way to know if a patient has arrived unless the encounter form is placed in the box on his door. To assess if the patient has cancelled or is just late, he has to log in and check on the computer, (which may not be up to date), track down the medical assistant, or call the receptionist into his office so that the patient's name is not broadcast all over the waiting room. None of these methods were cited as efficient or satisfactory. They waste his time (**15**).

Private thoughts:

(**2**) As the morning wore on I noticed that Dr. Harris's patients were not always in the room ready for him. This could be due to one or a combination of the following:

- Staff assume that he is behind so there isn't any pressure on them to keep things on stream,
- Staff can't see his office or examining rooms from their work stations so they can't see where he is in his work flow,
- Patients are often kept waiting so they tend to come late,
- Patients are often elderly and take much longer to get dressed and undressed, so Dr. Harris leaves them and often starts on the next patient while he is waiting for the first patient to get dressed. This is very confusing for the staff who aren't able to keep an eye on where Dr. Harris is in the flow.

- This means that Dr. Harris frequently comes up to the front desk and personally escorts the next patient down to the office.

(6) Dr. Harris needs an organizer shelf unit built around his desk and against the wall behind his desk.

(15) Because there isn't a protocol in place, it is easier for him to run around and find out.

Reflection over time:

(3) I wondered if it wasn't easier for Dr. Harris to do things himself rather than explain what he wanted done. This morning there was no opportunity to sit down with the medical assistant or call her and say, "this is how I like things to be set up; can you make sure it happens from now on."

Undoubtedly, the incoming electronic medical record is not going to solve this practitioner's espoused need for better support for his work/work practice. In fact, based on the extensive case study of this practitioner, one can postulate that the level of pre-implementation efficiency of a practice has direct bearing on the success or failure of an incoming medical informatics technology. Moreover, the electronic medical record is not going to automatically improve communication amongst all the stakeholders supporting his practice: the electronic medical record can only build on what already exists. The granular data in this excerpt underscores the crucial role that detailed needs assessments play in the successful design and implementation of medical informatics technologies, and the magnitude of the challenge faced by the medical informatics profession during the lifecycles of these technologies.

2.4.3 The Survey

The survey is a quantitative tool. In other words, "data is presented as numbers rather than as text". (Bernard, 1995). What distinguishes the 68-question survey reported in this document is the 72% response rate that it generated: 586 practitioners were surveyed; 423 responded. Often under-appreciated in survey design is the fact that a survey is really a dynamic instrument for dialogue. By that I mean a well designed survey presents an opportunity for the party administering the survey to ask something that they really want to know; and just an importantly, the survey affords an opportunity for the respondent to say something that they really want you to hear. This art of matching up what you want to know with what they want to tell you is facilitated by a preceding qualitative program of interviews, observation, and participant observation. Simply stated, it is not possible to hone in on *hot buttons* which make for *hot survey questions,* which in turn, make for *hot response rates*, without that preliminary qualitative legwork.

In addition to identifying specific questions, analysis of the qualitative data also begins to suggest an appropriate framework for quantitative tools such as the survey. In other words, as the qualitative data continues to be collected and analyzed, it becomes self-evident what general categories of questions need to be asked. These categories, of course, complement the over-arching aims of the research program, in this case the Telemedicine Needs Assessment. To reiterate, the purpose of the Telemedicine Needs Assessment survey was to assess: 1. practitioners' access to and use of the computer and the web. *(Do you have a computer supplied by the institution at work? How often do you use the computer?)* 2. practitioners' perceived need for remote monitoring and management technologies. *(Do you have chronic disease patients who would benefit from on-going remote monitoring and management at home?)* 3. practitioners' receptiveness to web based information, education, and training. (*Would you take continuing medical education over the web?*) and, finally, 4. if practitioners were interested in becoming involved in the provider organization's telemedicine or web based innovations. *(How interested are you in participating in future on-going discussion about telehealth and web innovations at the provider organization?)* A sample of the survey is attached as APPENDIX B. The specifics of the survey are the subject of Chapter Two.

2.4.4 The Informant

The key informant throughout out this entire research project, and well beyond, has been the clinician whom I had met while working in 1996 on the National Healthcare Project during my first term at MIT. Without his involvement and generosity, the breadth and depth of this research would simply not have been possible. Every morning at six this telemedicine champion picked me up on his way to the hospital. En route, outstanding events from the previous day's research would be reviewed and subjected to a rigorous analysis using the alternating frameworks of the disenchanted clinician and budding ethnographer. Then the agenda for the day would be outlined. At seven in the evening, the process would be reversed. Events that weren't covered en route were reflected upon in e-mail correspondence. The informant was not only a long standing, experienced senior insider within the organization but well versed on the history of the institution, managed care, professional medical organizations, and the American healthcare delivery system generally. Coming from the single-payer, Canadian healthcare system, I had a lot to learn; but as a social scientist, I also had a lot to offer.

The informant-mentor and I had highly complementary skill sets. I would read aloud my notes from an observational session or interview and he would situate the interviewees' comments in a professional and organizational context, thus frequently facilitating a mid-course correction on my part. Or, I would identify a question to be included in the survey: he would word it in a way that made it *practitioner friendly*. The informant was particularly good at coaching me on how to navigate the power infrastructure within the organization. For example, I would propose a survey question like *"Do you have patients that would benefit from 24/7 access to a call center staffed by qualified triage nurses?"*, clearly a hot potato, and he would tell me whom in upper management to review the question with, because they would have a vested interest in the answer. It was important to establish these alliances with senior management so that survey questions deemed too sensitive by middle management wouldn't be deleted. This kind of coaching by the informant was invaluable.

In addition to innumerable introductions, the informant made his car, (an 86 Volvo!) readily available for transport to remote community group practices for interviews, and so on. Finally, the informant, who was also on the provider organization's Medical Informatics Task Force, took me along when vetting potential technologies for the provider organization. The pros and cons of each system and their potential applicability within the provider organization would be debated on the way home. Additionally, the informant was an accomplished programmer and ardent EXCEL advocate. He built and continues to manage the survey data base. All in all, it was an extraordinary research opportunity and education with a manageable downside.

The informant co-sponsored my position, along with senior administration on the Telemedicine Task Force. Days when my administrative and clinical bosses' espoused agendas conflicted, it was an unenviable position to be in; but for the most part, it was a privileged to be able to experience and learn from their differing work/work practices first hand. Being so closely aligned with the informant also meant that I had to make conscious choices about alliances with other individuals within the provider organization. I had professional regrets about not being able to develop some of these leads. Working so closely with the informant also meant that the data I was collecting and analyzing had to be triangulated by other members of the provider organization.

When the contract as senior consultant to the Telemedicine Task Force ended, my relationship with the informant, who graciously offered to continue massaging the survey database for the benefit of my dissertation, continued. In fact, we are presently laying the groundwork for a two year follow up to the survey reported in Chapter Two.

2.5 Section four: Process Architecture concepts inform data analysis

In addition to the Process Architecture Theory that stipulates that work must not be conceived of separate and apart from work practice, there are four process architecture concepts that can inform data analysis and tool development. Those concepts are: *dynamic coherence, uneven development, design inquiry*, and *collaborative engagement*. These four concepts serve two functions. The first two concepts, *dynamic coherence* and *uneven development* are diagnostic. In other words, these concepts assist the researcher in teasing apart the specific traits of an organization in flux. The remaining two concepts are what I shall refer to as *process tools* for effecting change within an organization in flux. Within the context of this dissertation, *dynamic coherence* and *uneven development* have been used to guide data analysis. This will be readily apparent in the qualitative findings presented in the typology of barriers subject of Chapter Three. On the other hand, the concepts of *design inquiry* and *collaborative engagement* have informed the design of the framework that integrates real and virtual healthcare delivery, presented in Chapter Four and the model for systems-based infrastructure support presented in Chapter Five. Were the framework and model to be implemented, these process architecture constructs would inform the processes that the framework and model precipitate.

In their book Horgen et al., (1999) "*Excellence By Design: Transforming Workplace and Work Practice*", define these concepts as follows:

2.5.1 Dynamic coherence: "*is an evolving match between the changing work process and its workplace environment. Dynamic coherence depends upon establishing a relationship among the four principal interdependent environments for work: spatial, organizational, financial and technological. When an organization sets out to transform its work process*", as in the case of implementing telemedicine, "*it commits itself to a transformation of all these four dimensions of its work environment.*" In the typology of barriers presented in Chapter Three, it becomes apparent that the telemedicine technology and its strategic partners, which as a group form an integrated delivery network, if implemented, would potentially influence all four of these dimensions. This concept of dynamic coherence can be used as a conceptual diagnostic tool in the sense that the provider organization can't successfully implement that remote monitoring and management telemedicine technology without considering the impact it will have on these interdependent spatial, organizational, financial, and work environment domains.

2.5.2 Uneven development: "*Effective workplace-making follows a path of uneven development in which innovation in one aspect of the workplace creates new potentials or demands for innovation in other areas*". To return to the example of the aforementioned telemedicine technology: because the telemedicine technology and the requisite web portal came bundled with communications and data management infrastructure, they offered the provider organization the opportunity to segue straight into strategic e-commerce dare-delivery applications and related business opportunities. These technologies were, in effect, imposing a new advertising, marketing, and business culture that historically had been outside the purview of traditional hands-on clinical practice.

2.5.3 Design inquiry: This term, borrowed from the philosopher John Dewey (1938), "*is a situation in which intelligent human beings engaged in transaction within their environments create a new or modified artifact through collective thoughts and action*". The framework proposed in Chapter Four is such an artifact: the framework is developed through "collective thoughts and actions". The deployment of the framework integrating real and virtual healthcare delivery presented in Chapter Four, by, for example, a liver transplant program, would necessitate design inquiry processes.

2.5.4 Collaborative engagement: "*This is defined as a process where all players move from passive to active involvement and from unilateral to collaborative design inquiry.*" Once again we can use the example of the framework integrating real and virtual healthcare delivery. Presently, the provider

organization effects a hierarchical, top-down decision-making model. In contrast, this concept of collaborative engagement portends that a better quality end product, and as importantly, better overall process, results from collaborative engagement. Again, the strength of the framework, presented in Chapter Four, is that it accommodates and is strengthened by the input of all stakeholders in the healthcare delivery system, not just senior or middle management's.

Understandably, because tenets of Process Architecture originated in northern Europe, the work done by Sjoberg and Timpka at the Linkoping University in Sweden specific to medical informatics, complements these four Process Architecture concepts. The Swedish researchers have used the objectives, processes, and ideologies expressed during *participatory design* sessions specific to healthcare information systems to assist in subsequent design decision making (Sjoberg, Timpka, 1998; Timpka et al., 1995; Vimarlund, Eriksson, & Timpka, 2001). They have also advocated the design and development of computer supported collaborative work within healthcare. Their model for collaborative work is situated in three social arenas: the societal arena, the organizational arena, and the workplace arena (Timpka & Sjoberg, 1998). These social arenas are somewhat analogous to Process Architecture's four workplace dimensions: *spatial, organizational, financial and technological.* Interestingly, some of the differences between these Process Architecture and Participatory Design approaches are attributable to a free market versus single payer healthcare delivery system. For this reason the Process Architecture constructs are more relevant to the free enterprise, American, healthcare delivery market.

2.6 Section Five: anatomy of a telemedicine needs assessment and the dissertation research

It is important to differentiate between the Telemedicine Needs Assessment commissioned by the Telemedicine Task Force and my dissertation research program. The purpose of the Telemedicine Needs Assessment was to produce a report; the purpose of the dissertation was to produce a document describing how practitioners integrate the computer and web into medical practice. Although the Telemedicine Needs Assessment Report is a valuable document, it is restricted to what the Telemedicine Task Force commissioned, namely, a report. That being said, in the process of producing the report, the seeds were laid for further analysis of the data which resulted in the four products cited at the beginning of the introduction. To reiterate, the products that emerged from the dissertation research are: 1. the development of a needs assessment theory and methodology; 2. a typology of barriers to the integration of computer and web-based technologies into healthcare delivery; 3. a framework for integrating real and virtual healthcare delivery; and finally; 4. a model for systems-based clinical and telecommunications integrated delivery networks supporting combined real and virtual healthcare delivery.

To conclude, this chapter on Needs Assessment Theory and methodology has introduced the site, sample, and the provider organization's rationale for commissioning a Telemedicine Needs Assessment. Additionally, it has established how Process Architecture constructs, if assimilated by medical infomaticians, can ground a combined qualitative and quantitative methodological research design and the tools to be deployed. Moreover, the chapter has described how Process Architecture beliefs and processes can potentially inform tool development and data analysis. Finally, the chapter differentiates between the Telemedicine Needs Assessment that culminated in a report for the client, namely the provider organization, and my dissertation research, namely an ethnography, resulting in this document.

Chapter Two will now present the quantitative data from the Telemedicine Needs Assessment survey.

3. THE TELEMEDICINE NEEDS ASSESSMENT SURVEY

3.1 Introduction

Chapter Two presents the Telemedicine Needs Assessment Survey. The format for the chapter follows the conventions of a scientific publication. It begins with an abstract which guides the reader as to what's ahead. The abstract is then followed by background information on the provider organization's rationale for carrying out a Telemedicine Needs Assessment and the aims it hopes to achieve. Next, the survey methodology is detailed and the significant findings are stated. Finally, the chapter concludes by reflecting on the significance of those findings for the provider organization and for medical informatics generally.

Viewer discretion is advised for front line administrators and clinician administrators. Findings in this chapter determine that the greatest number of significant differences between comparison groups, specific to computer and web enablement, center around issues of *use*, not access or practitioners' perceived needs for a technology. In other words, having access to a computer or web technology does not mean that the practitioner is using it. For example, 91% of respondents have e-mail access, but only 65% of respondents are using e-mail. Similarly, 91% of respondents report having access to the intranet, the provider organization's premier paperless communication channel, but only 11% are using it, and so on. Findings such as these, once again, underscore the need for medical informatics developers and researchers to conceptualize and link the computer and web technologies that they are developing directly with the end users' work/work practice.

To successfully conceptualize and link the development of a technology with work/work practice, researchers and developers have to ask and reflect on the answers to the following questions: "*How do computer and web access, use, and perceived needs differ from one practitioner's work/work practice to the next?*"; "*How can we get a better fit between these computer and web technologies and practitioners' espoused work/work practice needs?*"; and finally, "*How can these technologies be configured to increase practitioner's efficiency and thereby increase the technology's acceptance and use?*." Bluntly put, in the field of medical informatics, '*use*' is work/work practice.

The decision to present the quantitative data from the Telemedicine Needs Assessment survey before presenting the qualitative data generated by the interviews, observation, and participant observation, was not arbitrary. As medical infomaticians, we are acculturated to numbers, and find security both in the process of arriving at those numbers and what we're convinced they signify once we've got them. In other words, citing a punishing statistic tends to make us feel we've *bagged the goods*, when ironically, it is the teasing out and telling of the story behind those same numbers that brings us closer to understanding and appreciating the barriers to integrating these technologies into work/work practice.

Presenting the quantitative data in Chapter Two and following with the presentation of the qualitative data in Chapter Three is, in effect, a cautionary tale. Chapter Two establishes the provider organization's practitioners' computer and web enablement baseline, and determines the affect of practitioner status, practice location, and gender on that baseline. The statistics are significant, startling. But at the end of the day, we have no insight into why the provider organization's baseline computer and web access, use, and perceived needs are what they are, nor what we can do to improve these baselines. Moreover, we have no insight into what practitioners' and administrators' perceive as barriers to integrating the computer and web into healthcare delivery. This data is the provenance of the ensuing chapter, Chapter Three.

3.2 Abstract

Objectives: *First, analyze the provider organization's Telemedicine Needs Assessment data to establish current levels of computer and web access, use, and perceived needs. Second, determine if practitioner status, practice location, and gender influence practitioners' computer and web enablement.*

Design: *January 2000, a 68 item, closed-ended, Telemedicine Needs Assessment survey was sent to all 586 practitioners within the physician-run provider organization's two hospitals and 29 community group practices (CGP). Self-reported survey data were classified by practitioner status (physician versus non-physician); practice location (hospitals versus community group practices); and gender (male versus female), then subjected to chi-square analyses: $p<0.05$ was considered significant.*

Results: *The survey (71% response rate) yielded two outcomes of interest. First, computer and web enablement within the organization is not ubiquitous: although 91% of respondents have computers: 35% of respondents are not using e-mail; 60% are not using e-mail with colleagues; 77% are not using e-mail with administration; and 89% are not using the organization's premier "paperless" communication channel, namely the staff-only intranet. Second, data suggest that differences in practitioners' computer and web access, use, and perceived needs are related, in part, to practitioner status, practice location, and, to a lesser degree, gender. When compared, non-MDs, community group practice-based practitioners, and female practitioners, have less access to computers and are less likely to have e-mail installed, use e-mail to communicate with colleagues and administration, search the web for medical information, and so on, than MDs, hospital-based practitioners, and male practitioners.*

Conclusions: *If a provider organization's goal is ubiquitous computer and web enablement, then differences in computer and web access, usage, and perceived needs, based on practitioners' status, practice location, and gender, must be addressed. Moreover, the design, development, and implementation of these technologies must be inextricably linked with practitioners' work/work practice.*

3.3 Background

This research took place at a physician-run provider organization, consisting of two hospitals and 29 community group practices (CGP) located throughout Massachusetts. A clinician telemedicine champion commissioned PHASE I: A Profile of Four Telemedicine Programs, January - June 1999. Subsequently, the clinician and the provider organization's administration jointly commission PHASE II: A Telemedicine Needs Assessment, August 1999 - February 2000.

The provider organization's reasons for commissioning the Telemedicine Needs Assessment were fourfold. The provider organization wanted to:

1. establish its practitioners' computer and web access, use, and perceived needs baseline -- a baseline against which the success, failure, or potential usefulness of any future medical informatics implementation would be evaluated;

2. identify the factors influencing practitioners' computer and web enablement. Establishing these factors would assist the provider organization in determining and aligning its strategic clinical and administrative business trajectories, with its information systems and information technology needs;

3. project realistic timelines for moving towards a paperless environment and an electronic medical record -- goals requiring ubiquitous computer and web enablement, and finally;

4. determine if telemedicine, particularly the web-based remote monitoring and management of acute and chronic disease populations with call center support, would complement the organization's extensive in-patient and out-patient case management program.

The Telemedicine Needs Assessment incorporated qualitative and quantitative research programs to include: 1. cross-sectional, institution-wide, in-depth interviews; 2. participant observation at administrative and clinical meetings and during day-to-day operations at the provider organization, and 3. a survey distributed to all clinical practitioners to assess current computer, web, and telemedicine technology usage and needs. Findings presented in this chapter are derived from the Telemedicine Needs Assessment survey only.

3.4 Methods

The 68-question survey (Appendix B) was developed out of findings from the in-depth, cross-institutional interviews. The preceding interviews are important because, in effect, they laid the foundation for the survey: survey questions were distilled from issues raised during the course of these interviews. Also, the process of interviewing established my presence within the provider organization and educated interviewees about the telemedicine research agenda. As a result of knowing me and being familiar with what I was trying to achieve, formerly *outlier* individuals were co-opted and in some cases became stalwart advocates of the need for a telemedicine program.

The purpose of the survey was to assess: 1. practitioners' access to and use of the computer and the web; 2. practitioners' perceived need for remote monitoring and management technologies; 3. practitioners' receptiveness to web based information, education, and training, and; 4. whether practitioners were interested in becoming involved in the provider organization's telemedicine or web based innovations. Of the 68 survey questions, 30 questions were designed to assess computer and web enablement. These specific questions are presented in Table 5.

Over the last 20 years, a number of surveys have been developed to assess practitioner's computer and web enablement. However, at the time of this survey, none of the available instruments were designed for the scope and depth that the Telemedicine Needs Assessment required. Furthermore, none of the instruments were designed to simultaneously assess access, use or function, and perceived need. The drawbacks of existing tools are in part historical. Twenty years ago the web wasn't used for healthcare delivery; five years ago practitioners were not using e-mail to communicate with patients, and so on. In the current healthcare delivery environment where technologies and organizations are constantly evolving and merging, the entire survey process, from design onwards, must be ad hoc enough for the instrument and the results to be meaningful. The intent of this survey was not to develop it into a standardized assessment tool but rather to customize a broad brush -- a readily accessible survey instrument capable of reflecting back to the provider organization its computer and web access, use, and perceived telecommunication technology needs. Tool validation was achieved by developing the survey questions with practitioners, and administrators. Reliability was achieved by testing drafts of the survey with a representative sampling of practitioners.

Upon request, the provider organization's human resources personnel provided a list of the institution's 586 practitioners. The list was conveniently formatted on two sets of mailing stickers. One sticker was attached to the survey so respondents would be spared the irritating and time-consuming task of filling in their name, address, and specialty. The second sticker was affixed to the envelope. In an attempt to

increase response, the covering letter of endorsement was co-signed by the chair of the Telemedicine Task Force and the vice-president of community group practices. The survey was first mailed out January 2000 using inter-office mail. The survey was mailed flat and a self-addressed, inter-office, return envelope was enclosed. A second mail-out, two weeks later, targeted non-responders. The second mail out included the original introductory letter, another copy of the survey, and an additional cover letter from the Senior Telemedicine Consultant to the Telemedicine Task Force. Practice managers of non-respondents were also contacted and asked to facilitate the completion and return of outstanding surveys. If a practice manager did not have e-mail, they were contacted by phone.

Analysis of the data followed two complementary trajectories. The first aim of the analyses was to establish the provider organizations' practitioners' computer and web access, use, and perceived needs baseline. The second aim of the analysis was to determine if practitioner status, practice location, and gender influenced computer and web enablement. However, determining function (how much they use it) posed a very different challenge, both in the design of the question, and the design of the analyses, than determining access (do they have it). Analyzing data to establish practitioners' computer and web access, use, and perceived needs baseline proved particularly challenging.

Scoring respondents' answers on a five point Likert scale allowed the researcher to differentiate between respondents who used, for example, e-mail "*monthly*" and those who used it "*daily*" or "*multiple times daily*". A strictly binary approach would not reflect these important functional differences. In survey questions where the aim was to analyze respondents' 'functional' use of a technology, responses on the Likert five-point scale were reduced to a binary response. For example, using e-mail "*never/weekly/monthly*" was interpreted as "*no*": using e-mail "*daily/multiple times daily*" was interpreted as "*yes*". Where data are presented as a binary response, the p values, which continue to reflect the significant findings for the entire Likert scale, are accompanied by an (*). Survey data were entered into an EXCEL spreadsheet. Chi-square analyses based on an $n \times m$ table were applied: $p<0.05$ was considered significant.

The specific practitioner status, practice location, and gender analyses of the survey data are summarized in Table 1. Two sub-groups, CGP-based specialists and male non-MDs, are too small (five and 11 members respectively), to constitute reliable comparison groups. Recognizing this limitation, male non-MDs are used in two analyses: 1. A practitioner status analysis where male MDs versus male non-MDs are compared with female MDs versus female non-MDs, and 2. A gender analysis where male non-MDs are compared with female non-MDs.

Throughout the paper the term "practitioners" is used. It encompasses all respondent sub-groups to include: MDs, non-MDs, specialists, and generalists. For brevity, the four psychologist PhDs who responded are counted as MDs. In addition to being independent sub-groups, specialists and generalists are members of the MD sub-group. The term generalist includes: primary care practitioners, family practitioners, internists, and pediatricians.

Table 1. Practice location, practitioner status, and gender analyses of the Telemedicine Needs Assessment Survey data.

Categories	Analyses and total members for each sub-group: 586 Surveyed/406 responded		
Practitioner Status Analyses	341 MDs	versus	65 Non-MDs
	246 Hospital-based MDs	versus	37 Hospital-based non-MDs
	95 CGP-based MDs	versus	28 CGP-based non-MDs
	247 Male MDs	versus	11 Male non-MDs
	94 Female MDs	versus	54 Female non-MDs
	205 Specialists	versus	136 Generalists
Practice Location Analyses	283 Hospital-based practitioners	versus	123 CGP-based practitioners
	246 Hospital-based MDs	versus	95 CGP-based MDs
	37 Hospital-based non-MDs	versus	28 CGP-based non-MDs
	180 Hospital-based male MDs	versus	67 CGP-based male MDs
	66 Hospital-based female-MDs	versus	28 CGP-based female-MDs
	96 Hospital-based female practitioners	versus	52 CGP-based female practitioners
	46 Hospital-based generalists	versus	90 CGP-based generalists
	200 Hospital-based specialists	versus	5 CGP-based specialists
Gender Analyses	258 Male practitioners	versus	148 Female practitioners
	247 Male MDs	versus	94 Female MDs
	11 Male non-MDs	versus	54 Female non-MDs
	180 Hospital-based male MDs	versus	66 Hospital-based female MDs
	67 CGP-based male MDs	versus	28 CGP-based female MDs
	162 Male specialists	versus	43 Female specialists
	85 Male generalists	versus	51 Female generalists

Notes
Numbers represent the total number of respondent members for that comparison group.

3.5 Findings

Of the 586 practitioners surveyed January - February 2000, 423 (72%) responded. For the purposes of this analysis, 17 practitioners not having clinical contact with patients were extracted from the respondent database, leaving a total of 406 respondents. Respondents include: 337 physicians, four psychologists, and 65 non-MDs (37 registered nurse practitioners and 28 physician assistants). Respondents are profiled in Table 2.

At this provider organization's two hospitals and 29 community group practices, approximately two thirds of the practitioner population is hospital-based. Male practitioners out-number female practitioners almost 2:1, and female non-MDs out-number male non-MDs 5:1. Numbers of MDs exceed non-MDs 5:1, and there are one and a half times as many specialists as generalists. Male specialists outnumber female

specialists almost 4:1. There are marginally more females practitioners practicing in the CGPs than in the hospitals.

There are no significant differences between hospital-based and CGP-based MDs, relative to years since graduating: 20.71 and 19.97 respectively. By comparison, non-MD, across hospitals and CGPs graduated significantly later than the MDs: 8.99 and 11.79 respectively.

Hospital-based MDs averaged 9.8 years with the organization compared with CGP MDs' significantly lower average of 4 years. The difference in "years with the provider organization" between the two groups indicates that the provider organization purchased the majority of CGPs four years ago.

Table 2. Profiles of the 406 respondents out of 586 practitioners surveyed.

Respondent groups	Respondents n= 406	Location	Total population sub-groups	Total population male sub-groups	Total population female sub-groups
Practitioners	406 (100)	Hospitals	283 (70)	M 187 (66)	F 96 (34)
		CGPs	123 (30)	M 71 (58)	F 52 (42)
MDs	341 (84)	Hospitals	246 (72)	M 180 (73)	F 66 (27)
		CGPs	95 (28)	M 67 (71)	F 28 (29)
Non-MDs	65 (16)	Hospitals	37 (57)	M 7 (19)	F 30 (81)
		CGPs	24 (43)	M 4 (14)	F 24 (86)
Specialists	205 (50)	Hospitals	200 (98)	M 159 (80)	F 41 (20)
		CGPs	5 (2)	M 3 (60)	F 2 (40)
Generalists	136 (33)	Hospitals	46 (34)	M 21 (46)	F 25 (54)
		CGPs	90 (66)	M 64 (71)	F 26 (29)

Notes
Percentages are represented in brackets.

No significant differences between respondents and non-respondents are apparent. However, there are three significant but not very dramatic differences (1 access, 1 use, 1 perceived needs), between those practitioners who responded to the first mail-out, 257 (63%) and those practitioners who responded to the second mail-out, 149 (37%). Those practitioners who responded to the first mail-out reported greater access to Microsoft Outlook; greater use of e-mail; and a greater need for remote monitoring and management of acute patient populations. Details are presented in Table 3.

Table 3. Three differences emerged between first and second responders to the Telemedicine Needs Assessment Survey.

Survey question	Response	First Responders n= 257/406 (63)	Second Responders n= 149/406 (36)	*p value p<0.05*
1 Have Microsoft Outlook installed on computer at work	"Yes"	230/243 (95)	114/134 (85)	.002
2. Use e-mail	"Daily/ Multiple times daily"	177/253 (70)	77/138 (56)	.046*
3. Would be beneficial for acute patients to have remote monitoring and management	"Yes"	81/208 (39)	34/125 (27)	.029

Note
The first number represents the number of respondents who answered the question affirmatively. This number is represented as a percentage in brackets. The number immediately following the "/" indicates the total number of respondents for that question.
* Indicates the p value for the entire Likert scale.

Finally, and importantly, as noted in Table 4, no differences were manifest across any of the comparison groups specific to using a computer or e-mail at home.

Table 4. Respondents' computer access and e-mail use at home.

Disparity/survey question	Response	Comparative Analyses: Practitioner Status (PS), Practice Location (PL), Gender (G)			*p value p<0.05*
1. Use a computer at home	"Yes"	PS	MDs 296/338 (88)	Non-MDs 50/62 (81)	.142!
		PL	Hospital-based practitioners 242/281 (86)	CGP-based practitioners 104/119 (87)	.733 !
		G	Male practitioners 227/257 (88)	Female practitioners 119/143 (83)	.151 !
2. Use e-mail at home	"Daily/ Multiple times daily"	PS	MDs 135/295 (42)	Non-MDs 24/51 (47)	.224*!
		PL	Hospital-based practitioners 99/240 (41)	CGP-based practitioners 50/106 (47)	.498*!
		G	Male practitioners 106/230 (46)	Female practitioners 43/116 (38)	.225*!

Note
(!) Denotes not statistically significant.
* Indicates the p value for the entire Likert scale.

3.5.1 Practitioners' baseline computer and web access, usage, and perceived needs

Of the 68 Telemedicine Needs Assessment Survey questions, 15 questions were designed to establish practitioners' baseline computer access, use, and perceived needs. Likewise, 15 questions were designed to establish practitioners' baseline web access, use, and perceived needs. The specific questions and respondents' answers to them are presented in Table 5. The analysis is attached as Appendix C. Findings are summarized as follows:

Access: Of the respondent population 91% have computers with the institution's e-mail handler installed. Moreover, of the respondent population; 82% have access to cell phones; 28% have access to laptops; and 17% have access to palm pilots. Cell phones are included because of their potential use in telemedicine applications. Twenty-seven percent of respondents access on-line professional memberships, and 16% access on-line professional subscriptions on-line. However, only 39% of respondents access institutional policies on-line; for example, the provider organization's e-mail policy posted on the staff-only intranet.

Use: Of the respondent population, 87% use computers and 65% use the computer to do e-mail. Respondents use e-mail for the following: 40% to communicate with colleagues; 23% to communicate with administration; 11% to request case consults; and 10% use e-mail to communicate with patients. Seventy-six percent of respondents report training on the institution's e-mail handler to be "none/non-existent". Specific to web use: 11% of respondents use the provider organization's staff-only intranet, and 18% use the provider organization's public internet site. Also, 67% of respondents report having made a purchase on-line, and 51% of respondents use the web to access medical information.

Patient-related access and use: Specific to patient-related use of e-mail; 17% of respondents are receiving unsolicited e-mails from patients; 10% of respondents are using e-mail to communicate with patients; but only 2% of respondents discuss the institution's e-mail protocols face-to-face with patients and get them to sign a consent form. Specific to patient-related use of the web, 61% of respondents have patients who bring medical information from the web to office visits; but only 4% of respondents refer patients to the provider organization's web site for medical information.

Perceived Needs: The majority of respondents' perceived needs center on potential uses of computer and web telecommunication technologies to support and deliver healthcare generally and telemedicine in particular. Of the respondent population; 53% would like to attend web-cast medical events, such as grand rounds presented at the hospitals, using their desktop computer; 45% would like to take continuing medical education over the web; and 38% would like to use video teleconferencing to participate in administrative meetings.

Respondents' perceived needs specific to telemedicine applications are: 55% of respondents have patients who would benefit from access to a 24/7 call center triage staffed by qualified registered nurses; 36% have patients who are potential candidates for short term remote monitoring and management; and 35% have patients who are potential candidates for long term remote monitoring and management. Finally, 51% of respondents report they are "interested/very interested" in participating in any future ongoing discussion about telehealth and web-based innovations at the provider organization.

Table 5. Practitioners' current baseline computer and web access, use, and perceived needs.

	15 Computer Enablement Baselines	
Access	364/399 (91)	of respondents have provider organization computers in their office
	344/377 (91)	of respondents have Microsoft Outlook on their computer
	154/391 (39)	of respondents are familiar with the provider organization's e-mail policy
	6/388 (2)	of respondents discuss e-mail protocols with patients and get them to sign a consent form
	114/401 (28)	of respondents have a laptop
	70/401 (17)	of respondents have a palm pilot
	327/400 (82)	of respondents have a cell phone
Usage	342/393 (87)	of respondents use the computer "daily/multiple times daily"
	254/391 (65)	of respondents use e-mail "daily/multiple times daily"
	157/389 (40)	of respondents use e-mail to communicate with colleagues "daily/multiple times daily"
	89/391 (23)	of respondents use e-mail to communicate with the provider organization's administration "weekly/daily/multiple times daily"
	43/392 (11)	of respondents get e-mail requests from colleagues for case consultations "weekly/daily/multiple times daily"
	38/390 (10)	of respondents use e-mail to communicate with patients "weekly/daily/multiple times daily"
Perceived needs	291/383 (76)	of respondents rate the training they received on Microsoft Outlook as "none/not adequate"
	24/390 (17)	respondents report receiving unsolicited e-mails from patients "weekly/daily/multiple time daily"
	15 Web Enablement Baselines	
Access	103/385 (27)	of respondents have on-line professional memberships
	61/389 (16)	of respondents have on-line subscriptions
Usage	41/386 (11)	of respondents use the provider organization's staff-only intranet "daily/multiple times daily"
	68/386 (18)	of respondents use the organization's internet site "weekly/daily/multiple times daily"
	198/392 (51)	of respondents use the web to access medical information "weekly/daily/multiple times daily"
	13/339 (4)	of respondents refer patients to the organization's internet site "weekly/daily/multiple times daily"
	265/397 (67)	of respondents have made an on-line purchase

Perceived needs	175/391 (45)	of respondents would take continuing medical education over the web "frequently/very frequently/always"
	144/382 (38)	of respondents would prefer to participate in administrative meetings using video teleconferencing "frequently/ very frequently/ always"
	205/386 (53)	of respondents would like to access live conferences from their desktop computer "frequently/ very frequently/ always"
	120/330 (36)	of respondents have acute patients who would benefit from remote monitoring and management
	115/333 (35)	of respondents have chronic patients who would benefit from remote monitoring and management at home
	183/330 (55)	of respondents have patients who would benefit from access to a 24/7 call center staffed by qualified triage nurses
	212/349 (61)	of respondents have patients who during an office visit present with medical information from the web "weekly/daily/multiple times daily"
	180/356 (51)	of respondents are "interested/ very interested" in participating in future ongoing discussion about tele-health and web innovations at the provider organization

Notes
The first number represents the number of respondents who answered the question affirmatively. The rate of response is represented as a percentage in brackets. The number following the / indicates the total number of respondents for that question.

Having established practitioners' computer and web enablement baseline, the question is, what factor or combination of factors within the provider organization -- for example, distance (practice location), culture (practitioner status) or historical bias (gender), -- are affecting practitioners' baseline computer and web access, use, and perceived needs?

3.5.2 The process which led to data analysis by practice location, practitioner status, and gender

Initially data were analyzed by gender to determine if gender would account for practitioners' baseline computer and web access, use, and perceived needs. However, when gender analyses identified, for example, that there were 20 significant differences between male and female practitioners (which include non-MDs), but only seven between male and female MDs, a series of practitioner status analyses was initiated. In turn, the practitioner status analyses identified, for example, that there were 17 significant differences between hospital-based MDs and hospital-base non-MDs, but only ten significant differences between CGP-based MDs and CGP-based non-MDs. Similarly, the practitioners status analyses identified 15 significant differences between the specialists, primarily practicing in the hospitals, and the generalists, primarily practicing in the CGPs. Findings such as these prompted the final series of comparative analyses focused on practice location. The categories of analyses carried out on the Telemedicine Needs Assessment Survey data, the total number of members for each comparison group, and the total number of statistically significant differences identified in each analysis are presented in Table 6.

Table 6. Categories of analyses carried out on the Telemedicine Needs Assessment Survey data, total number of members for each comparison group, and the number of statistically significant differences identified in each analysis.

Categories	Analyses and total members for each sub-group: 586 Surveyed/406 responded			Significant differences
Practitioner Status Analyses	341 MDs	versus	65 Non-MDs	22
	246 Hospital-based MDs	versus	37 Hospital-based non-MDs	17
	95 CGP-based MDs	versus	28 CGP-based non-MDs	10
	247 Male MDs	versus	11 Male non-MDs	9
	94 Female MDs	versus	54 Female non-MDs	9
	205 Specialists	versus	136 Generalists	15
Practice Location Analyses	283 Hospital-based practitioners	versus	123 CGP-based practitioners	18
	246 Hospital-based MDs	versus	95 CGP-based MDs	18
	37 Hospital-based non-MDs	versus	28 CGP-based non-MDs	6
	180 Hospital-based male MDs	versus	67 CGP-based male MDs	16
	66 Hospital-based female-MDs	versus	28 CGP-based female-MDs	6
	96 Hospital-based female-practitioners	versus	52 CGP-based female practitioners	6
	46 Hospital-based generalists	versus	90 CGP-based generalists	9
	200 Hospital-based specialists	versus	5 CGP-based specialists	5
Gender Analyses	258 Male practitioners	versus	148 Female practitioners	20
	247 Male MDs	versus	94 Female MDs	7
	11 Male non-MDs	versus	54 Female non-MDs	4
	180 Hospital-based male MDs	versus	66 Hospital-based female MDs	4
	67 CGP-based male MDs	versus	28 CGP-based female MDs	1
	162 Male specialists	versus	43 Female specialists	4
	85 Male generalists	versus	51 Female generalists	1

NOTES
Numbers represent the total number of members for that comparison group.

3.5.3 The influence of practice location, practitioner status, and gender on computer and web enablement

Of the 207 significant differences (practitioner status -- 82; practice location -- 84; and gender -- 41) presented in Table 6, only those differences that correlate with the baseline survey questions presented in Table 5. "Practitioners' current baseline computer and web access, use, and perceived needs", will be analyzed. The master compiler of all analyses is attached as Appendix D. Of the 15 computer and 15 web baseline questions, only one question, asking respondents if they referred patients to the provider organization's web site for medical information, did not manifest as a difference across any comparison group. From the remaining 29 questions, a total of 57 significant differences emerge across the three categories: practitioner status (21), practice location (20), gender (16).

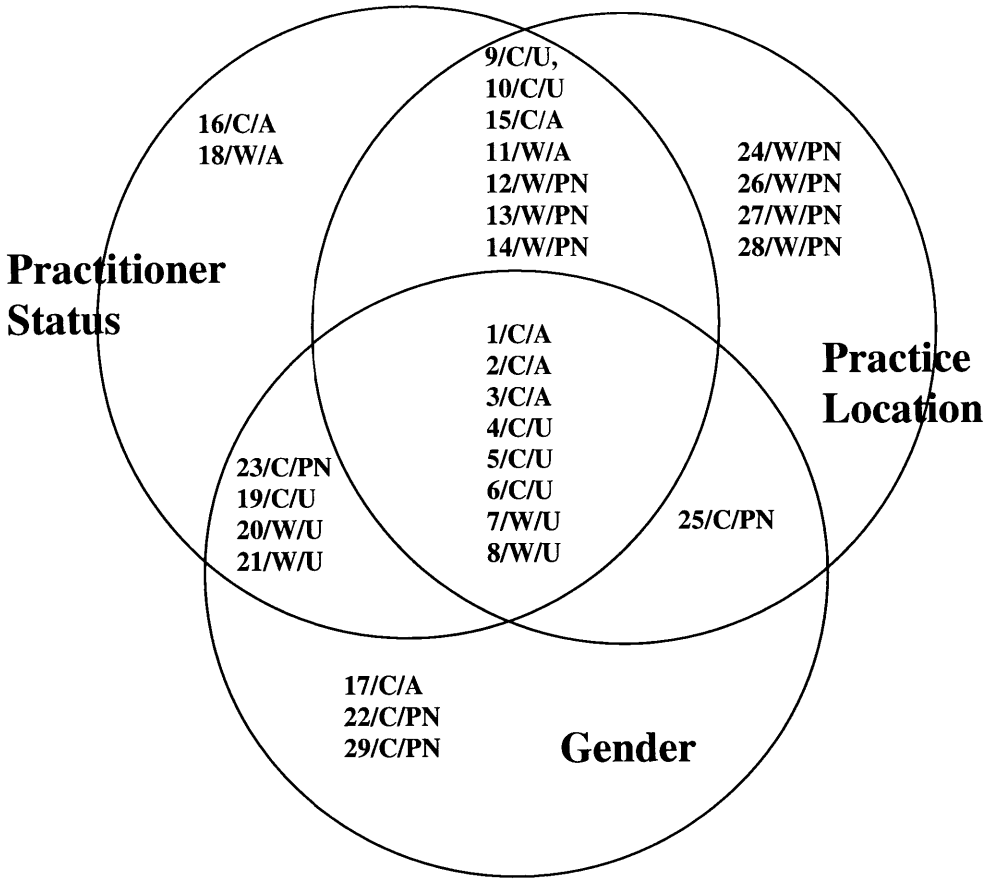
Table 7 provides an overview of the distribution of these differences. Practitioner status analyses have the most computer and web access and use differences (7 and 10 respectively). Practice location analyses have twice as many computer and web perceived needs differences (8), as practitioner status and gender. Gender analyses differences relate primarily to computer and web use (8). Overall, fewer computer and web enablement differences are attributable to gender. When enablement differences are totaled horizontally, there are 16 access differences, 25 use differences, and 16 perceived needs differences.

Table 7. The distribution of significant differences in computer and web access, usage, and perceived needs, across practitioner status, practice location, and gender.

Computer and Web	**Practitioner Status**			**Practice Location**			**Gender**			**Enablement Differences totals**
	Computer	Web	**Total**	Computer	Web	**Total**	Computer	Web	**Total**	
Access	5	2	**7**	4	1	**5**	4	0	**4**	**16**
Usage	6	4	**10**	5	2	**7**	4	4	**8**	**25**
Perceived Needs	1	3	**4**	1	7	**8**	4	0	**4**	**16**
Difference Totals			**21**			**20**			**16**	

To better understand the interrelatedness and potentially overlapping affect of practitioner status, practice location, and gender on practitioners' computer and web enablement, significant responses to the 29 survey questions are modeled using a Venn diagram, Figure 1. Although the Venn is a useful device for illustrating interrelatedness it does not show the direction of the differences between comparison groups, and for that reason, details of the findings are presented in Tables 8-10.

Figure 1. The Venn diagram represents the 15 computer (C) and 14 web (W) access,(A) usage (U), and perceived needs (PN) differences distributed across practice location, practitioner status, and gender.



Notes
Numbers correlate with the survey questions listed in Tables 6-8.
C represents computer.
W represents the web.
A represents access.
U represents use.
PN represents perceived needs.

The intersection of the three sets Practitioner Status (MDs versus non-MDs), Practice Location (hospital-based practitioners versus CGP-based practitioners), and Gender (male versus female), in the Venn Diagram, Figure 1, captures eight differences that center on computer and web *access* (three) and *use* (five). Differences specific to respondents' computer and web *perceived needs* did not emerge.

The eight differences present in the intersection of the three sets, detailed in Table 8, center on the requisite tools and skill sets for computer and web enablement set out in the computer and web baselines Table 5. Those tools and skill sets are: having a computer or laptop at work; having the provider organization's e-mail handler installed; using e-mail at work; using e-mail to communicate with colleagues and administration; using the web to access medical information; and being web enabled to the point of making an on-line purchase. In six out of the eight questions, the degree of difference between practitioner status comparison groups is greater than between practice location and gender comparison groups. Note in Table 8 that the largest, and therefore the most representative sub-groups in each category, are compared.

Table 8. This table presents findings identified in the intersection of the three sets of the Venn diagram's Figure 1.

Disparity/survey question	Response	Comparative Analyses: Practitioner Status (PS), Practice Location (PL), Gender (G)			*p value* *p<0.05*
1. Have a computer at work	"Yes"	PS	MDs 329/336 (98)	Non-MDs 35/63 (56)	**1.07E-27**
		PL	Hospital-based practitioners 267/282 (95)	CGP-based practitioners 97/117 (83)	.000153658
		G	Male practitioners 243/254 (96)	Female practitioners 121/145 (83)	**3.32E-05**
2. Have Microsoft Outlook installed on computer at work	"Yes"	PS	MDs 307/321 (96)	Non-MDs 37/56 (66)	**5.04E-13**
		PL	Hospital-based practitioners 260/272 (96)	CGP-based practitioners 84/105 (80)	**1.58E-06**
		G	Male practitioners 228/244 (93)	Female practitioners 116/133 (87)	.041
3. Have a laptop	"Yes"	PS	MDs 107/338 (32)	Non-MDs 7/63 (11)	.001
		PL	Hospital-based practitioners 95/282 (34)	CGP-based practitioners 19/119 (16)	0.000326
		G	Male practitioners 86/257 (33)	Female practitioners 28/144 (19)	.003
4. Use e-mail at work	"Daily/ Multiple times daily"	PS	MDs 239/336 (71)	Non-MDs 15/55 (27)	**5.44E-15***
		PL	Hospital-based practitioners 201/279 (72)	CGP-based practitioners 53/112 (47)	**1.27E-06***
		G	Male practitioners 175/254 (69)	Female practitioners 79/137 (58)	.001*

5. Use e-mail to communicate with colleagues	"Weekly/ Daily/ Multiple times daily"	PS	MDs 236/333 (71)	Non-MDs 13/56 (23)	**7.27E-12***
		PL	Hospital-based practitioners 198/278 (71)	CGP-based practitioners 51/111 (46)	**5.52E-05***
		G	Male practitioners 178/252 (71)	Female practitioners 71/137 (55)	.001
6. Use e-mail to communicate with administration	"Weekly/ Daily/ Multiple times daily"	PS	MDs 86/334 (26)	Non-MDs 3/57 (5)	0.000237*
		PL	Hospital-based practitioners 74/279 (27)	CGP-based practitioners 15/112 (13)	.026*
		G	Male practitioners 72/252 (29)	Female practitioners 17/139 (12)	.001*
7. Use the web to find medical information	"Weekly/ Daily/ Multiple times daily"	PS	MDs 180/333 (54)	Non-MDs 18/59 (30)	.008*
		PL	Hospital-based non-MD/PhDs 7/37 (19)	CGP-based non-MD/PhDs 11/22 (50)	.051*
		G	Male practitioners 145/256 (57)	Female practitioners 53/136 (39)	.003*
8. Have made a web purchase	"Yes"	PS	MDs 235/338 (70)	Non-MDs 30/59 (51)	.005
		PL	Hospital-based practitioners 196/281 (70)	CGP-based practitioners 69/116 (59)	.048
		G	Male practitioners 182/257 (71)	Female practitioners 83/140 (59)	.02

Notes
The first number represents the number of respondents who answered the question affirmatively. This response rate is represented as a percentage in brackets. The number following the / indicates the total number of respondents for that question.
* Indicates p value represents the entire Likert scale.

The second most significant grouping of computer and web enablement differences, illustrated in the Venn diagram Figure 1, and detailed in Table 9, are the seven differences -- access (two), usage (two), and perceived needs (three)-- common to practitioner status and practice location but not gender. Note

also than in four of the seven survey questions, the degree of difference specific to practitioner status is greater than the difference specific to practice location.

Practitioner status comparison sub-groups include MDs versus non-MDs and specialists versus generalists. Non-MDs, when compared with MDs, use computers less, have fewer on-line professional memberships, and less access to cell phones. Generalists, when compared with specialists; perceive a greater need for: web-cast medical events such as grand rounds on their desktop computers; remote monitoring and management of chronic disease patient populations; and a 24/7 call center staffed by qualified triage nurses. Specialists, when compared with generalists, receive more e-mail requests for case consultations from colleagues.

Practice location comparison sub-groups include hospital-based practitioners versus CGP-based practitioners, and hospital-based MDs versus CGP-based MDs. CGP-based MDs have greater access to cell phones and on-line professional memberships than their hospital-based MDs. CGP-based practitioners also report a greater need for remote monitoring and management for chronic patients, a call center, and desktop web-cast medical meetings than hospital-based practitioners. Hospital-based practitioners use computers more and get more e-mail requests from colleagues for case consultations than CGP-based practitioners.

Note that hospital-based practitioners and specialists have the advantage of in-house medical students, residents, and so on, who, by virtue of their training, provide an on-call service. Additionally, hospital-based practitioners are located where most medical meetings and conferences take place.

Table 9. Computer and web access, usage, and perceived need disparities common to practitioner status and practice location but not to gender.

Disparity/survey question	**Response**	**Comparative Analyses: Practitioner Status (PS), Practice Location (PL),**			***p value p<0.05***
9. Use the computer at work	"Daily/ Multiple times daily"	PS	MDs 300/336 (89)	Non-MDs 42/57 (74)	**7.39E-06***
		PL	Hospital-based practitioners 261/281 (93)	CGP-based practitioners 81/112 (72)	**4.91E-11***
10. Get e-mail requests from colleagues for case consultations	"Weekly/ Daily/ Multiple times daily"	PS	Specialists 27/204 (13)	Generalists 13/131 (10)	.006*
		PL	Hospital-based practitioners 32/280 (11)	CGP-based practitioners 11/112 (10)	.004*
11. Have on-line professional memberships	"Yes"	PS	MDs 95/328 (29)	Non-MDs 8/57 (14)	.019
		PL	Hospital-based MDs 61/237 (26)	CGP-based MDs 34/91 (37)	.038

12. Would like to access live conferences from their desktop computer	"Frequently/ Very frequently/ Always"	PS	Specialists 94/201 (39)	Generalists 79/129 (61)	.034*
		PL	Hospital-based practitioners 124/273 (45)	CGP-based practitioners 81/113 (72)	**7E-06***
13. Have chronic patients who would benefit from remote monitoring and management at home	"Yes"	PS	Specialists 37/158 (23)	Generalists 52/119 (44)	0.000346
		PL	Hospital-based practitioners 69/231 (30)	CGP-based practitioners 46/102 (45)	.007
14. Have patients who would benefit from access to a 24/7 call center staffed by qualified triage nurses	"Yes"	PS	Specialists 66.156 (42)	Generalists 83/119 (70)	**6.04E-06***
		PL	Hospital-based practitioners 111/227 (49)	CGP-based practitioners 72/103 (70)	0.000375*
15. Have a cell phone	"Yes"	PS	MDs 288/337 (85)	Non-MDs 39/63 (62)	**8.88E-06**
		PL	Hospital-based MDs 202/244 (83)	CGP-based MDs 86/93 (92)	.024

Notes
The first number represents the number of respondents who answered the question affirmatively. The response rate is represented as a percentage in brackets. The number following the / indicates the total number of respondents.
* Indicates P value represents the entire Likert scale.

The remaining differences identified in the Venn diagram, Figure 1, are presented in Table 10. The 14 findings are organized under computer and web access (three), use (three), and perceived needs (eight). The degrees of difference between comparison groups is less marked than between the previous comparison groups presented in Table 8, and Table 9, except in a practitioner status comparison where respondents are asked if they are familiar with the provider organization's e-mail policy. The significant differences that emerge, specific to access and usage, are restricted to practitioner status and gender analyses: no access or use differences emerge in the practice location analyses. The remaining differences that emerged specific to perceived needs are as follows: practitioner status (one), gender (four), and practice location (five).

Five of the 14 differences pertain to practitioners' use of computers and the web in relation to patients. Fewer male MDs discuss e-mail protocols with patients and get them to sign a consent form than female MDs. Fewer non-MDs use e-mail to communicate with patients and they receive less unsolicited e-mail from patients than MDs. Finally, CGP-based practitioners are less likely to have patients present with medical information from the web than hospital-based practitioners.

The second distinct concentration of differences is specific to the remaining five perceived needs. Practice location and gender influence perceived needs but notably, differences specific to practitioner

status do not emerge. To summarize the findings, specific to practice location, CGP-based MDs perceive a greater need for web-based continuing medical education and video teleconferencing for administrative purposes than hospital-based MDs. Also, CGP-based MDs perceive a greater need for remote monitoring and management of acute patients than hospital-based MDs.

Practice location and gender affect the perceived need for training on the provider organization's e-mail handler: hospital-based MDs and female practitioners cite a greater need than CGP-based MDs and male practitioners. Finally, data suggest that gender alone influences respondents' perceived need for participation in future on-going discussion about tele-health and web innovations at the provider organization: male practitioners are significantly more interested in this than female practitioners.

The remaining five usage and access differences are influenced by practitioner status and gender. Specific to the influence of gender, more male practitioners than female practitioners use the staff-only intranet and the organization's internet site. Similarly, and specific to the influence of practitioner status, more MDs than non-MDs use the staff-only intranet and more generalists than specialists use the organization's internet site. The remaining access difference influenced by gender is, more male practitioners have access to palm pilots than female practitioners. The final two differences influenced by practitioner status are, MDs are more familiar with the provider organization's e-mail policy and have more on-line professional subscriptions than non-MDs.

Table 10. The remaining 14 computer and web disparities common to practitioner status, practice location, and gender are grouped under computer and web access, use, and perceived needs.

Differences specific to computer and web access, use and perceived needs	**Response**	**Comparative Analyses: Practitioner Status (PS), Practice Location (PL), Gender (G)**			***p value p<0.05***
Access					
16. Are familiar with the provider organization's e-mail policy	"Yes"	PS	MDs 145/334 (43)	Non-MDs 9/57 (16)	**7.98E-05**
17. Have a palm pilot	"Yes"	G	Male Practitioners 57/257 (22)	Female practitioners 13/144 (9)	.001
18. Have on-line professional subscriptions	"Yes"	PS	MDs 57/331 (17)	Non-MDs 4/58 (7)	.046
Use					
19. Use e-mail to communicate with patients	"Weekly/ Daily/ Multiple times daily"	PS	MDs 38/334 (11)	Non-MDs 0/56 (0)	.038*
		G	Male MDs 32/244 (13)	Female MDs 6/90 (7)	.023*

20. Use the staff-only intranet	"Daily/ Multiple times daily"	PS	MDs 40/328 (12)	Non-MDs 1/58 (2)	.001*
		G	Male practitioners 32/253 (13)	Female practitioners 9/133 (8)	.006*
21. Use the provider organization's internet site	"Weekly/ Daily/ Multiple times daily"	PS	Specialists 37/198 (19)	Generalists 26/130 (20)	.004*
		G	Male practitioners 51/250 (20)	Female practitioners 17/136 (12)	.042*
Perceived Needs					
22. Discuss e-mail protocols with patients and get them to sign a consent form	"Yes"	G	Male MDs 1/242 (.5)	Female MDs 4/90 (4)	.024
23. Receive unsolicited e-mails from patients	"Weekly/ Daily/ Multiple times daily"	PS	MDs 24/333 (7)	Non-MDs 0/57 (0)	.011*
		G	Male practitioners 17/251 (7)	female practitioners 7/139 (5)	.026*
24. Have patients who during an office visit present with medical information from the web during	"Weekly/ Daily/ Multiple times daily"	PL	Hospital-based practitioners 157/241 (65)	CGP-based practitioners 55/108 (51)	.043*
25. Training on Microsoft outlook	"None/ Not adequate"	PL	Hospital-based MDs 183/242 (76)	CGP-based MDs 65/88 (74)	0.040*!
		G	Male practitioners 183/250 (73)	Female practitioners 108/133 (81)	.049*
26. Would take continuing medical education over the web	"Frequently/ Very frequently/ Always"	PL	Hospital-based MDs 92/241 (38)	CGP-based MDs 49/91 (54)	.027*
27. Would prefer to participate in administrative meetings using video teleconferencing	"Frequently/ Very frequently/ Always"	PL	Hospital-based practitioners 89/271 (33)	CGP-based practitioners 55/111 (50)	.001*

28. Have acute patients who would benefit from remote monitoring and management	"Yes"	PL	Hospital-based MDs 12/35 (34)	CGP-based MDs 12/21 (57)	.009
29. Interest in participating in future on-going discussion about tele-health and web innovations at the provider organization	"Interested/ Very interested"	G	Male practitioners 129/229 (56)	Female practitioners 51/127 (40)	.018*

Notes
The first number represents the number of respondents who answered the question affirmatively. The response rate is represented as a percentage in brackets. The number after the / indicates the total number of respondents.
* Indicates P value represents the entire Likert scale.
*! Denotes that the p value is chi-squared but not binary significant.

3.6 Discussion

The gathering and analysis of this qualitative data were framed around the four Telemedicine Needs Assessment aims. To reiterate, those aims are: 1. establish a computer and web enablement baseline; 2. identify factors influencing practitioners' computer and web enablement; 3. project realistic timelines for moving towards a paperless environment, and finally; 4. determine if a telemedicine program complete with call center interface could potentially complement the provider organization's case management program. As noted in the introduction, findings from the survey provide the provider organization with fixed data points specific to computer and web access, use, and perceived needs. However, this quantitative data does not shed any light on the individual, organizational, and industry dynamics driving these numbers. After reading the findings, we know where the provider organization is but have no inkling where it is going. In other words, are the numbers likely to increase, decrease, or have they achieved stasis? Simply stated, these findings describe *work* but not *work practice*: numbers and percentages alone do not afford predictive insights into the motivators for or barriers to computer and web enablement.

The provider organization's first aim was to establish its practitioners' computer and web access, use, and perceived needs baseline -- a baseline against which the success, failure, or potential usefulness of any future medical informatics implementation would be evaluated. The need for provider organizations to establish computer and web enablement baselines, particularly during this period of burgeoning, interoperable clinical and telecommunication integrated delivery networks, cannot be stated plainly or often enough (Anderson, Aydin, & Jay, 1994; Friedman & Wyatt, 1997). Prior to the data generated by this Telemedicine Needs Assessment, the provider organization's senior management lacked critical information on which to base realistic clinical, business, information systems, and information technology decisions that would move the institution towards realizing its goals: a paperless environment and an electronic medical record -- both, operations requiring a high level of computer and web enablement. The provider organization's comfort level of knowing that 90% of their practitioners had access to computers was altered significantly when 76% of the practitioner population reported training on the organization's e-mail handler as "*none or inadequate*". Similarly, discovering that only 10% of practitioner respondents are using the provider organization's staff-only intranet -- the institution's primary "paperless" telecommunications tool, also affected the provider organization's paperless and electronic medical record implementation strategies and timelines. To summarize, survey data can

establish the incidence and prevalence of a problem but it doesn't assist the provider organization in moving towards a potential solution.

The provider organization's second aim was to identify the factors influencing practitioners' computer and web enablement. Establishing these factors would assist the provider organization in determining and aligning its strategic clinical and administrative business trajectories with its information systems and information technology needs. Findings determined that practitioner status, practice location, and gender do influence practitioners' computer and web enablement and seemingly in very specific ways. In this physician-run provider organization, practitioner status has a marked influence on computer and web enablement: non-MD/PhDs report significantly less access to and use of computer and web technologies. Similarly, practice location affects practitioner's perceived needs for computer and web technologies: CGP-based practitioners perceive a greater need for teletechnologies that would potentially support and assist healthcare delivery. Finally, gender influences computer and web enablement but seemingly to a lesser degree than practitioner status. Preliminary data suggest that there may be differences in the ways that males and females use or integrate computer and web technologies into medical practice. These surprising findings, at the aggregate level of practitioner status, practice location, and gender, force us to re-examine how, as researchers, we've tended to delimit our repertoire of factors influencing computer and web enablement at the level of the individual practitioner.

The traditional lens for establishing factors influencing practitioners' computer and web enablement is to frame the factors as *barriers*. These "barriers to practitioners integrating computers and the web into medical practice" are well documented in the medical informatics literature (Anderson, Aydin, & Jay, 1994; Field, 1996; Friedman & Wyatt, 1997; Harrop, 2001; Lorenzi & Reily, 1994; Lorenzi et al., 1997; Lorenzi & Reily, 2000). Prior research has focused, for the large part, on practitioners' age (Liaw, Ugni, & Cairns, 2000); inadequate skill sets (Mamary & Charles, 2000); lack of training (Jerant & Lloyd, 2000); and even recalcitrance (Anderson, Aydin, & Jay, 1994). In contrast, this research allows speculation on the influence of the practitioners' *context* on computer and web enablement. This paper suggests that forces well beyond the individual, such as practitioner status, practice location, and gender can potentially influence computer and web access, usage, and perceived needs. In part, the influences or barriers to computer and web enablement are driven by the organization itself --- its geography (practice location), culture (practitioner status), and historical biases (gender).

The third aim of the Telemedicine Needs Assessment was to project realistic timelines for moving towards a paperless environment and an electronic medical record -- goals requiring ubiquitous computer and web enablement. Survey findings suggest that the provider organization has a long way to go to realize its goals. For example, the success of the extensive in-patient and out-patient case management program depends on attendant practitioners' ability to communicate and co-ordinate a patient's "cycle of care" with a patient's case manager and specialists. Learning that 70% of hospital-based practitioner respondents and 87% of CGP-based practitioner respondents "*never*" get e-mail requests from colleagues for case consultations underscores the magnitude of change required to move even the administrative aspects of the case management program from paper to the provider organization's intranet.

The final aim of the Telemedicine Needs Assessment, was to determine if telemedicine, particularly the web-based remote monitoring and management of acute and chronic disease populations with call center support, would complement the organization's extensive in-patient and out-patient case management program. It was a worthy aim, but achieving it, given the complexity of the task, would require a dedicated research program. That being said, just identifying and framing up this aim proved useful for both the provider organization and the researcher. The provider organization became sensitized to a vision wherein remote monitoring and management, a call center, and case management programs complemented one another. Moreover, the researcher was inspired to conceive of a clinical and

telecommunications integrated delivery systems model that would deliver such a service. This model is the subject of Chapter Five.

To conclude, based on these findings, the question facing the provider organizations is, how would they go about addressing these differences in practitioners' computer and web enablement? This research identified 29 computer and web access, usage, and perceived differences between comparison groups. These differences could also be framed as disparities, in computer and web access, use, and perceived needs. As noted earlier, when these 29 differences were modeled, across practitioner status, practice location, and gender, using a Venn diagram, tellingly, the intersection of the three sets captured the core tools for practitioners' computer and web enablement: having a computer or laptop at work, having the provider organization's e-mail handler installed, using e-mail to communicate with colleagues and administration, and so on. In effect, the Venn Diagram provides the provider organization with a hierarchy of disparities, which conversely, can be interpreted as a hierarchy of needs -- needs the provider organization must address to achieve ubiquitous computer and web enablement.

3.7 Conclusion

If a provider organization's goal is ubiquitous computer and web enablement then differences in computer and web access, usage, and perceived needs, based on practitioners' status, practice location, and gender, must be addressed. Moreover, the design, development, and implementation of these technologies must be inextricably linked with practitioners' work/work practice.

4. TYPOLOGY OF BARRIERS TO COMPUTER AND WEB ENABLEMENT

4.1 Introduction

This chapter presents findings from the Telemedicine Needs Assessment qualitative research program. When appropriate, quantitative data generated by the Telemedicine Needs Assessment survey are cited to establish the pervasiveness of a phenomenon. The qualitative data were gathered during cross-sectional, institution-wide, in-depth interviews, observation, and participant observation at administrative and clinical meetings and during day-to-day operations. Over the course of the research project, analysis of the data evolved into a typology of barriers to ubiquitous computer and web enablement within the provider organization. The typology of barriers is the focus of this chapter.

Qualitative data presented in this chapter are an unequivocal complement to the quantitative data offered in the preceding chapter. Together, Chapters Two and Three establish the degree of flux that the provider organization is experiencing -- flux resulting from the introduction of the computer and web into healthcare delivery. Moreover, these two chapters establish how that state of flux affects the organization's ability to move towards ubiquitous computer and web enablement. Guiding the investigation into this state of flux has been Process Architecture's underlying construct that discussions specific to technology and work must be inextricably linked to the end user's work practice. Too, the Process Architecture concepts of dynamic coherence and uneven development, presented in chapter one, are brought to bear on the investigation. These analytical tools, when applied, result in the requisite data for an emergent vision or framework for integrating real and virtual healthcare, the subject of Chapter Four; and the model for realizing that vision, the subject of Chapter Five. The remaining Process Architecture concepts of design inquiry and collaborative engagement, also introduced in chapter one, will be instrumental in both the design of the framework and model and the healthcare delivery processes that the framework and model precipitate.

The typology of barriers presented, is by no means exhaustive. However, it does constitute a significant contribution to the field of medical informatics for three reasons. First and foremost, the typology demonstrates, from the level of the individual practitioner up to the organization as a whole, the critical importance of linking work with work practice. In other words, the typology gives heft to the argument that these barriers to ubiquitous computer and web enablement exist because there is a pervasive disjunction -- in the minds of the attendant administrators, practitioners, and vendors -- between potential medical informatics technologies and the end users' work/work practice. Second, the barriers that this typology articulates point to the need for a conceptual framework that identifies and integrates the computer and web's real and virtual products, services, and technologies into the existing healthcare delivery system. Third, the prospect of a conceptual framework raises the need for a complementary information technologies (IT) and information systems (IS) infrastructure to make the framework a reality.

While reading this chapter, practitioners and administrators will identify with the plight of the provider organization studied. As barriers in the typology exemplify, when it comes to integrating computer and web technologies into healthcare delivery, provider organizations lack a *big picture*. Persons do not fully understand what these technologies are capable of, how they work, what their infrastructure requirements are, or how to integrate them into the existing healthcare delivery system. The typology of barriers presented in this chapter is a tool, albeit rudimentary, for building that *big picture*. In other words, the typology allows us to identify areas and issues, where there is ignorance, oversight, misunderstanding, or in many case all three. It is these issues or dynamics that, left unattended over time, manifest as significant barriers to ubiquitous computer and web enablement.

This chapter begins where the background theory and methodology presented in Chapter One concluded. First, the specifics of the qualitative research program are outlined. After identifying how and where data were collected, an analytic matrix is tabled. The matrix illustrates how an interview, (a formal qualitative data collection event) is deconstructed and used to inform the typology presented in this chapter, the framework presented in Chapter Four, and the model in Chapter Five. Then, the typology of barriers is presented. Following that, the Process Architecture concepts of dynamic coherence and design inquiry are applied. The chapter concludes by reflecting on what happens within a provider organization when barriers to computer and web enablement are not addressed.

4.2 Specifics of the qualitative methodology

This chapter presents the qualitative data from the Telemedicine Needs Assessment, August 1999 through March 2000. To reiterate, the qualitative methodology included cross-sectional, institution-wide, in-depth interviews, and participant observation at administrative and clinical meetings and during day-to-day operations at the provider organization. The specifics of those interviewed, the number of interviews, types of observation, participant observation sessions, and so on, are presented in Table 11 and 12.

Table 11. An overview of the interview data collected during the Telemedicine Needs Assessment Aug 1999 – March 2000.

Interviews **Subjects**	**Number of persons interviewed**	**Number of times interviewed**	**Number of sites visited**
Management			
Chief strategic officer	1	4	
Chief financial officer	1	2	
Chief information systems officer	1	1	
Chief medical officer	1	3	
Network services officer	1	6	
Specialist Practitioners			
Chronic heart failure	1	1	
Orthopedics	1	1	
Liver transplant social worker	1	1	
World Clinic clinician and staff	4	1	
Infectious diseases and travel: clinician and staff	2	2	
Concierge Service for the middle east: practitioner and administrator	2	2	
Dermatologists	1	2	
Medical Informatics	1	2	
Radiology	1	2	
Breast Cancer	1	1	
Executive check ups	1	1	
Urology	1	1	

Community group practices (CGP)			
Chief of CGPs	1	2	
Senior administrator for CGPs	1	2	
Community group practice physicians	6	1	6
Senior office manager CGP	1	3	
Senior office administrator	1	2	
Case Management			
Head of in-patient case management	1	3	
Head of out-patient case management	1	2	
Regional head of case managers	1	1	
In-hospital case manager	2	1	
Out-patient case manager	1	1	
Case manager	1	1	(home visit)
Geriatrics			
Geriatric internist	1	3	
Geriatric internists nurse	1	1	
Geriatric internist case managers	1	3	
Geriatric internist skilled nursing facility case manager	3	1	5
External lab serving skilled nursing facilities	1	1	
Others			
Diabetes dietitian	1	1	
Social workers	2	1	
Web page development staff	2	2	
Provider organization's lawyer	1	1	
Librarian	1	1	
Research services	1	1	
Appointment booking	2	1	

Following is an overview of what I refer to as "Operation Water Cooler". As any ethnographer will attest, there is no substitute for just being there. Although these tables capture an overview of specific events, listening to a participant critique the meeting we've just attended, while waiting to advance in the cafeteria lineup, could potentially yield qualitative data that is just as important as the data that emerged from a formal meeting.

Table 2. An overview of observation and participant observation data collected during the Telemedicine Needs Assessment Aug 1999 – March 2000.

Observation and participant observation sessions

Administrative meetings

Senior management meetings to vet the following web and telemedicine technologies and related companies:

- Americasdoctors.com
- DrKoop.com
- VNCI
- Bang

- Web development
- Caduceus
- CD/Web patient education products
- Concierge service for the middle east

Senior Management meetings specific to international initiatives that would potentially require a telemedicine interface

Middle management meetings to ascertain appropriate granting agencies and patient populations for telemedicine pilots

Telemedicine Task Force monthly meetings

Telemedicine Task Force Executive meetings

Telemedicine Task Force special committees, bi-monthly meetings

On-going meetings with my administrative and clinical bosses

Clinical meetings

Networked grand rounds

Monthly telemedicine dermatology cost model meetings

Tours of five skilled nursing facilities and one laboratory

Day-to-day operations: "Operation Water Cooler"

Finances department (where my office was located for three months)

Word Clinic (where my office was located for five months)

Numerous follow up meetings to each of the vendors presentations

The following thematic matrix illustrates how the data in an interview is deconstructed and used to inform the typology, the framework, and the model. To preserve continuity I've used the interview with the community group practice practitioner cited in chapter one, Dr. Snow. To reiterate the methodology in Chapter One, data pointing to a survey question or follow up in subsequent interviews is underlined. Subject matter for the typology is bolded.

Table 13. Sample thematic matrix established by deconstructing the data from an interview with a community group practitioner.

Interview: Harrop/Snow 99 06 03	**Typology**	**Framework**	**Model**
1. Establish computer and web enablement baseline			
Access			
• e-mail with patients is going to increase		F	M

Use			
• Practitioners in 30s and 40s not using computers	T		M
• Only 10%-12% of practitioners look at lab results on-line			
Perceived needs			
• **Colleagueship cited as fundamental building block**	T		M
o Will refer patients if can put a name to a face			
o Will cement practice relationships			
o CGPs need to feel part of the provider organization community			
• **VTC needed**			M
o For grand rounds, educational sessions, medical meetings, lectures in cyberspace			
• Need teledermatology: younger doctors don't have enough experience in dermatology			M
• **Would use VTC for administration**			M
2. Identify factors influencing computer and web enablement			
Access			
• Competitor provider organizations provide tech support at work and at home			M M
• For patients who have to travel, the tertiary care hospital is a long way from the community group practice			M
• **Convenient and established relationships with local specialists: feedback is instantaneous**			
Use			
• It has taken a long time for physicians to become programmers	T		
• **Microsoft Outlook is not intuitive**	T		
• **E-mail needs to be secure**	T		
• Practitioners get too much e-mail from administration			
• Nurses spend too much time reading e-mail			
Perceived Needs			
• **Computer interface should engage physicians not frustrate them to death**	T		
3. Timelines for a paperless environment and electronic medical record			
Access			
o **Presently the practice is not on the provider organization intranet**			M
Use			
• Pre-managed care a physician needed 2.2 support staff, now they need 3.5 because of the additional paperwork			M
Perceived Needs			
• **Intranet home page is a problem**. Should come up when turned on; list medical events of the day; special events, VTC should be advertised	T	F	
• Computers should tell you when you have e-mail		F	
• Provider organization with scrolling events as screen saver		F	
• **Password protocols too cumbersome**	T		M
• **System not reliable: breakdowns frequent**	T		M
• Speed, simplicity, and accessibility are everything			M
• MDCONSULT, Scientific America and AOL have great interfaces			
• Provider organization intranet home page should link to			

MEDLINE; provider organization's library	F	
• Drug companies could underwrite web development		
• **Cut back on paperwork**. Prescriptions, referrals, feedback from referrals, clearance from third parties should all be computerized		M
• On-line patient education		
o CGPs should be able to download education and support material off the provider organization's web site	F	
o Should be able to e-mail patients info or hot links pertinent to their condition	F	
o Need to deliver credible medical information		M
o Need to delivery it when the patient is most receptive to it		M
4. Can remote monitoring and management complement case management		
Access		
Use		
• Virtual consults for patients	F	M
• Patients don't discriminate between real and virtual healthcare delivery, they are acculturated from playing computer games		
Perceived Needs		

Notes
Data pointing to a survey question or follow up in subsequent interviews is underlined. Subject matter for the typology is bolded.

One of the mandates of the Telemedicine Needs Assessment was to identify barriers to practitioners' computer and web enablement. At the time the Telemedicine Needs Assessment was submitted to the Telemedicine Task Force, the barriers cited had not evolved into a typology. In fact, the submission to the Task Force was limited to a list of barriers. It was only during the development of both the framework for integrating and real and virtual healthcare, and the systems-based clinical and telecommunications integrated delivery network model, covered in Chapters Four and Five that a typology of barriers started to emerge. In other words, these structures: the typology, the framework, and the model, were all emergent. Their development did not follow a linear progression, but rather, progress resulting from developments in one area resulted in round robins of insight and advancement in the other two.

4.3 Typology of barriers

In the typology overview presented in Table 14, barriers to computer and web enablement are grouped as follows: provider organization barriers; practitioner barriers; administrator barriers; and lastly, healthcare delivery sector barriers. Until recently, research into barriers to computer and web enablement has focused primarily on the shortcomings of the end user (Aas, 2000; Anderson, Jay, Schweer, & Anderson, 2001; Field, 1996; Frazer, Jamalapuram, & Hughes, 2001: Latcher, 2000; Teach & Shortliffe, 1981). More recently, research on barriers has shifted to include organizational issues. (Aas, 2001; Ash, 1997; Braude, 1997; Kaplan, 1997; Kaplan et al., 2001; Lorenzi, 1994; Southon, Sauer, & Dampney, 1997; Southon, Sauer, & Grant, 1997)

Although recognizing the role of provider organizations is a step in the right direction, to date there is no methodology to tease apart what constitutes an organizational barrier to computer and web enablement. This typology guided by Process Architecture Theory concepts of *dynamic coherence* and *uneven development*, puts forward a methodology for identifying and understanding these complex and interrelated organizational behaviors.

Table 3. Overview of the typology of barriers to computer and web enablement.

	BARRIERS
Organizational	1. Institutional understanding of telemedicine technologies is nascent: video teleconferencing is familiar whereas remote monitoring and management technologies are an unknown. 2. The provider organization's lack of conceptual frameworks for a full-service web portal and telemedicine technologies impedes the corporate decision making process. 3. Stakeholders' concept of remote monitor and management program does not include electronic record keeping. 4. Stakeholders' concept of remote monitor and management program does not include a call center. 5. Uncharted strategic partnerships with integrated delivery networks would replace familiar service relationships and necessitate outsourcing. 6. Integrated delivery networks push the business model envelope. 7. Potential use of teletechnologies reveals the provider organization's espoused agenda. 8. Administration and clinicians apply different lenses when assessing the viability of a remote monitoring and management program. 9. Web development lacks patient/consumer and practitioner input. 10. Hierarchical culture of the organization clashes with technology's "level playing field" effect. 11. Previous IS failures have sensitized the provider organization to tech innovation.
Practitioner	1. Practitioners' internet web site needs not met by the provider organization. 2. Practitioners' perceive *"Medico-legal issues, added expense, limited utility"*; and so on, as barriers to integrating telemedicine technologies. 3. Microsoft Outlook does not meet practitioners' work/work practice needs. 4. IS infrastructure of the provider organization is less developed than the IS systems of the community group practices they purchased.

Administrative	1. Access to a computer, the web, and training on these technologies, is not consistent across the provider organization. 2. Lack of a strategic vision and mandate impedes interdepartmental collaboration and resource coordination. 3. Administration is apprehensive about independent telemedicine initiatives. 4. IS's Microsoft web page wizard preempts a fit between stakeholders and their work/work/practice needs.
Industry wide	1. Telemedicine vendors and provider organizations restrict the conceptualizing of potential applications of remote monitoring and management to established vertical acute and disease populations. 2. Potential synergies between telemedicine and case management are overlooked. 3. Classification and stratification of patient populations undermines the potential integration of computer and web technologies. 4. Lack of reimbursement continues to be a negative issue for provider organizations. 5. Concerns about security, confidentiality, and privacy persist.

Barriers identified in the overview will now be elaborated on.

4.3.1 Organizational Barriers

Barriers to computer and web enablement at the organizational level coalesce around a lack of understanding of what these technologies are capable of; how they work independently and together; what their infrastructure requirements are; and how to integrate them into the existing healthcare delivery system. These barriers speak to the need for two critical tools: 1. a framework integrating real and virtual healthcare delivery, and, 2. a model for a systems-based IT and IS infrastructure that would support integration and delivery.

4.3.1.1. Institutional understanding of telemedicine technologies is nascent: video teleconferencing technologies are familiar whereas remote monitoring and management technologies are an unknown. Qualitative findings revealed that practitioners and administrators lacked a background understanding of telemedicine. For example, it was not general knowledge that the term telemedicine encompasses a number of telecommunications technologies to include: phone or web based video teleconferencing, remote monitoring and management incorporating simultaneous video, audio, and data transmission, store and forward, interactive video teleconferencing, and so on. Additionally, stakeholders were unaware that remote monitoring and management technologies and their concomitant infrastructure and peripheral device requirements varied from application to application. For example, radiology and dermatology use still images but the image quality requirements are significantly different as are their technology infrastructures for image capture, transmission, data archiving, and so on. Finally, the relationship between potential teletechnologies and their integrated delivery network partners, and the organization's extant IS infrastructure and potential web portal, remained undefined.

4.3.1.2. The provider organization's lack of conceptual frameworks for web portal and telemedicine technologies impedes the integration of these technologies. The provider organization was confused about the infrastructure requirements for telemedicine and a full service web portal. First, stakeholders did not understand that telemedicine initiatives and a fully operational web portal, when appropriate, would share the same information systems backbone. In fact, the provider organization's administration and practitioners did not have a conceptual framework for differentiating between the web portal and the infrastructure required to support it. Similarly, the provider organization's administration and practitioners did not have a conceptual framework for differentiating between telemedicine technologies and the infrastructure required to support them. Furthermore, stakeholders in the provider organization didn't appear to be able to conceptualize the interdependent and overlapping integrated infrastructure requirements of the telemedicine and web portal technologies. For example, both the full service web portal and the telemedicine program for the remote monitoring and management of acute and disease populations, that the provider organization was entertaining, required a call center operating twenty-four hours a day, seven days a week. Finally, it was not transparent to the provider organization's administration and practitioners that the telemedicine technology and web portal individually or together, required the highly specialized integrated delivery networks' service provider's skills and its integrated and interoperable interface to be fully operational.

4.3.1.3. Stakeholders' concept of remote monitoring and management program does not include electronic record keeping. Integral to the concept of remote monitoring and management is an electronic record of the processes being monitored. Steps a provider organization would take towards implementation of an electronic medical record would include stakeholders' ubiquitous use of e-mail and the organization's intranet. Although the adoption of an electronic medical record was part of senior management's strategic plan, the cultural and practical transition to a 'paperless' environment within the organization studied was nascent. Survey results demonstrated that practitioners had yet to integrate use of the provider organization's intranet, the premier paper alternative, into every day practice. Of the 406 survey respondents, 386 practitioners answered the question, "*Do you use the provider organization's intranet*?" which is the organization's existing paperless communication channel, 41 (11%) responded "*Yes*" meaning "*daily/multiple times daily*". Of the total number of 406 survey respondents 389 answered the question, "*Do you use e-mail to communicate with colleagues*?" 157 (40%) responded, "*Yes*" meaning "*daily/multiple times daily*". Of the total number of 406 survey respondents 391 answered the question, "*Do you use e-mail to communicate with administration*?" 89 (23%) responded, "*Yes*", "*Weekly, Daily, Multiple times daily*". To summarize, although it was the provider organization's intent to move in the direction of an electronic medical record, even preliminary steps in that direction, namely ubiquitous use of the intranet and e-mail with administration and amongst practitioners, had yet to be realized.

4.3.1.4. Stakeholders' concept of remote monitoring and management program does not include a call center. The call center forms the hub of any remote monitoring and management initiative. Survey results did indicate significant support amongst practitioner respondents for an outsourced call center offering patients twenty-four hours a day, seven days a week, access to triage by qualified registered nurses. Of the 366 out of 406 practitioners who responded, 182 (54.16%) reported being "*positive/very positive*" about a call center service. However, a previous clinician-led initiative to establish an in-house call center had failed, and at the time of the Telemedicine Needs Assessment, neither an in-house nor an outsourced call center was being planned. Interestingly, the outsourced call center that came bundled with the telemedicine technology, worked against the vendor. The provider organization perceived it as competition for the tertiary setting's in-house, nine to five, nurse triage services offered by general internal medicine.

4.3.1.5. Uncharted strategic partnerships with integrated delivery networks would replace familiar service relationships and necessitate outsourcing. For the provider organization, telecommunication integrated networks, together with outsourcing, posed two interrelated and seemingly insurmountable practical and cultural hurdles. Formerly, individual companies sold a single technology or service for that technology to the provider organization (for example PICTEL or VTEL). By way of contrast, the telemedicine company lobbying the provider organization came packaged with several strategic partners offering a call center, data management and archiving center, secure IP-VPN internet service provider, and so on. Unfortunately for the provider organization, the proposed telecommunication integrated delivery network was wholly dependent on outsourcing for its services such as: a 24/7 call center, data management, data archiving, e-commerce capabilities, and so on. At the time of the study, all of these outsourced services were outside the culture and strategic plan of the provider organization. At the same time, these same integrated services could not be provided in-house. The provider organization's IS staff reported that they lacked the requisite skills and did not have the autonomy, flexibility, adequate IS infrastructure, or operational resources to respond quickly to proposed web and telemedicine technological initiatives. Finally, the provider organization's outsourcing alternative, high pressure, "limited-time-only" affiliated partnerships with newly established web portals were soundly rejected because the canned solutions would have exchanged the provider organization's identity for the external brand of the dot.com. Moreover, these commercial web portals would have failed to fully address the provider organization's entire virtual healthcare delivery infrastructure needs.

4.3.1.6. Integrated delivery networks push the business model envelope. If implemented, integrated delivery networks and outsourcing would have a profound influence on the provider organization's extant cultural norms and revenue generating practices. Because telemedicine and web portal technologies came bundled with communications and data management infrastructure, they offered the provider organization the opportunity to segue straight into strategic e-commerce care-delivery applications and related business opportunities. These technologies were, in effect, imposing a new advertising, marketing, and business culture that historically had been outside the purview of traditional hands-on clinical practice. Lack of experience in the e-domain left senior management vulnerable to the demands of members of the institution's board of trustees who were promoting their latest e-healthcare initiatives. In other words, business and personal in-house relationships rather than objective protocols became a "fall back" criteria for whether or not a software application or telemedicine technology was considered.

4.3.1.7. Potential use of these telemedicine technologies reveals the provider organization's espoused agenda. The telemedicine company alleged that cost savings could be realized if their integrated delivery network was used to remotely monitor and manage chronic heart failure patients. This caused the provider organization to question, "*Would virtual healthcare delivery's potential for savings negate real healthcare delivery's potential to generate revenue?*" Coupled with this issue of determining the provider organization's espoused healthcare delivery agenda was the organization's inability to determine how to arrive at an answer. This issue is detailed in the third of the industry-wide barriers, "*The Classification and stratification of patient populations undermines the integration of computer and web teletechnologies*".

4.3.1.8. Administration and clinicians apply different lenses when assessing the viability of a remote monitoring and management program. During the course of vetting potential teletechnologies it became apparent that practitioners and administrators have differing criteria and processes for evaluating the potential viability of a proposed telemedicine program. Administration's criteria, namely a guaranteed, immediate return on investment, precipitated a classic, top-down, cost-benefit analysis of the teletechnologies' potential. Administrators, whose mandate was fiscal responsibility, asked, for example,

"Does the institution have enough chronic heart failure patients to warrant the investment? Will it result in significant savings?" By way of contrast, clinicians engage in a bottom-up, incremental, case-by-case, proof-of-concept approach, to mean, *"I have a patient that could really use this. I'd like to demo the device and see if we can make it work"* Administration, having determined that the application would not result in sufficient cost-savings for a specific disease population, disengaged from negotiations with the telemedicine vendor. Clinicians meanwhile, maintained contact with the vendor and continued searching for an appropriate demonstration project that would allow practitioners to concomitantly "test-drive" the remote monitoring and management technology and the relationship with the vendor.

4.3.1.9. Web development lacks consumer and practitioner's input. Unfortunately the mandate of the Telemedicine Needs Assessment did not include patients. That having been said, survey results indirectly revealed the need for a tighter fit between patients' desire for web-based medical information and the web-based medical information that the provider organization currently offers. Of the total number of survey respondents, 349 answered the question, *"Do you have patients who present with medical information that they have pulled down from he web?"* 57 did not answer the question. Of the 349 who did answer the question 212 (61%) responded "*Yes*", 137 (39%) did not. In contrast, of the total number of 406 survey respondents, 339 practitioners answered the question *"Do you refer patient to the provider organization's internet web site for health information?*" 67 did not answer the question. Of the 339 who did answer the question 13 (4%) responded "*Yes*", 326 (96%) did not. To elaborate, there are two parts to this barrier. First, the provider organization is not meeting the patient's needs for web-based medical information. Second, the practitioners themselves do not perceive the provider organization's web site as one to recommend to patients. It may be that the patients are more web-savvy than the provider organization and the practitioners.

4.3.1.10. Hierarchical culture of the organization clashes with technology's "level playing field" effect. Prominent surgeons with military backgrounds founded the provider organization. Consequently, the provider organization is steeped in top-down traditions that contrast sharply with the distributed, grass roots, "development from the bottom up" clinical and telecommunications integrated delivery networks being considered. One hospital-based internist pointed out that telemedicine technologies that facilitate autonomy and the flow of information were not in keeping with senior administration's modus operandi, namely, "*loose lips sink ships*".

4.3.1.11. Previous IS failures sensitize the provider organization to tech innovation. At the time of the study, the provider organization was immersed in rectifying a hugely expensive institution-wide IDX (an office management and billing software) implementation gone wrong. Consequently, innovation on the scale required by full-scale virtual healthcare delivery would be considered only if there was an immediate and guaranteed return on investment. However, without a clear understanding of these technologies and their requisite infrastructures, the provider organization was unable to determine where the potentially return on investment would be.

4.3.2 Practitioner barriers

Barriers to computer and web enablement at the practitioner level underscore the need and importance of applying Process Architecture Theory to the field of Medical Informatics. Each of the barriers cited here exhibit the disjunction between the computer and web technologies being offered by the provider organization and the specific work/work practice needs of individual practitioners.

4.3.2.1. The provider organization's internet web site does not meet practitioner's needs. Typically, the web portal forms the front end of a remote monitoring and management program and, as such, must be acutely tuned to the needs of the practitioners and patients served. As noted previously, survey results revealed that less than 4% of practitioners referred their patients to the provider organization's site, "*daily/multiple times daily*", for healthcare information. Furthermore, practitioners surveyed, and support staff including social workers and dietitians servicing disease populations, were blunt about the lack of fit between their needs, what they perceived their patients' needs to be, and what the provider organization's intranet offered, *"Useless, very hard to use, very little available to patients"*.

4.3.2.2. Practitioners' perceive barriers to integrating telemedicine technologies. At the end of the Telemedicine Needs Assessment survey, a space was provided for respondents to register comments. Following are excerpts representing what practitioners perceive as barriers to integrating clinical and telecommunication integrated delivery networks into healthcare delivery: *"Medico-legal issues must be addressed"; "Huge added expense with unclear functional benefits"; "Very limited utility"; "Might further strip the "human component" away from the profession"; "What is the proven reliability and effectiveness?"; "Need to understand more about telemedicine's capabilities"*.

4.3.2.3. Microsoft Outlook interface does not meet practitioners' work/work practice needs. Outlooks' e-mail interface appeared to pose significant problems for end users, including the researcher. First, all employees in the institution's e-mail directory were listed by their first name. This unusual presentation resulted from a time sensitive merger "annulment". Second, interview subjects noted that, to the end user, it was not immediately transparent or intuitive how to organize the mail boxes in Microsoft Outlook. In the healthcare industry where organizing and accessing information is of paramount importance, the Microsoft Outlook e-mail interface poses a significant barrier. Practitioners were positive about Pegasus, the previous free e-mail handler, that the provider organization had used prior to licensing Microsoft Outlook.

4.3.2.4. The provider organization's office management infrastructure is less developed than the computer-based office management systems used by the community group practices they purchased. Several of the community group practitioners interviewed pointed out that the office management infrastructure that they had as independent privately owned medical practices was more sophisticated than the practice management infrastructure that the provider organization had since put in place. In other words, they perceived using the provider organization's practice management system to be a step backwards. As independent businesses, the community group practice practitioners had been accountable for the bottom line on a day-to-day basis. This level of accountability for the number of patients seen or revenues generated was not possible with the new management and accounting software.

4.3.3 Administrative barriers

Administrative barriers to ubiquitous computer and web enablement arise from the lack of a vision integrating real and virtual healthcare and additionally, a basic understanding of the technologies and how they can be successfully deployed. Administrative barriers differ from organizational barriers in that the barriers cited are the provenance of senior management including the Chief of Information Systems.

4.3.3.1. Access to a computer, the web, and training on these technologies, is not consistent across the provider organization. Access to, and an ability to use and organize e-mail, is key to a remote monitoring and management program's success. At this provider organization, 75% of survey respondents reported training on the institution's e-mail handler as "*non-existent*" or "*inadequate*".

Furthermore, practitioners did not have uniform access to basic remote monitoring and management technologies, namely, the computer and web: *"I have no computer, I travel to four skilled nursing facilities and long term care. Use community group practice site computer hook-up to obtain labs, x-rays. Would love to have a laptop. Would be beneficial for my daily work."* In fact there were 65 (16%) non-MDs in the 406 respondents. Of the 65 non-MD survey respondents, 2 did not answer the question. Of the 63 who did answer the question, 35 (56%) had a computer, 30 (44%) did not. By way of contrast, there were 337 MDs and 4 Psychologists in the 406 respondents. Of the 341, 5 did not answer the question. Of the 336 who did answer the question, 329 (98%) had a computer, 7 (2%) did not.

4.3.3.2. Lack of a strategic vision and mandate impede interdepartmental collaboration and resource coordination. There was a high degree of interest in, and informal support for telemedicine from clinicians, the IS department, members of the institution's medical informatics group, the web development department, and philanthropy. However, without a clear mandate and directive from senior management, interested parties were unable to realize and coordinate their support. For example, philanthropy was unable to actively pursue telemedicine donations to underwrite remote monitoring and management initiatives, and the web development team was unable to collaborate on a web portal interface supporting remote monitoring and management.

4.3.3.3. Administration was apprehensive about independent computer and web initiatives. Administrators were disturbed by the proliferation of independent telemedicine initiatives taking hold across the organization. Administration's concerns were threefold. First, they were concerned that the provider organization would develop telecommunications systems that were not interoperable. Second, they questioned if the independent initiatives would duplicate what IS already provided. Third, they suspected that time, money, and effort, were being invested in initiatives independent of directives from senior management. Interestingly, it was not transparent to administration that these independent telemedicine initiatives, by virtue of the circumscribed clinical needs they addressed, were self-contained and self-limiting. For example, a clinician in psychiatry implemented a secure, off-the-shelf, phone based video-teleconference link with colleagues at a remote site so that remotely located colleagues could take part in weekly problem-case reviews. Additionally, administrators, because of their naiveté, did not understand that without the systems infrastructure that remote monitoring and management applications require, (for example, a call center, data management and archiving, administrative and clinical support personal, and so on), telemedicine initiatives, other than strictly telecommunications applications, are forced to stay at the demonstration level. Finally, administrators expressed an affinity for the single umbrella telecommunications technology that would meet all the institutions telemedicine needs and afford control over the remote monitoring and management initiatives instigated.

4.3.3.4. The IS department's use of Microsoft web page wizard preempts a fit between stakeholders and their work/work practice needs. As senior telemedicine consultant to the Telemedicine Task Force, I approached the IS department to establish a web site for the telemedicine task force members. Interestingly, the IS department would only support web sites generated by the Microsoft web page wizard. Furthermore, no modifications to the structure of these sites, accessible through the provider organization's intranet, were permitted. The web wizard template did not meet the Telemedicine Task Forces' most basic needs so, ironically, the concept of a web site for the telemedicine group was abandoned.

4.3.4 Industry wide barriers

Barriers to ubiquitous computer and web enablement in the healthcare delivery sector, as at the level of the provider organization, lack a vision articulating how to integrate real and virtual healthcare delivery. This lack of vision is, in part, an evolutionary issue. It is only now that we have clinical and telecommunications integrated delivery networks that we can entertain and deploy a comprehensive, interoperable, systems-based vision.

4.3.4.1. The telemedicine vendor and administration restrict conceptualizing potential applications of remote monitoring and management to established vertical acute and disease populations. The lack of methodologies for identifying potential remote monitoring and management patients poses a significant barrier. Just prior to the Telemedicine Needs Assessment the provider organization's senior management determined that less than 1% of the organization's entire patient population accounted for 40% of inpatient costs and 30% of outpatient costs. Although not committed to print, this construct was internalized and acted upon by case managers and senior management. These costly, "high risk" or "frequent flyer" patients were identified using after-the-fact and often difficult to procure pharmacy and insurance claims data. As the analysis of the Telemedicine Needs Assessment data on remote monitoring and management unfolded, the hypothesis amongst clinicians emerged that there might be significant overlap between the patients identified through case management and the patients identified in the Telemedicine Needs Assessment survey. Practitioners' rationale for investigating an alternative methodology of identifying patients was to identify "frequent flyers" before they burdened the system, not after the fact. Testing this hypothesis however, was beyond the scope of the Telemedicine Needs Assessment. That being said, this issue underscored the lack of combined administrative and financial infrastructures specific to identifying on-the-fly appropriate telemedicine and "high risk" patient populations.

4.3.4.2. Potential synergies between telemedicine and case management overlooked. Interestingly, during the vetting process, neither the telemedicine vendor nor administrators explored the possibility of using remote monitoring and management to complement the provider organization's burgeoning, institution-wide, in-patient and out-patient case management program for high-risk patients. To elaborate, the vendor lobbying the provider organization to remotely monitor and manage the institution's chronic heart failure patients came with a call center but no provision for integration with the provider organization's extant case management infrastructure. The vendor's classic vertical-sector approach meant, for example, that a chronic heart failure patient would be monitored and managed according to established disease staging protocols, but that the monitoring and management of that same high-risk patient's co-morbidities and accompanying psycho-social problems would fall outside the purview of the remote monitoring and management application. The practitioner in charge of the chronic heart failure clinic estimated that 95% of her clients had multiple co-morbidities.

4.3.4.3. Classification and stratification of patient populations undermines the integration of computer and web teletechnologies. Unavoidably during the process of vetting clinical and telecommunications technologies, the issue arose as to which patients, according to their insurance status, would be eligible for inclusion in a potential telemedicine intervention. When this question was raised, discussion ground to a halt because clinicians and administrators did not have the tools to determine, on-the-fly, which categories of patients constituted a potential candidate cohort and which patients were to be exempt. Furthermore, practitioners and administrators were unable to determine aggregate numbers based on insurance status in combination with clinical status. In practical terms not knowing, for example, how many capitated, Type A diabetics the provider organization was responsible for posed an insurmountable challenge to meaningful discussions around cost savings, return on investment, allocation of resources, and so on.

4.3.4.4. Lack of reimbursement continues to be a negative issue for provider organizations. Although reimbursement is touted in the medical informatics literature as being the primary barrier to the uptake of telemedicine technologies, this research suggests that the aforementioned organizational, practitioner, and administrative barriers are equally significant. At the grass roots clinical level the issue of reimbursement was not raised. At the administrative level the discussion stopped before it reached reimbursement issues because, as previously noted, the provider organization did not have the tools to determine, on-the-fly, which patients, according to their insurance policy would potentially be eligible for reimbursable services. In fact, practitioners noted that this problem is a more general problem and not specific to potential telemedicine applications. Findings from this research suggest that if telemedicine services and products did become reimbursable, the provider organization would have to scramble to put processes in place to operationalize reimbursement.

4.3.4.5. Concerns about secure, confidential, and private telecomunications persist. Practitioners did express their concerns about security, confidentiality, and privacy specific to the use of computer and web-based technologies. However, only 39% of survey respondents reported that they knew of the provider organization's e-mail policy posted on the intranet, -- a policy aimed at addressing these issues. Furthermore, although 10% of respondents reported receiving e-mail from patients, only 2% of respondents met face-to-face with patients, discussed the e-mail policy, and had patients sign the requisite consent form. These findings suggest barriers are present on two levels. First, there are extant barriers to informing practitioners of the institution's security, confidentiality, and privacy policies. Second, there are barriers to enforcing the provider organization's security, confidentiality, and privacy policies.

4.4 Process Architecture concepts of *dynamic coherence* and *uneven development* inform the analysis

In chapter one, four Process Architecture concepts specific to organizations in flux, were presented. Two of these concepts, *dynamic coherence* and *uneven development* have particular relevance for the typology of barriers. To reiterate, Process Architecture defines dynamic coherence as *"an evolving match between the changing work process and its workplace environment.* Moreover, *dynamic coherence depends upon establishing a relationship among the four principal interdependent environments for work: spatial, organizational, financial and technological.* Finally, *when an organization sets out to transform its work process*, as in the case of this provider organization effecting ubiquitous computer and web enablement, *the organization commits itself to a transformation of all four dimensions of its work environment.* The second concept is *uneven development.* Process architects note that, *"effective workplace-making follows a path of uneven development in which innovation in one aspect of the workplace creates new potentials or demands for innovation in other areas"(Horgen et al., 1999).*

Both of these concepts can be applied to better understand the data analysis presented in the typology of barriers. Computer and web technologies are constantly changing both the work process, namely, healthcare delivery and the work place environment, in this case, the provider organization. Remote monitoring and management of acute and disease patient populations would be an example. Instead of patients presenting for encounters with their specialist in the hospital or at the office of a community group practice practitioner, aspects of the patient's healthcare are monitored and or managed off site. In other words, facets of the work process, for example, monitoring blood pressure, weight, and blood sugars, carried out previously by the provider organization at the provider organization's facility, can now be done remotely by the patient themselves, a friend, or family member, at a hotel, home, cottage, and so on.

These kinds of changes in work process and work environment bring with them concomitant changes in all four dimensions of the work environment: spatial, technological, organizational, and financial. For example, a remote monitoring and management program may result in less pressure on the demand for communal office space but more demand on a dedicated space for telecommunication transmissions. There may be less demand on support staff to take blood pressure readings but now more IS staff is needed to service and maintain the telemedicine equipment and manage the data generated by the remote monitoring and management application. Moreover, the organization may elect to outsource the remote monitoring and management service rather than do it in house. Finally, there are always financial implications. For example remote monitoring and management might provide better care and decrease costs, but as noted in the typology, doing so may decrease important revenue generating streams. All of this is to say that any computer or web based innovation is going to impact all four dimensions. Therefore, when we identify a barrier that appears specific to one dimension, we would be well advised to look for impact in the other three. These concepts serve to remind us that no medical informatics implementation takes place in a vacuum.

Finally, the concept of *uneven development* has particular relevance for computer and web enablement. As noted in Chapter One, the telemedicine technology and the requisite web portal being marketed to the provider organization came bundled with a communications and data management infrastructure which offered the provider organization the opportunity to segue straight into strategic e-commerce dare-delivery applications and related business opportunities. These technologies were, in effect, imposing a new advertising, marketing, and business culture that historically had been outside the purview of traditional hands-on clinical practice. Clearly, these teletechnologies created new demands on the provider organization's collective skill sets and resources but at the same time created new revenue generating opportunities. Simply stated, the provider organization had not evolved far enough to optimize these opportunities.

Before concluding, I want to comment on the issue of reimbursement. Up until October 21, 2001, when HICFA announced that certain medicare telemedicine applications would be reimbursable, provider organizations cited the lack of reimbursement as a major barrier to integrating telemedicine into healthcare delivery. I would like to make two points. First, there are significant billing issues independent of whether the service is delivered using telemedicine or not. As noted in the typology, administration and practitioners can't determine, on-the-fly, a patient's insurance status relative to their clinical status. This means that patients are presently receiving services that the provider organization is not billing any party for. Second, services such as the executive healthcare assessments that the provider organization was renowned for were not billed for because a billing infrastructure was not in place. In both cases, it is not the just the practitioner's time that is being provided gratis, it is the provider organization's support staff, lab services, equipment, and so on, that are being, in a sense, donated. This raises the question, how can one make the argument that telemedicine costs more or less than the existing service when closer scrutiny of the traditional in-house service reveals that the costs are unknown?

Building on the first point, the second point I would like to make is that if communication between parties is good, technology can potentially make it even better. This holds true for healthcare delivery. If a primary care practice is highly efficient, problems arising from incorporating additional technologies will be greatly reduced. This is because the practice already has a culture of problem solving in place. Without it they wouldn't be efficient. Simply stated, if a practice is dysfunctional, technology is not going to magically solve or even improve its dysfunction.

4.5 Conclusion

To conclude, this chapter presents a typology of barriers to computer and web enablement that emerged over the course of the research program. The typology presented is limited in that it focuses solely on barriers specific to the Needs Assessment phase of a telemedicine initiative. Undoubtedly, every stage of a medical informatics or telemedicine technology's life cycle -- design, implementation, evaluation, and so on -- could generate a typology of barriers. As researchers, developers, practitioners, and provider organizations, our tendency, has been to simplify and abstract the subject of barriers to telemedicine or computer and web enablement. Consequently, the medical informatics literature is rife with references citing reimbursement, security, and privacy issues as the definitive and prescient barriers to integrating telemedicine into healthcare delivery (Bashshur, 1995; Edelstein, 1999; Grisby & Sanders, 1998; Jacobson & Selvin, 2000; Schick, 1996). These findings, direct from the clinical trenches, would suggest otherwise.

Having identified the provider organization's needs and established their prevalence, we will now turn our attention to the design of a tool to address then: the framework integrating real and virtual healthcare delivery.

5. FRAMEWORK INTEGRATING REAL AND VIRTUAL HEALTHCARE DELIVERY

5.1 Introduction

This chapter presents a framework for integrating real and virtual healthcare delivery. Simply stated, this framework is a tool that a provider organization can use to systematically deconstruct healthcare delivery in the real world and reconstruct the appropriate pieces in the virtual world. The typology of barriers presented in the preceding chapter established the need to identify what these telecommunication and web portal technologies are, what they are capable of delivering, how they work together, and what their infrastructure requirements are. This framework addresses those needs by defining real and virtual healthcare delivery, and presenting a 2x2 real and virtual healthcare delivery framework integrating healthcare delivery for real and virtual patients and a real and virtual provider organization. In addition to teasing out differences and overlaps between real and virtual healthcare delivery, this chapter clarifies the differences and overlaps between full service web portals and telemedicine technologies. Clarification takes place on two levels, first, that of the services, products, and processes that web portals and telemedicine independently and or jointly provide; and second, the information systems infrastructure that web portals and telemedicine share.

In addition to these prosaic details, the chapter also reflects on the soon-to-be-realized revolutionary effect of these combined web portal and telemedicine technologies on the healthcare delivery industry at large. The rationale for integrating complementary real and virtual services, technologies, and infrastructures, and developing a virtual arm of the provider organization, is to remain competitive in the market place. Being competitive, as the medical informatics and healthcare management literature is quick to point out, means meeting consumer's access, convenience, self-management, and self mastery needs while containing or reducing the provider organization's costs (Hertzlinger, 1997; Stead, et al., 1997). The shift from a doctor-centered to a consumer-centered delivery system is as powerful as it is imminent. Presently, we're experiencing the tip of the consumer-driven healthcare delivery iceberg. The increasing presence of the web and telecommunications technologies in healthcare delivery point to the need for provider organization's to have the following in place: a vision for healthcare delivery now that we've transitioned from the industrial to the information age; a framework for integrating real and virtual healthcare; and, a systems-based model for delivering real and virtual healthcare.

Additionally, and potentially most importantly, this chapter articulates the processes that the framework precipitates. For example, in applying the framework, stakeholders' individual work/work processes and concomitant espoused agendas are identified and made transparent. In this respect the framework operates as a knowledge brokering platform between stakeholders; for example, between clinical and administrative parties. As a knowledge brokering tool, the application of the framework makes public a level of granular data about work/work practice that facilitates first, an appropriate fit between potential web and telemedicine technologies and practitioners' work/work practice needs; and second, it identifies a common ground that accommodates stakeholders' differing and sometimes conflicting work/work practice needs.

Finally, the design of the framework integrating real and virtual healthcare delivery is grounded in the Process Architecture precept which states that work cannot be discussed or conceptualized separate and apart from work practice. This framework is, in effect, a tool that ensures the inextricable link between stakeholders' work and work practice. Moreover, the needs assessments processes engendered by the framework are informed and strengthened by the Process Architecture concepts of *design inquiry* and *collaborative engagement* introduced in Chapter One. Importantly, use of these Process Architecture concepts facilitates the engagement of the entire spectrum of stakeholders to include those who have power and control the resources, and those who do not.

This chapter begins with the background information on the provider organization that led to the development of the framework. Next, real and virtual healthcare delivery is defined. Then the framework integrating real and virtual healthcare delivery is presented, illustrated, and applied. Thereafter it is noted that the concepts of *design inquiry* and *collaborative engagement* can inform the processes around the application of the framework. Finally, the overlapping features and infrastructure requirements of a telemedicine application and full service web portal are modeled. The chapter concludes with reflections on the future of virtual healthcare delivery.

5.2 The challenge facing provider organizations

During the nine months of fieldwork prior to submitting the formal Telemedicine Needs Assessment report, I observed the provider organization being aggressively lobbied by companies offering: "full service" web portals such as Dr.Koop.com and Americasdoctors.com, health content on web compact disk, telemedicine technologies, and systems supporting ubiquitous internal video teleconferencing. What these companies had in common was their promise of *virtual* products and services. What became apparent during the vetting process was the provider organization's lack of a working definition of *virtual* and furthermore, the absence of a framework to assist the provider organization in determining what blend of real and virtual hybrid products, services, and processes would complement their core business, budget, and strategic trajectory. The first step in addressing this dearth was to decisively differentiate between *real* and *virtual* healthcare delivery products, services, and processes.

5.3 Defining real and virtual healthcare delivery

Erroneously, within the healthcare sector, the term *virtual* has become synonymous with high tech. This is due in part to the precedent set by early video-teleconferencing technologies popularized by telemedicine. For example, at this provider organization in 1997, a specialist conducted a follow-up appointment with his patient in Monaco using video teleconferencing. This one-on-one telemedicine encounter between patient and provider, performed in real time, across great distance and multiple time zones, was, for its time, certainly high tech but it was not, by definition, virtual healthcare delivery.

In practice, virtual healthcare delivery is characterized by *asynchronicity, outsourcing, and anonymity.* Real or traditional healthcare delivery, by way of contrast, is characterized by *the patient and practitioner meeting in real-time, face-to-face, utilizing a provider organization facility.* Thus, the aforementioned video teleconferencing is not a significant component in the larger strategic shifts that this paper considers in effecting a full-scale model of virtual healthcare delivery.

Having differentiated between real and virtual healthcare delivery products, services, and processes, the challenge is to conceive of a framework that accommodates both extremes: real and virtual healthcare delivery, and any transitions in between.

5.4 Framework integrating real and virtual healthcare delivery

Following is a classic 2x2 model featuring the real and virtual patient, and the real and virtual provider organization. For the purposes of this chapter, the framework focuses on the provider organization and the patients it serves. However, the framework could just as easily be centered on the provider organization in conjunction with real and virtual clinicians, real and virtual administrators, real and virtual case managers, and so on. In other words, potentially all stakeholders within the healthcare delivery system can be represented within this framework.

Figure 1. The framework integrating real and virtual healthcare delivery.

	Real Patients	Virtual Patients
Real Provider Organization	**1.** **Real Patients** / **Real Provider Organization**	**2.** **Virtual Patients** / **Real Provider Organization**
Virtual Provider Organization	**3.** **Real Patients** / **Virtual Provider Organization**	**4.** **Virtual Patients** / **Virtual Provider Organization**

To reiterate, definitions for real and virtual healthcare delivery are:

- ***Real products/services/processes are***
  - ***delivered in real time,***
  - ***face-to-face, and***
  - ***involve provider organization facilities;***

- ***Virtual products/service/processes are***
  - ***asynchronous,***
  - ***outsourced, and***
  - ***anonymous.***

5. 5 The framework illustrated

To illustrate how the framework is applied, representative healthcare delivery scenarios for each of the four quadrants are offered.

Quadrant 1: real patient / real provider organization

- Patients meet one-on-one with real practitioners in real hospitals or practitioner's offices.

- The hospital-based specialist conducts a video teleconferencing consult with a community group practice-based patient and practitioner.

In both Quadrant One encounters, practitioners and patients meet face-to-face, in real time, using the provider organization's facilities. Although the second scenario involves a video teleconferencing technology, as noted previously, the encounter still conforms to the conventions of *real* healthcare delivery in that it takes place in real time, face-to-face, and uses the provider organization's facilities.

Quadrant 2: real provider organization / virtual patient

- Anonymous patients access the provider organization's in-house web site for background information on plastic surgery services and rates.

- Anonymous consumers access, in real-time, a web-cast of a symposium on teenage smoking cessation taking place in the hospital's auditorium.

In the Quadrant Two scenarios, anonymous patients and consumers access the provider organization's real facility. For the purposes of this framework, patients are defined as persons that the provider organization knows and has been formally contracted to care for. In contrast, consumers are defined as anonymous persons with no formal relationship with the provider organization.

Quadrant 3: real patient / virtual provider organization

- One of the provider organization's young female patients, diagnosed with gestational diabetes, receives on-line remote monitoring and management of her condition through an outsourced third party company contracted by the provider organization.

- Provider organization patients requiring counseling following genetic screening are automatically referred to a counseling service that offers access to an on-line genetic counselor and on-line support group. Once again, the provider organization offers its real patients this genetic counseling service through an external, third party contract.

In these Quadrant Three scenarios, the provider organization is delivering virtual healthcare to mean the services are asynchronous, outsourced, and anonymous. However, from the patient's perspective the telemedicine and genetic counseling companies are perceived as an extension – a virtual arm of the provider organization.

Quadrant 4: virtual patient / virtual provider organization

- The provider organization sponsors an on-line breast cancer support group offered on a renowned women's health website.

- The provider organization underwrites the cost of maintaining the hardware and technical support for a self-selecting group of brain cancer patients conducting their own clinical trial on the side effects of a specific experimental drug protocol to which they all subscribe. The results of this on-line group's research will be published in the medical literature and pushed back to the drug company.

Until recently, healthcare delivery in the Forth Quadrant has followed the advertising model. Advertising media, for example the flyer in your mailbox or the advertisement on TV, is clearly the product of a sub-contract the corporation has with an advertising company. The end product carries, for example, Wal-Mart's name and logo, not the name and logo of the advertising company that designed and produced it. That being said, there is a significant difference between advertising and the healthcare delivery product, service, and processes that the provider organization can potentially offer in Quadrant Four. One of the emerging models in Fourth Quadrant healthcare delivery is that of targeted marketing wherein players in the healthcare industry, (for example, drug companies, medical equipment and supply companies, and so on), through a mediating third party, would be able to target their products and services to appropriate end

users. The mediating third party would ensure that the end user, namely the patient or consumer, would remain anonymous. By the same token, the third party would ensure that, for example, updates on drugs, would reach the end users directly, thus replacing the current system where the information is delivered to practitioners whose dissemination of that information to patients is discretionary. The mediating party in this model could also broker bulk purchases of, say supplies for diabetics, special insurance rates, mediate the buying and selling of patient data, and so on. It remains to be seen whether this domain is that of the provider organization or an independent company with which the patient can chose to register a healthcare delivery profile.

Finally, activities in Quadrant Three and Four underscore the convergence of web and telecommunications technologies. The healthcare delivery taking place in these quadrants draws attention to the patient's or consumers burgeoning control, self-management, and self-mastery in healthcare delivery. If the present consumer health informatics trajectory continues, the challenge for provider organizations is going to be how to claw back facets of healthcare delivery, which are presently the domain of consumer groups. For example, rather than have on-line support groups organize ex officio, the provider organization may decide to offer, gratis, in house hardware and tech support services to targeted on-line patient populations, support groups, news groups, and so on.

To summarize, the overarching advantage of compartmentalizing healthcare delivery into four distinct quadrants is that the provider organization can systematically develop a big-picture design for a streamlined, strategic healthcare delivery system that capitalizes on the overlap between the organization's existing strengths in the real world and the efficiency, cost savings, and e-potential afforded by the virtual on-line world. Conceptualizing these quadrants individually allows the entire spectrum of clinical and administrative healthcare delivery stakeholders to identify and discuss activity currently undertaken in each of these quadrants, then determine where their end user population is better served: in the real or virtual realm. If their decision is to proceed with an intervention in either direction, then stakeholders can systematically strategize about objectives, timeframes, resources, and so on.

The processes of applying the framework will now be elaborated upon.

5.6 The framework applied

Applied at the senior management level, the framework becomes a tool for determining appropriate directives and mandates. In other words, the framework provides a structure and methodology for breaking down, or teasing apart, confusing overlaps in real and virtual healthcare delivery. For example, using this framework; a provider organization can determine for each quadrant:

1. *preferred patient population*: Are the interventions targeting their patients, anonymous consumers, or both;

2. *is the population large or costly enough* to warrant the investment that an intervention would require;

3. *focus*: Is the provider organization's motivation clinical (diagnostic, treatment); commercial (marketing, advertising, branding); educational (prevention, training, upgrading), or all three;

4. *organizational goals*: Is the provider organization's goal to expand market share, reduce costs, increase revenues, and so on;

5. *teletechnology:* What products, services, processes, are appropriate;

6. *web portal*: Similarly, what products and services, and processes; are appropriate;

7. *requisite infrastructure:* What would be needed to support the teletechnology and web portal interface.

This framework can potentially assist senior management's decision-making processes specific to which real and virtual healthcare delivery services, products, and process are best provided in which healthcare delivery quadrant.

In addition to determining trajectories at the senior management level, the framework also facilitates drilling down at the level of the individual healthcare delivery stakeholder. To elaborate, each quadrant represents a unique sphere of: encounters, values, services, costs, products, and liabilities. Furthermore, those spheres are unique to each stakeholder, (patients, practitioners, administration, and so on). Given this attribute, the framework becomes scaleable and thus allows a practitioner, team, department, program, provider organization, and so on, to conceptually assess a program or initiative in, for example, Quadrant 1 (real patient / real provider organization), and then assess it, for example, in Quadrant 3 (real patient / virtual provider organization).

In the process of articulating each of the dimensions just identified (preferred patient population, and so on), the detailed work/work practice of each stakeholder is revealed. Also in the process, stakeholders' espoused agendas become apparent. There are advantages and disadvantages to the processes that the framework precipitates. On the one hand, the more detailed the stakeholders' work/work practice profiles are, the better the potential fit with an incoming telecommunications or web portal technology. On the other hand, stakeholders, for political reasons, may choose to chest their cards. Although this posturing might maintain the status quo of the incumbent power structure, it decreases the possibility of brokering common ground through increased knowledge of fellow stakeholders' work/work practice and attendant professional and organizational responsibilities.

The processes of applying the framework can be enhanced by Process Architecture concepts of *design inquiry* and *collaborative engagement.* To reiterate, *design inquiry "is a situation in which intelligent human beings engaged in transaction within their environments create a new or modified artifact through collective thoughts and action".* Collaborative engagement is defined as *"a process where all players move from passive to active involvement and from unilateral to collaborative design inquiry."*

These Process Architecture concepts underwrite processes that enhance the effectiveness of the framework as a tool designed to represent all stakeholders needs. As noted in the introduction, the term *stakeholders* is all-inclusive in that it represents those who have the power and control over resources and those who do not. As noted in Chapter Three "The Typology of Barriers to Computer and Web Enablement", the differences in administrative and clinical stakeholders pose a significant barrier to progress. The common ground, as it were, roundly established in the Masters Thesis, "Primary Care Practice: By Default or by Design", is that of improved *efficiency*. Engaging the processes of design inquiry and collaborative engagement, during the application of the framework, will facilitate identifying where those mutual efficiencies might be made manifest.

Finally, in the process of applying the framework, stakeholders are compelled, by the conceptual design of the framework, to maintain the link between work and work practice. In doing so, data in the framework becomes a concrete reference point for the provider organization when being wooed by vendors.

5.7 The framework applied to patient care plans

The fact that the framework can be applied to individual patient's care plans will be of interest to practitioners with challenging patient panels and, most certainly, case managers. As noted in the typology of barriers to computer and web development, the provider organization's senior management determined that less than 1% of the organization's entire patient population accounted for 40% of inpatient costs and 30% of outpatient costs. Using the proposed framework, a practitioner or case manager can better manage these costly patients.

Initially, 100% of a patient's care plan will start off in Quadrant 1 where the patient is meeting with the practitioner, face-to-face in their office or more commonly, the emergency department. However, as virtual healthcare delivery options unfold for his/her care, there will be a possible combination of real and virtual services. For example, 20% of that patient's care may come from Quadrant 1; 36% from Quadrant 2; 33% from Quadrant 3; and 11% from Quadrant 4. Understandably, these percentages will change dynamically in keeping with alterations in the patient's clinical state. All of this is to say that the movement between these quadrants is fluid, transparent, and unlike the capitated, managed care, or fee-for-service models which exclude patient populations, this model, (although it segments the patient population real and virtual), applies to all patients independent of insurance status.

Importantly for the case managers and the provider organization's senior management, these percentages can be aggregated by program or by disease staging. In other words, using the framework, the director of, for example, a kidney transplant or chronic heart failure program can identify the numbers of patients and their attendant expenses per quadrant. Once baseline use-per-quadrant is identified, then directors can ascertain if dimensions of the entire program's care might be better served, (meaning, more cost effective, more efficient, and so on), if carried out in another quadrant.

Integral to envisioning how real and virtual healthcare delivery services, products and processes might be deployed is a background understanding of what remote monitoring and management telemedicine technologies and a full service web portal are, and how they might fit together.

5.8 The relationship between telemedicine technologies and a full service web portal

Virtual healthcare is delivered via telecommunications technologies and the web. Some might even argue that the web is a telecommunications technology. However, for the purposes of this dissertation, the web is treated as a distinct virtual healthcare delivery technology because of its capacity and exponential potential for autonomous healthcare delivery. In this case, autonomous means independent from any provider organization. As noted in the typology of barriers, the lack of background understanding of these technologies and the differences and overlaps between them, constitutes a significant barrier to the provider organization's goal of ubiquitous computer and web enablement. The purpose of this section is to clarify what the web and telecommunications are and where their services and infrastructure requirements overlap. Once a provider organization understands what they are and how they work, they can then envision how to integrate them into work/work practice. Clarifying what these technologies are and how they work will also set the stage for the final chapter of this dissertation that presents a systems-based model for integrating real and virtual healthcare delivery.

To illustrate how these technologies work in concert and apart, one of the telemedicine products that the provider organization was presented with, namely, a remote monitoring and management technology, will be characterized in concert with a hypothetical web portal. The integrated service providers complementing the telemedicine technology are also profiled. One of the disease populations the telemedicine company targeted was diabetics. For that reason, definitions and scenarios will center on the virtual healthcare delivery needs of that specific patient population.

5.8.1 The full-service web portal

The hypothetical web portal called www.diabetescentral.com acts as a HIPPA compliant e-commerce-ready full service clearing house for all diabetes related healthcare processes, products, and services, to include but not limited to: interactive risk assessment tools; hot links to electronic medical journals and credible sites such as Pubmed; continuing medical education focused on diabetes, diabetic conferences; diabetes related web casts; postings for clinical trials; diabetic medical devices like infusion pumps; diabetic supplies to include needles and so on; diabetic list servs, support groups, news groups; diabetic holiday packages; diabetic investments; diabetic cook books and diabetic cooking clubs; diabetic products available at local grocery stores; and so on.

The concepts behind this full service web portal are threefold:
1. the web portal is an entry point for all diabetic stakeholders into the provider organization's healthcare delivery system;

2. the web portal is designed to meet the global needs of diabetic patients and healthcare professionals specializing in this field, and;

3. this shared platform insures that patients and their care team, which also includes, family members, friends, and so on, are on the same page.

It is important to differentiate between the web portal and the infrastructure required to support it. The former is the purview of web developers, e-commerce, on-line consultants, and so on. The latter is the outsourced services that provide the vast majority of those processes, products, and services, that the web portal is offering globally. In this imagined web portal www.diabetescentral.com, the web developers have strategic partnerships with outsourced integrated service providers whom they contract to provide the following services on the web portal: 24/7 registered nurse-run call center; 24/7 registered nurse triage; on-line consultations with diabetes specialists; remote monitoring and remote management; data management; data archiving; automated voice response; electronic medical record; patient tele-education; dietitians; cybrarians; e-commerce; billing, Medicare claims; broker for selling patient data; broker for clinical trials and broker for targeted marketing from industry sectors such as: pharmaceuticals, medical devices, education, health insurance, turnkey technology providers, telephone surveys, audio health information, research data collection, and so on.

5.8.2 The remote monitoring and management telemedicine technology

The telemedicine technology that the provider organization was presented with was a video-phone device capable of simultaneous video, audio, and data transmission using analogue phone lines and a standard television set. This portable system, the size of a cable box, sits adjacent to the television or computer monitor and mediates between the off-the-shelf ancillary devices such as a blood pressure cuff, glucometer, oximeter, ekg, scale, thermometer, and an analogue push button phone and standard American or European television set. The patient operates the devices distally. That being said, some of devices, such as the blood pressure cuff, can also be controlled remotely by the health-care professional. The video frame rate is thirteen to seventeen frames per second and the system is capable of capturing video stills at a resolution acceptable for wound management. The system uses Windows-based software.

5.8.3 Clinical and telecommunications and integrated delivery networks

It is important to understand that combined real and virtual healthcare delivery requires two integrated delivery networks: a telecommunications integrated delivery network and a clinical integrated delivery network. The telemedicine technology and its strategic partners formed a telecommunications integrated delivery network. The video-phone teletechnology came bundled with nine strategic partners: 1. a

boutique registered nursing call center and market research service; 2. a data management and archiving company; 3. an internet service provider replete with IV-VPN; 4. an automated voice response company; 5. a computer company; 6. a foreign government as investor; 7. a university where the original technology was developed; 8. a research and development company underwriting next generation development of the video-phone device (ISDN, DSL, and cable compatibility); and 9. a boutique registered nursing company offering a global 24/7 concierge, nursing and rehabilitation service. (Interestingly, the telemedicine company did not have a strategic partner specializing in web development and maintenance.) Working in concert, these strategic partners constitute a telecommunications integrated delivery network that ideally offers an integrated and interoperable interface with its companion clinical integrated delivery networks. A clinical integrated delivery network is made up of pharmacy, laboratory, billing, insurance, and utilization data; case management data; clinical documentation; and so on (Glaser, 2000; Kuperman et al., 2000; Schneider, 1999; Young & Barrett, 1997). Together, these two integrated delivery networks form the DNA, as it were, of a provider organization.

5.8.4 Outsourcing

Because the video-phone telemedicine technology comes bundled with these service providers, the telemedicine company is able to offer the provider organization the following outsourced e-commerce-ready and guaranteed ATM-grade, secure, outsourced services: 1. a 24/7 call center; 2. telehomecare to include both remote monitoring and management and patient education; 3. home-to-hospital-to-home medical care anywhere in the world; 4. nurse triage; 5. appointments and scheduling; 6. billing, 7. an e-commerce infrastructure; 8. product-line telemarketing; 9. product support; 10. telephone surveys; 11. audio health information; and 12. research data collection.

To summarize, the video-phone telemedicine technology is simply an analogue phone-line technology. The internet/intranet/extranet web portal is a menu: the front door for an entire healthcare delivery industry. Both the teletechnology and web portal require the highly specialized service provider's skills and integrated and interoperable interface to be fully operational. The potential overlapping and interdependent infrastructure needs of the teletechnology and web portal are illustrated in *Table 15. Integrated delivery network services shared by the telemedicine technology and the web portal.* It is important to understand that the integrated delivery network, and web portal interface, integral to virtual healthcare delivery, would remain constant across all four healthcare delivery quadrants. In other words, if the provider organization were to outsource its entire integrated-services infrastructure it would be contracting for one infrastructure, not four individual infrastructures.

5.9 Modeling the relationship between the telemedicine technology and web portal

Following is a chart that itemizes in Column One -- the relevant components of the telemedicine technology; in Columns Two -- the products, processes, and services, of the integrated interoperable service providers; and in Column Three -- the diabetic processes, products, and services menu offered by the hypothetical diabetic web portal. The contents of the web portal, Column Three, and the contents of the integrated services, Column Two, share a significant number of features. This is because the web portal is offering consumers a *menu* of products and services to choose from; whereas it is the integrated service providers in Column Two that actually provide those products, services, processes.

Also, Table 15. emphasizes the interdependent and overlapping integrated infrastructure requirements of the telemedicine and web technologies. To elaborate, integrated means that each of the services offered by the teletechnology or web portal (for example, remote monitoring and management), require the highly specialized 24/7 service and concomitant infrastructure (for example data management and archiving, of a registered nurse call center). Without this integrated infrastructure, the video-phone is just a piece of equipment and the web portal is just a URL and a collection of buttons on which to click. Undoubtedly, it

is the integrated off-line and on-line services that are going to make Fourth Quadrant virtual healthcare delivery possible.

Table 15. Integrated delivery network services potentially shared by the telemedicine technology and the web portal.

1. Telemedicine teletechnology video-phone	2. Integrated delivery network services	3. Hypothetical web portal menu www.diabetes.com
Desktop system black box push button analogue phone television, or computer monitor Portable system black box push button analogue phone laptop video-phone video transmission data transmission audio transmission ancillary devices blood pressure cuff glucometer oximeter ekg scale thermometer	24/7 call center staffed by registered nurses 24/7 triage by registered nurses online consults with specialists remote monitoring remote management data management data archiving automated voice response electronic medical record patient education dietitians cybrarians e-commerce electronic billing Medicare claims processing broker for patients selling data broker for clinical trials broker for targeted marketing from industry sectors to include: pharmaceuticals medical devices education health insurance turnkey technology providers telephone surveys audio health information research data collection global registered nurse services: nursing concierge services rehabilitation	24/7 call center staffed by RNs 24/7 triage by registered nurses online consults with specialists remote monitoring remote management data management data archiving automated voice response electronic medical record patient education dietitians cybrarians e-commerce electronic billing Medicare claims processing broker for patients selling data broker for clinical trials broker for targeted marketing from various industry sectors: pharmaceuticals medical devices education health insurance turnkey technology providers telephone surveys audio health information research data collection global registered nurse services: nursing concierge services rehabilitation interactive risk assessment tools Hot links: NML and so on on-line electronic medical journals list servs: support and news groups holiday packages investments cooking classes continuing medical education diabetic rounds diabetic clinic diabetic lecture series posting for clinical trials diabetic supplies and equipment education material specific to the patients education level and disease state

5.10 The future of integrated real and virtual healthcare delivery

Telemedicine and web technologies, in concert with the proposed framework integrating real and virtual healthcare delivery, support the current premise that a significant and growing percentage of healthcare delivery will be virtual (Butz & Dilday, 2000; Bashshur, Reardon, & Shannon, 2000; Goran &Stanford, 2001; Menduno, 1999; Shortliffe, 1998; Walsh, 2001). Furthermore, it is not inconceivable that, using virtual healthcare delivery, the entire healthcare system will be inverted and that the virtual on-line interface in Quadrant 4. will become the patient's entry point into the healthcare system. The front line of healthcare will be the web portal. The second line will be registered nurse triage, and the third line will be the face-to-face encounter with the practitioner, taking place in Quadrant 1. In fact, at the American Medical Informatics Association's annual meeting, November 2001, a prominent physician and consumer health informatics advocate suggested that given the present and increasing empowerment of consumers, the appropriate medical model for healthcare delivery is "tech support!" (Ferguson, 2001). Although intriguing, it is hard to imagine any provider organization wholly endorsing the *tech support* model of healthcare delivery anytime soon.

The above having been said, there is an important lesson here to be learned. The first round of virtual healthcare delivery, typified by DrKoop.com and Americasdoctors.com failed because these businesses attempted to replicate traditional physician-centered healthcare delivery on-line. In contrast to the healthcare delivery sector dotcoms, the banking, investment, airline, and book industries bobbed to the surface with their virtual services, products, and processes titrated to the individual needs of the autonomous consumer. Common to their success is the empowerment of the consumer: no longer does the individual have to deal with the middle-person, the bank teller, the broker, the travel agent, or bookstore agent. Instead their needs are met by an anonymous, asynchronous, web-mediated communication with an outsourced third party. The healthcare sector equivalent is Fourth Quadrant healthcare delivery, a dimension wherein provider organizations can meet the needs of the empowered, self-motivated, in-control consumer. The phenomenal potential of this healthcare delivery quadrant has yet to be realized.

Finally, it is important to recognize that the framework presented in this chapter is simply a needs assessment tool and that successfully applying the tool is only the first of many steps on the road to integrating real and virtual healthcare delivery. Once stakeholders' needs have been identified, the actual implementation of computer and web technologies requires a full and developed process of investigation, design, and planning hopefully guided by the Process Architecture precept of work/work practice and the attendant concepts of *design inquiry* and *collaborative engagement.* Moving beyond the dotcom debacle necessitates clear needs assessment and implementation methodologies; otherwise the legacy of poor adherence and adoption rates within provider organizations will persist.

To conclude, this provider organization lacked a concise definition of *virtual* healthcare delivery relative to the products, services, and processes offered by telemedicine technologies and full service web portals, and a framework for integrating real and virtual healthcare delivery. This chapter addressed those issues by defining real and virtual healthcare delivery, and offering a framework for integrating real and virtual healthcare delivery. Moreover, the framework can be used by any provider organization to systematically develop a big-picture design for a streamlined, strategic healthcare delivery strategy that capitalizes on the overlap between the organization's existing strengths in the real world, and the efficiency, cost savings, and e-potential afforded by the virtual on-line world.

The dissertation will now conclude with a model for systems-based healthcare delivery designed to make the framework integrating real and virtual healthcare a reality.

6. MODEL FOR SYSTEMS-BASED HEALTHCARE DELIVERY

6.1 Introduction

This chapter presents the context, rationale, and design for a systems-based model of healthcare delivery. The model emerged from the qualitative and quantitative data generated by the provider organization's Telemedicine Needs Assessment. Moreover, it evolved in tandem with the typology of barriers to computer and web enablement presented in Chapter Three, and the framework for integrating real and virtual healthcare delivery presented in Chapter Four. Simply stated, this chapter bridges the gap between thinking about integrating real and virtual healthcare delivery and doing it.

The proposed systems-based model, supporting clinical and telecommunications technologies and a full service web portal, challenges the traditional, vertical, remote monitoring and management telemedicine model. It is designed specifically to meet the provider organization's needs and build on its existing infrastructure strengths. The new model incorporates ubiquitous phone access to qualified nurse triage, case management, and complementary, interoperable clinical and telecommunications integrated delivery networks. Furthermore, this systems-based model potentially affords provider organizations the requisite infrastructure to identify and manage their neediest and most costly patients, irrespective of acute or chronic status, disease category, and location in the care cycle.

Finally, this system-based model is important because it provides the infrastructure for integrating real and virtual healthcare delivery. The importance of *real* or traditional face-to-face healthcare delivery, as defined in Chapter Three, is well understood. In contrast, the significance of *virtual* healthcare delivery has yet to be fully realized. As demonstrated in Chapter Four, virtual healthcare delivery has the potential to invert the entire healthcare delivery system, in that the web portal becomes the patient's point of entry into the healthcare system: the consumer starts by looking up medical information on the web, then, based on what he or she finds, elicits on-line triage by a registered nurse. After that, if necessary, there is a face-to-face encounter with a practitioner. The proposed systems-based model provides the administrative and clinical infrastructures that are going to support these strategic shifts in healthcare delivery.

As witnessed in the consumer health informatics community, the framework's third and fourth healthcare delivery quadrants are the domain of the empowered, self-motivated, prevention-conscious individual, be they the provider organization's patient or an anonymous consumer. Regardless of their health insurance status, increasingly, these persons are using virtual, on-line healthcare to meet their needs for diagnostic, treatment, medical information, and support. The challenge facing provider organizations is how can they evolve an information system and information technology infrastructure that meets the needs of these empowered consumers? I propose that a systems-based infrastructure, built on complementary interoperable clinical and telecommunications integrated delivery networks, can position the provider organization to do so.

This chapter begins by describing the current model for remote monitoring and management technologies. Following that, the needs assessment methodology used to ascertain practitioners' perceived needs for telemedicine technologies is briefly stated. Then, the quantitative and qualitative findings specific to practitioners' needs for remote monitoring and management technologies are presented. Next, the systems-based model providing the infrastructure for real and virtual healthcare delivery is offered and the design implications for meeting stakeholders' needs are roundly discussed. Subsequently, the Model is hypothetically applied across all four healthcare delivery quadrants. Finally, additional data from the Telemedicine Needs Assessment Survey and the Process Architecture concepts of *design inquiry* and *collaborative engagement* are

called upon to illustrate how the deployment of the systems-based model can be optimized. The chapter concludes by reflecting on how the systems-based model could potentially facilitate the provider organization in achieving its aims identified by the Telemedicine Needs Assessment.

6.2 Background

Presently, the remote monitoring and management applications that vendors market and provider organizations instigate are designed to meet the needs of discreet acute or chronic disease patient populations. An established acute population would be, for example, premature infants (Grey, et al., 1998; Grey et al., 2000). Sample chronic disease populations, to name a few, include: the elderly (Lindberg, 1997), cancer (London et al., 1997), AIDS (Brennan & Reich, 1994), Alzheimer's (Brennan, Moore, & Smyth, 1995), and diabetes patients (Schultz, Bauman, Hayward, & Holtzman, 1972). What these acute and chronic remote monitoring and management applications have in common is that even when operating within a single institution, their infrastructures remain distinct. To elaborate, each vertical sector customarily has its own circumscribed remote monitoring and management technologies, and clinical, administrative, and integrated delivery networks or information system infrastructures. It is this *silo* model of vertical healthcare delivery that the proposed systems-based model challenges.

Although the passing of the long anticipated legislation, wherein HIPPA, as of October 21st, 2001, is allowing limited reimbursement of telemedicine services, is expected to increase the use of telemedicine technologies, the extant reasons for the proliferation and uptake of remote monitoring technologies are tied to stakeholders' espoused needs and the possibility, however remote, that telemedicine might be able to meet those needs. Stakeholders include everyone involved in healthcare delivery: practitioners, administrators, support staff, patients, and so on.

The drivers are, provider organization administrators need to manage their patient populations more cost-effectively, particularly if the population is capitated. At the same time, the provider organizations need to capitalize on any revenue generating potential that telemedicine technologies can facilitate. Moreover, practitioners, who are experiencing top-down pressure to increase production, are looking for technologies that will help them manage their patient populations more efficiently (Hertzlinger,1997; Stead et al., 1997). Likewise, patients are expressing the need for increased self-mastery, self-reliance, security, and control (Hagan, Morin, & Lepine, 2000; Piette, Weinberger, Kraemer, & McPhee, 2001; Piette, et al., 2000). For the empowered consumer, web-based teletechnologies present as a vehicle to achieve that end. Last, there are amorphous but well documented gains that result from using remote monitoring and management telemedicine technologies such as: decreased costs (Kinsella, 1998); enhancement of existing patient care services (Kastens, 1998); increased patient compliance (Piette, et al., 2000); and overall improved outcomes (Bleich, 1998; Johnston, Wheeler, Deuser, & Sousa, 2000). For all of these reasons, provider organizations are assessing what their real telemedicine needs are; where a remote monitoring and management might fit into their healthcare delivery system; what such a program would look like; and what they might stand to gain from it. This chapter focuses on framing up answers to these questions on behalf of the provider organization studied.

To reiterate the salient background details, this model emerged out of a Telemedicine Needs Assessment at a provider organization, consisting of two hospitals and twenty-nine community group practices located throughout Massachusetts. In response to increasing pressure from telemedicine technology vendors to "test drive" their products, and to better understand the concomitant proliferation of independent, grass roots telemedicine initiatives taking hold across the provider organization, the clinician telemedicine champion and the provider organization's

administration jointly commission PHASE II: A Telemedicine Needs Assessment, August 1999 – February 2000. The Telemedicine Needs Assessment necessitated a combined qualitative and quantitative research methodology detailed in Chapters Two and Three. Additional data from these complementary research programs are reported herein.

During the Telemedicine Needs Assessment, a telemedicine vendor lobbied the provider organization to pilot its remote monitoring and management system with a disease population. The lobbying process included two demonstrations of the technology to administration, practitioners, specialists, the information systems department, case managers, social workers, and other staff. The technology that the vendor was marketing was a video-phone device capable of simultaneous video, audio, and data transmission, using analog phone lines and a standard television set or computer. It used FDA approved off-the-shelf ancillary devices, to include a blood pressure cuff, glucometer, oximeter, ekg, scale, and thermometer. However, the technologies' principal feature was that the device came bundled with multiple strategic partners. Together, these partners formed a telecommunications integrated delivery network that included: a 24/7 call center, data management and archiving company, an internet service provider replete with IP-VPN, an automated voice response company, a computer company, a foreign government as investor, a university, a company underwriting next-generation development, and finally, an internet service company and market research service.

Presently, technology options are so numerous and the infrastructure requirements so complex, it is difficult for provider organizations to identify, or tease apart their technology and infrastructure requirements (Leonard, Tan, & Pink, 1998). In fact, it was the provider organization's fledgling relationship with this telemedicine company that produced a watershed of data, which in turn, resulted in rethinking the practical aspects of integrating real and virtual healthcare delivery. The first step in rethinking the requisite practical requirements was a re-examination of relevant findings from the survey data and typology of barriers.

6.3 Methodology Review

The complementary quantitative and qualitative research methodologies and survey design have been detailed in earlier chapters but the following specific survey questions and findings have not. Briefly stated, the Telemedicine Needs Assessment incorporated qualitative and quantitative research methodologies to include: 1. cross-sectional, institution-wide, in-depth interviews; 2. participant observation at administrative and clinical meetings and during day-to-day operations at the provider organization, and 3. a survey distributed to all clinical practitioners to assess current computer, web, and telemedicine technology usages and perceived needs. Of particular relevance, to the emergence of the model, were survey questions determining practitioners' needs for remote monitoring and management, and practitioners' receptiveness to a call center service.

The specific survey questions were:

1. "Presently, do you have high-risk or chronic disease patients who would benefit from using video-teleconferencing for remotely monitoring and management of their on-going care in their homes?

2. Presently, do you have a patient population that would benefit from short-term home monitoring and management using video teleconferencing technology?

3. Presently, do you have high-risk or chronic disease patients who would benefit from 24-hour access to a call center staffed by registered nurses?

4. How receptive would you be to an outsourced call center offering patients 24 hours a day, seven days a week, access to triage by qualified registered nurses?

5. How receptive would you be to having these call center nurses provide you with the patient's history prior to your office visit with the patient?"

Respondents were also asked to estimate numbers of potential candidates for Questions One through Three.

6.4 Findings

Briefly stated, the survey data establishes that:

1. practitioners' degree of need for acute and or chronic telemedicine remote monitoring and management applications varied across specialties, practice location, and even between individual practitioners;

2. only hepatobiliary self-identified enough potential candidates for a discreet program; and,

3. community group practice practitioners espoused a significantly greater need for long-term monitoring and management and a call center service than their hospital based colleagues.

Concomitantly, qualitative data revealed that:

4. a remote monitoring and management initiative would have to address administrators' need to manage their most *costly* patients, and similarly, address practitioners' need to manage their *neediest* patients.

The details of these four findings, three quantitative and one qualitative, will now be elaborated upon.

6.4.1 Quantitative findings influencing the design of the systems-based model

These survey findings are grouped under *"Practitioners' perceived needs for remote monitoring and management technologies"* and *"Practitioners' receptiveness to a call center service."*

6.4.1.1 Practitioners' perceived needs for remote monitoring and management technologies

A perceived need for remote monitoring and management was reported by the two hospitals and 16 of the 29 community group practices distributed across the state of Massachusetts. Of the 235 practitioners who responded that they had patients who would benefit from either acute post hospital and/or chronic long term remote monitoring and management, 143 practitioners included an estimate of the number of patients that they had in at least one of the two categories. A total of 3,539 potential candidate patients were estimated. The perceived need for short or long term remote monitoring and management varied significantly at both the practitioner, and hospitals/community group practices levels.

The prevalence differences between short and long term cohorts varied enormously depending upon the individual practitioner, the medical or surgical specialty, and the site of practice. The following tables demonstrate the unique and diverse needs of the different sub-environments within the provider organization across specialties, practice location, and even between individual

practitioners. For example, in Table 16, Four Primary Care/General Internal Medicine practices at different locations are compared, site B estimated that the number of high-risk chronic and acute patients (116:126) was about equal ~0.92 while a similar site, 18 miles away, estimated a considerably greater ratio of chronic: acute (60:5) ~12.

Table 16. Four Primary Care/General Internal Medicine practices at different locations are compared.

Site	# long term chronic patients	# short term acute patients	Ratio Chronic/Acute
Site A- General Internal Medicine	0	45	<0.01
Site B- General Internal Medicine	116	126	0.92
Site C- General Internal Medicine	138	83	1.66
Site D- General Internal Medicine	60	5	12

In the hospital setting shown in Table 17, there are considerable differences amongst both medical and surgical subspecialties specific to long term chronic and short-term acute patient populations suitable for remote monitoring and management. Hepatobiliary is the only specialty that self-identified enough potential patients for a discreet remote monitoring and management program.

Table 17. Six tertiary care specialties are compared.

Site	# long term chronic patients	# short term acute patients	Ratio Chronic/Acute
Hospital-Orthopedic Surgery.	0	87	<0.01
Hospital-Cardiothoracic Surgery	9	56	0.16
Hospital-Endocrinology	50	50	1.00
Hospital-Hepatobiliary Surgery.	490	460	1.09
Hospital-Cardiology	120	30	4.00
Hospital-Neurology	208	5	52

In Table 18. three General Internal Medicine practices at the same site are compared. These practices are part of the same hospital-based general internal medicine practice with ostensibly similar patient demographics but identify very different actual or perceived potential remote monitoring and management patients.

Table 18. Three General Internal Medicine practices at the same site are compared.

Site	#long term chronic patients	# short term acute patients	Ratio Chronic/Acute
Hospital-General Internal Medicine: Physician A	0	30	<0.01
Hospital-General Internal Medicine: Physician B	24	15	1.6
Hospital-General Internal Medicine: Physician C	20	0	> 20

At the individual practitioner level, the espoused need for remote monitoring and management are homogeneous in that they are diffuse and idiosyncratic. At the hospital versus community group practice level community–based non-MDs report a greater need for acute remote monitoring and management than hospital-based non-MDs.

6.4.1.2 Practitioners' receptiveness to a call center

Of the 406 respondents, 183 confirmed that they had patients who would benefit from access to 24-hour access call center staffed by registered triage nurses. Of those practitioners 67 estimated 1,972 potential patient candidates. As illustrated in Table 4, this number of potential call center candidates correlates with the aggregate numbers of potential long and short-term remote monitoring and management candidates. Moreover, as in the case of short and long term remote monitoring and management needs, the perceived need for a call center service is distributed across the provider organization. However, the community group practice practitioners' espoused need for a call center service is statistically significantly higher than their hospital-based colleagues.

Table 19. The community group practice-based practitioners' espoused need for long term remote monitoring and management and a call center service is greater than their hospital-based colleagues*.

Potential patient candidates for:	Survey Respondents Hospital n=283 CGPs n=123 Total n=406	Response	Number of practitioners who gave estimates	Estimated number of potential remote monitoring and management candidates	P Value
Long term remote monitoring and management	Hospital n=69 (29.87%) CGPs n=46 (45.10%) **Total n=115**	"Yes"	Hospital n=40 CGPs n=30 **Total n=70**	Hospital n=1222 CGPs n=673 **Total n=1,895**	.007061
Short term remote monitoring and management	Hospital n=78 (34.06%) CGPs n=42 (41.58%) **Total n=120**	"Yes"	Hospital n=40 CGPs n=33 **Total n=73**	Hospital n=1018 CGPs n=626 **Total n=1,644**	NA

Call center access	Hospital n=111 (48.90%) CGPs n=72 (69.90%) **Total n=183**	"Yes"	Hospital n=32 CGPs n=35 **Total n=67**	Hospital n=1121 CGPs n=851 **Total n=1,972**	.000375

Practitioners were also surveyed to ascertain their receptivity to an outsourced call center service and additionally, having the call center service provide practitioners with the patient's history prior to an office visit. As exemplified in Table 20., the majority of respondents were "receptive/very receptive", with community group practice practitioners being marginally, but not significantly, more receptive than their hospital based colleagues.

Table 20. The majority of practitioners are receptive to an outsourced call center and the call center's provision of the patient's medical history*.

Survey questions	Total number of respondents n=406	Response	Hospital based respondents	Community group practice based respondents
1. How receptive would you be to an outsourced call center, offering patients 24 hours a day, 7 days a week, access to triage by qualified registered nurses?	Hospital n=231 CGPs n= 105 **Total n=336**	"Receptive/ very receptive"	117 (50.65%)	65 (61.9%)
2. How receptive would you be to having these call center nurses provide you with the patient's history prior to your office visit with the patient?	Hospital n=230 CGPs n=104 **Total n=334**	"Receptive/ very receptive"	130 (56.52%)	66 (63.46%)

6.4.2 Qualitative findings influencing the design of the systems-based model

The following briefly reiterates the relevant findings presented in the Typology of Barriers. Just prior to the Telemedicine Needs Assessment, the provider organization's senior management determined that less than 1% of the organization's entire patient population accounted for 40% of inpatient costs and 30% of outpatient costs. Although not committed to print, this construct was internalized and acted upon by case managers and senior management. The soundness of identifying and managing the smallest population of patients placing the greatest demand on medical resources has since been proven at the Health Management Partners, BJC/Washington University School of Medicine. These researchers determined that "*a sharply focused, internet-deployed case management strategy achieved economic and functional status results on a population basis and produced system wide savings in its first year of implementation*" (Lynch,

Forman, Graft, & Gatsby, 2000). At the provider organization studied, administration's espoused priority was to better manage the needs of their most *costly* patients, that 1% generating 40% of inpatient costs and 30% of outpatient costs. In the same way, practitioners' priority was to better manage their *neediest* patients, those patients whom practitioners perceived would benefit from call center access and on-going or short-term remote monitoring and management. In order to overlap administration's and practitioners' espoused priorities, these somewhat ambiguous terms *costly* and *neediest* must be examined more carefully.

Fuzzy logic lies behind the decision to use the terms *high-risk* and *neediest*. Ironically, when applied to medical informatics applications, fewer top-down global constraints may, in fact, facilitate titrating a bottom-up unique fit. Interestingly, the terms *most costly* and *neediest*, also referred to as *high risk*, model the uncertainty of natural language and mirror the lack of absolutes when dealing with clinical states. Lynch et al targeted their *frail* and *least stable* patient population that they estimated constituted 1.1% of their total patient population. Interestingly, the use of these fuzzy terms reflects the remote monitoring and management industries' shift from targeting established disease populations to servicing patients characterized as: "*chronic, at-risk, over-utilisers, non-compliant, lack local caregiver support*", and so on. In other words, remote monitoring and management vendors are realizing that the clinical states and psycho-social issues characterizing "*needy, costly, frail or least stable*" patients transcend vertical disease categories. From this point on, use of the term *high-risk* will be inclusive of *neediest* and *costly* patients.

6.5 Rationale for the systems-based model

What the findings firmly establish is that the provider organization's *high-risk* patients are distributed across the provider organization's two hospitals and 29 community group practices. In other words, these potential remote monitoring and management candidates, with the exception of hepatobiliary patients, are not confined to discreet disease sectors. Additionally, findings report that community group practice practitioners, distributed across 16 sites, espouse a greater need for on-going remote monitoring and management and a call center service than their hospital-based colleagues.

This perceived needs profile raises the specter of an alternative remote monitoring and management model. A model which would require a paradigmatic shift, from the vertical to the horizontal; from remote monitoring and management applications focused solely on traditional acute and chronic patient populations, to remote monitoring and management system that will assist the provider organization's practitioners and administration to manage their *high-risk* patients irrespective of disease category, duration of need, and or, location in the care cycle.

Shifting from a vertical to horizontal remote monitoring and management model requires a more detailed understanding of the patient population to be served. These high-risk patients may have acute needs as in the case of a post-operative hip replacement; or chronic needs, as in the case of the chronic heart failure patient. Alternatively, the patient may vacillate between chronic and acute status depending on their overall clinical state or disease staging, as in the case of, liver transplant, cancer, and HIV patients. Moreover, a patient, depending on their co-morbidities, may be a member of none, one, or several of the traditional vertical disease populations. As a case in point, the practitioner running the chronic heart failure clinic estimated that 95% of her patients had co-morbidities.

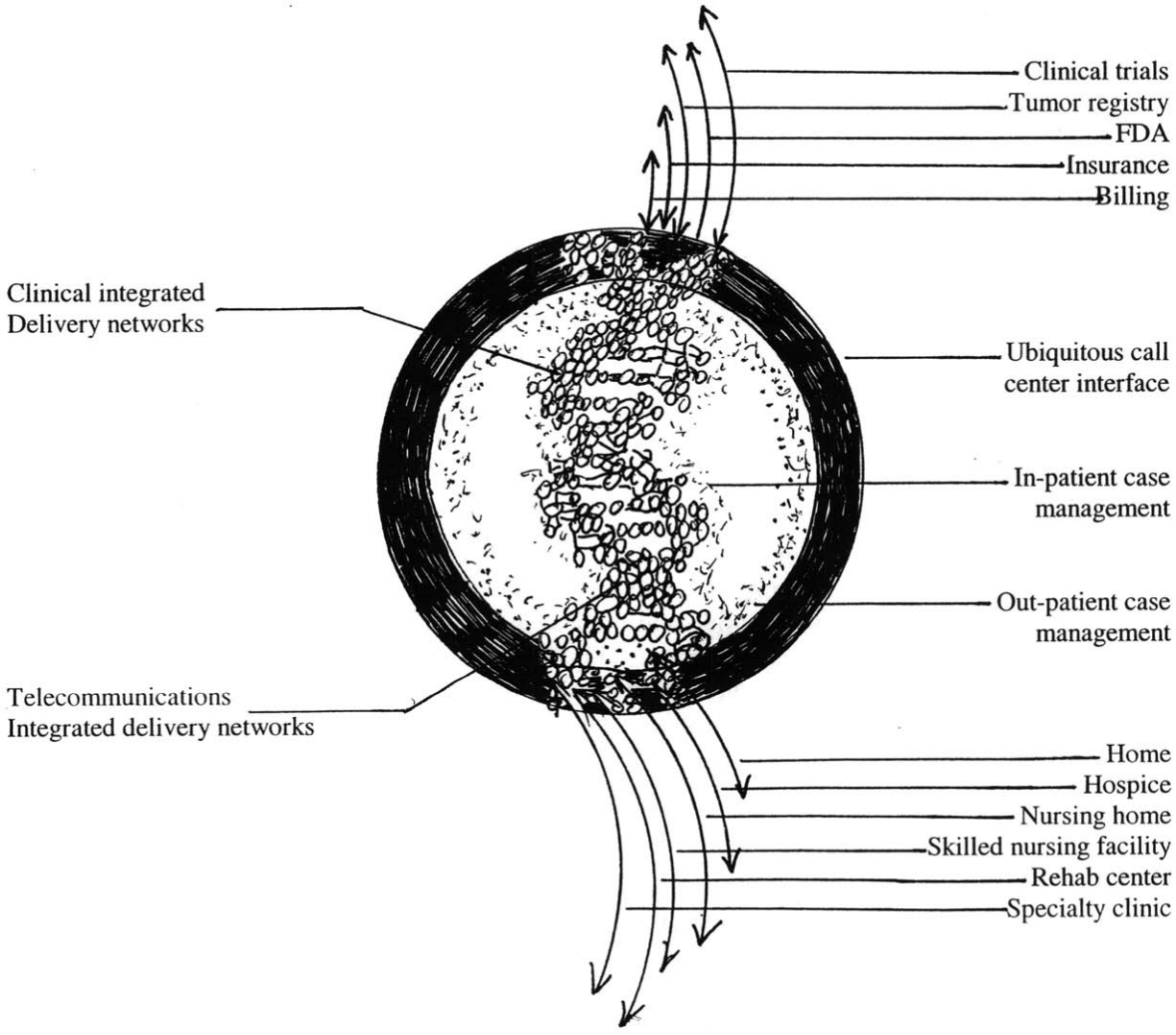
All of this is to say that the patient population constituting that somewhat arbitrary 1% is not constant but the needs of those *high-risk* patients when they are in that 1% are. This raises the pivotal issue of requisite infrastructure support for *high-risk* patients while they are in that 1%

zone, and as they transition in and or out of that zone. In the proposed systems-based model, requisite infrastructure support is defined as: 1. ubiquitous phone access to qualified nurse triage; 2. coordinated in-patient and out-patient case management; and 3. complementary clinical and telecommunications integrated delivery networks. The salient features of the proposed system-based remote monitoring and management model will now be presented.

6.6 The systems-based model supporting integrated real and virtual healthcare delivery

The proposed systems-based model, supporting clinical and telecommunications technologies and a full service web portal, incorporates ubiquitous phone access to qualified nurse triage, case management, and complementary, integrated and interoperable clinical and telecommunications integrated delivery networks. The model is presented in Figure 6.

Figure 6. Systems-based model supporting integrated real and virtual healthcare delivery



Details of the model's salient features and how those features facilitate the provider organization's achieving its goal of ubiquitous computer and web enablement will now be discussed.

Research has established that a 24/7 call center service working in concert with an institution-wide, in-patient and out-patient case management program is seminal to an efficient, cost effective, remote monitoring and management program (Bleich, 1998; Kastens, 1998; Piette, Weinberger, Kraemer, & McPhee, 2001). In the systems-based model, as illustrated in Figure 6., the entire provider organization's patient population has 24/7 phone access to qualified nurse triage. High-risk patients have phone access to qualified nurse triage and case management. Cost savings directly attributable to a call center are well recognized (Hagan, Morin, & Lepine, 2000). For example, the province of Ontario, Canada, following Quebec's example, is offering its entire population of 11.6 million, anonymous, free, 24/7 phone access to nurse triage because ubiquitous call center access to qualified nurse triage has been proven to decrease utilization of hospital emergency departments and physician office services (O'Connell, Stanley, & Malakar, 2001). In the proposed systems-based model, the call center and case management together provide a sliding scale of healthcare delivery support. To elaborate, as the patient health status improves and they transition out of the 1% high-risk zone, the call center nurse supplants the case manager.

As noted earlier, studies have established that economies of scale and cost savings are best achieved with case managers and phone triage nurses working in concert (Schwartz, Genovese, Devitt, & Gottlieb, 2000; Piette, et al., 2000; Kastens, 1998) Case management is a program whereby registered nurses, nurse practitioners, or physician assistants coordinate and facilitate the healthcare delivery services on a patient-by-patient basis. Case management's goal is to provide continuity of care and thereby reduce the need for emergency department visits and hospital recidivism (O'Connell, Stanley, Malakar, 2001). Interestingly, the evolution of telecommunication technologies has resulted in web and phone-based products that blur the line between call center, case management, and disease management functions (Walsh, 2001).This blurring of roles predicated on a technology's ability to elicit, collect, analyze, manage, and direct data, underscores the importance of a sound interoperable clinical and telecommunications integrated delivery networks infrastructure. Moreover, it points to the added advantage of the proposed model's capacity to accommodate the proclivities of individual integrated network systems.

The proposed systems based remote monitoring and management program would complement the provider organization's burgeoning case management program. The existing case management program already has an administrative and clinical infrastructure specifically mandated to meet the needs of both in-patient and out-patient, high-risk patients across the institution. However, case management is presently hampered in its development and efficacy, because it lacks the substrate support of a call center and clinical and telecommunications infrastructure. For example, at some sites within the provider organizations community group practices, patient profiles are hand written on cue cards and kept in a recipe box. At other sites case managers managed patient information on their laptops but lack intranet access to the physicians with whom they were coordinating patient care. Finally, if the provider organization plans to tap the corporate remote monitoring and management high-risk market, the call center/case management/clinical and telecommunications infrastructure inherent in this remote monitoring and management model has to be in place.

Interoperable clinical and telecommunications integrated delivery networks are critical to maintaining continuity of care, or put another way, managing a patient's transition in and out of that 1% zone. The role of the interoperable clinical and telecommunications integrated delivery networks, illustrated in Figure 6., is to provide seamless communication amongst all parties involved in a high-risk patient's cycle of care and as importantly, collect, manage, and mine the data that care events generate. As noted in Chapter Four, a telecommunications integrated

delivery network specific to remote monitoring and management refers to the remote monitoring and management device, its plug-and-play-peripherals, (for example blood pressure cuff, or glucometer), its call center interface, data management and archiving in-house or outsourced partner, phone/cable or provider, web portal interface, and so on. The provider organization's complementary clinical integrated delivery network would include: pharmacy, laboratory, billing, insurance, utilization data, case management, clinical documentation, and so on (Glasser, 2000).

Combined, these integrated delivery networks optimize communication, data gathering, and data management amongst the patient, their personal caregivers, call center triage nurses, the case manager, primary care physician, specialist, physiotherapist, dietitian, and so on. In this model, the integrated delivery networks service the potential cycle-of-care sites, which might include: the home, primary care office, tertiary hospital, rehabilitation center, skilled nursing facility, and so on. Clearly, the proposed model necessitates that whether in-house or outsourced, communication and data management must be centralized at the IS and IT systems level. This means that only the requisite, peripheral, remote monitoring and management plug-and-play attachments for specific disease populations are managed distally by complementary case management and specific disease population remote monitoring and management programs. For example, the extant chronic heart failure clinic would offer its high-risk patients, who were "*in the zone -- a member of that 1%*", remote monitoring and management scales; high-risk asthma patients would have remote spirometery; and so on. Furthermore, this systems-based remote monitoring and management model can potentially position the provider organization to proactively manage high-risk patients and instigate preventative programming (Kastens, 1998). Finally and importantly, the systems-based infrastructure ensures that all practitioners working within the healthcare delivery system, independent of location, have access to the same computer and web infrastructure support.

It is important to appreciate that just as computer and web technologies have empowered the consumer, they have also empowered the provider organization's practitioners. The systems-based model promotes and facilitates individual initiatives and technologies. Simply stated, it provides an infrastructure backbone for "point-of-service" solutions. Point-of-service technologies would include palm pilots, tablets, laptops, cell phones and so on. Potentially, data captured on these technologies can be synched to the various databases comprising critical components of the clinical and telecommunications integrated delivery networks. Working in concert, these technologies and the systems-based model supporting distributed healthcare delivery mark the evolution of the electronic medical record away from a single electronic artifact and towards an intelligent browser interface that goes out and searches the data bases of these interoperable clinical and telecommunications integrated delivery networks and manifests the critical data at the point of service. Together, point-of-service technologies and the systems-based model support individual initiatives and allow for incremental progress, that is, incremental implementations in areas where practitioners are experiencing real need.

Finally, before illustrating how the model can be applied across all four healthcare delivery quadrants, I want to touch on how interoperable clinical and telecommunications integrated delivery networks facilitate data gathering and data mining. Online tools can be developed to help practitioners' identify potential remote monitoring and management candidates. Furthermore, with data from the integrated delivery networks it is possible to determine if those same potential remote monitoring and management candidates are also the provider organization's '*frequent flyers*'-- those members that constitute that costly 1%. The ability to triangulate this critical information would serve both the practitioners' need to manage their *neediest* patients and administrators need to manage their *costliest* members. The provider organization studied wants an improved methodology for identifying and characterizing the top 1% of high-risk patients, the

next 20%, and so on, but to date has no timely means of doing so. As illustrated in Figure 6., these integrated delivery networks fully enable the provider organization to take part in and contribute to remote monitoring and management clinical trials, disease registries, and so on. Interoperable clinical and telecommunications integrated delivery networks were developed to make this kind of data communication, collection, and analyses possible. In fact, it was not possible to conceive of a systems-based remote monitoring and management model prior to the development and continuing evolution of these interoperable integrated delivery networks.

6.7 The Systems-based model applied across all four healthcare delivery quadrants

Having presented both the framework integrating real and virtual healthcare delivery and the proposed model supporting the framework, a hypothetical healthcare delivery scenario for each of the four healthcare delivery quadrants presented in the framework will now be presented. The purpose of these four mini-case studies is to represent the needs of the empowered healthcare patient/consumer and underscore the infrastructure that provider organizations will have to have in place in order to meet consumer demand. To complement the "Telemedicine Technology and Web Portal Model" presented in Chapter Four, the scenarios will be centered on meeting the needs of diabetics. Additionally, the *preferred patient population, focus* and *goals* of the healthcare delivery for that quadrant are also identified. The 2x2 framework and definitions for real and virtual healthcare delivery are reiterated in Figure 7.

Figure 7. The framework integrating real and virtual healthcare delivery.

	Real Patients	Virtual Patients
Real Provider Organization	**1. Real Patients** / **Real Provider Organization**	**2. Virtual Patients** / **Real Provider Organization**
Virtual Provider Organization	**3. Real Patients** / **Virtual Provider Organization**	**4. Virtual Patients** / **Virtual Provider Organization**

The definitions for real and virtual healthcare delivery are:

- ***Real products/services/processes are***
  - ***delivered in real time,***
  - ***face-to-face, and***
  - ***involve provider organization facilities;***

- ***Virtual products/service/processes are***
  - ***asynchronous,***
  - ***outsourced, and***
  - ***anonymous.***

6.7.1 Case Study Quadrant One: Real Patient/Real Provider Organization

Preferred Patient Population:

- Fee-for-service members
- Fee-for-service non-members

Focus:

- Clinical

Goals:

- Reduce costs while maintaining or improving the quality of patient care
- Minimize provider organization's capitated patients' use of on-site services, and products
- Increase provider organization's market share of fee-for-service patients requiring revenue generating face-to-face clinical services, products, or processes

Case Study 1

During a face-to-face office visit in the hospital, the primary care physician diagnoses one of her capitated patients: a recently widowed, sixty-seven year old male, with Stage One Diabetes. The doctor e-mails the hospital's wwwdiabetescentral.com web liaison person who then makes a house call to the patient's home. The provider organization's web-tech liaison department provides a turnkey service. Provider organization personel set up the patient's computer system and makes sure that the patient knows how to use it. The computer system, provided by one of the wwwdiabetescentral.com's integrated delivery network strategic partners, provides the patient with secure access to the full spectrum of on-line integrated services and products that the provider organization's diabetic web portal offers. By phone or via clinical grade e-mail, the patient now has 24 hour access to the provider organization's out-sourced call center staffed by registered nurses. Additionally, the patient has 24/7 access to on and off-line tech support.

The patient loves the convenience provided by wwwdiabetescentral.com. He now purchases his diabetic supplies on-line at a reduced bulk rate negotiated by the outsourced integrated service provider (OISP). The supplies are couriered directly to his home. The bills for the supplies are automatically OSIP supporting wwwdiabetescentral.com and sent to Medicare.

Recently widowed, the patient's life-lines are the on-line support group "Artificially Sweet After Sixty-five", and the on-line diabetic cooking club for singles. Wednesday mornings at 7:00 am, the patient logs on to the CME diabetes lecture run by University of Miami, Florida. As a result of last week's lecture, the patient is thinking of taking part in a clinical trial advertised on the web portal. He forwarded the web advertisement and links pertaining to the drug to be used in the clinical trial to his RN at the call center. He wants to know if he is a candidate for this trial. He expects to hear back from the RN within 24 hours.

In addition to the web access, the patient is now using a video-phone teletechnology. The monthly rental of the teletechnology and the services it comes with was arranged through wwwdiabetescentral.com. There are two reasons for the provider organization to implement this teletechnology. The first being remote management, the second remote monitoring. The patient's wife died just prior to the patient being diagnosed with diabetes. Subsequent to her death, the patient presented repeatedly in the emergency department complaining of loneliness, depression, and uncertainty about being able to manage his disease. The provider organization decided that a video-phone interface would better meet the patient's pressing psychosocial needs. The video-phone teletechnology comes equipped with a detachable camera and off-the-shelf glucometer.

Via the video-phone, the patient's glucose levels are transmitted to the call center at designated times, daily. If the call center's software detects an outlier, the patient is automatically called by the RN, told to leave those Duncan Donuts alone and take a walk down to the hardware store and back. Because the patient's results are usually reviewed by that same nurse, they are on a first name basis. Additionally, this same remote RN makes virtual visits twice a week to assess on an on-going basis how the patient is doing with activities of daily living. The RN also gets the patient to video his foot wound resulting from a recent toe amputation. The RN captures a still image of the wound and confirms progress by comparing the most recent image with previously archived stills. The wwwdiabetescentral.com dietitian also has a video-conference with the patient once a week. The data from these tele-encounters is captured and managed by the same outsourced integrated service provider that the organization's web portal uses. This data is accessible to the patient, his treatment team, and his daughter who lives out-of-state.

6.7.2 Case Study Quadrant Two: Virtual Patient/Real Provider Organization

Preferred Patient Population:

- Fee-for-service anonymous consumers

Focus:

- Commercial

Goals:

- Increase market share of virtual anonymous consumers who potentially would become fee-for-service patients requiring products or services located on-site at the provider organization's tertiary care facility

Case Study 2

The provider organization's in-house, world renowned, diabetic team receives a phone call from a diabetic Saudi business executive requesting access to the provider organizations' diabetic specialists. He read about the provider organization's program on wwwdiabetescentral.com and after two video teleconference consults with the diabetic team's surgical specialists, this consumer elects to come to the hospital for highly specialized revascularization. Via the wwwdiabetescentral.com web portal, the executive contracts the global RN concierge service to coordinate all aspects of the trip and his medical care. This Type A executive also contracts with the wwwdiabetescentral.com cybrarian to send him relevant medical literature via the portal's ATM-grade secure e-mail server interface. The client is adamant that his company remain unaware of his impending operation. The patient also contracts to have an automatic voice message left on his cell phone notifying him of upcoming web-cast CME lectures relating to this specific stage of his disease and information on the procedure he has elected to undergo. He will access these sessions via his laptop.

Following discharge after a successful operation, the patient purchases on-line a portable video-phone teletechnology to monitor the wound, his blood glucose levels, blood pressure, and weight. Data are entered into his wwwdiabetescentral.com web-based electronic medical record which he owns ands controls. The clients' business takes him around the world so he particularly appreciates the convenience and accessibility afforded by this service as well as the security of knowing that an electronic medical record of his vital information is available 24/7. The executives' rehabilitation with the provider organization's hospital physiotherapist is also managed via the video-phone device which interfaces with standard North American and European television and analogue phone systems found in hotels.

Payment for these devices and on-line services is made by credit card via the web portal. The hospital's billing is outsourced to the integrated service provider who contacts the customer directly and for an e-deposit from his bank. An unexpected upside for the executive is that on wwwdiabetescentral.com he discovered thediabeticinvestor.com and in buying Eli Lilly and Novo Nordisk stock, has seen a significant return on his investment.

6.7.3 Case Study Quadrant Three: Real Patient/Virtual Provider Organization

Preferred Patient Population:

- Provider organization's capitated members
- Provider organization's non-capitated members

Focus:

- Clinical

Goals:

- Maintain or improve quality of care
- Reduce costs
- Increase patient access and convenience
- Increase *real* market share

Case Study 3

One of the provider organization's members, recently diagnosed with gestational diabetes, asks her primary care physician for on-line access to a dietary councilor, cybrarian, gestational diabetes list serv, and on-line support group. In addition to being a mother of three she has a part-time job. Clearly her time and energy are at a premium. This patient wants all products and services available 24/7 and accessible according to her schedule. After the babies are in bed, she logs on to her personal wwwdiabetescentral.com web page provided by the provider organization and looks for the latest "targeted marketing" products and services that the web portal's outsourced integrated service provider has brokered. The patient, a seasoned on-line shopper now has complete control over whether or not she is notified of new diabetic products coming on stream, pharmaceutical updates, educational releases, and so on. With the outsourced integrated service provider as the broker, her anonymity is guaranteed. The provider organization levies a tariff on all targeted marketing activities completed by these companies and in this way underwrites the development and maintenance of the web portal and its contracts with the strategic companies that comprise the telecommunications integrated delivery network.

Because the patient is a provider organization member, she automatically has her own electronic medical record. Additionally, there is one for her husband even though through his work he is covered by a different provider organization. The provider organization also provides on-line records for each of the three children. The patient particularly appreciates that the children's' immunization records are web-accessible and up to date. Even though mom is the only diabetic, everyone in the family uses wwwdiabetescentral.com. The children use it because the resource material for the public school's health curriculum can be accessed through links from Mom's site, and Dad who does all the cooking, joined the on-line diabetic gourmet cooking class.

In order to titrate her exercise, the patient uses one of the web site's online exercise calculators. This has helped the patient implement an appropriate exercise program throughout her pregnancy. The patient has also rented a video-phone complete with off-the-shelf ancillary glucometer and scale devices to monitor her blood sugar and weight. These data are automatically entered into

her electronic medical record. The patient is considering selling access to this data to the company developing the next generation video-phone. The patient does not use the video transmission at home but plans to keep in touch with the 24/7 RN when the family goes to Barbados at Christmas time. The patients made the travel bookings through wwwdiabetescentral.com. which recommended a hotel supporting the diabetic diet and the video-phone teletechnology and web access.

6.7.4 Case Study Quadrant Four: Virtual Patient/Virtual Provider Organization

Preferred Patient Population:

- Provider organization members
- Anonymous consumer worldwide

Focus:

- Commercial

Goals:

- Maintain or improve quality of care
- Reduce or maintain costs
- Increase patient access and convenience
- Increase *virtual* market share
- Increase revenue
- Increase commercial potential.

Case Study 4

The provider organization's members and anonymous consumers worldwide log on to the provider organization's on-line alias, the web portal wwwdiabetescentral.com. It is the endusers' entry point into the healthcare delivery system. Non provider organization members can gain access to a full spectrum of on-line diabetes-related services and products by purchasing a membership to the site or by paying on a fee-per-transaction basis. Additionally, anonymous diabetic consumers can rent or buy the video-phone and a complement of services through the web portal.

Consumers are particularly comfortable with this site because there isn't any advertising. The provider organization states up-front that if the consumers choose to be placed on a targeted marketing directory and a transaction takes place, then the healthcare industry sector pays the provider organization a tariff. Two other services of revenue for the provider organization are: 1. companies who contract with wwwdiabetescentral.com as a "value added" service, to mean that they purchase access, for example to the 24/7 call center, as a perk to their customers, and 2. companies who purchase monitoring and management programs for their diabetic employees.

Clarity regarding financial transactions through the web portal has been fundamental to the web portal's success. Wwwdiabetescentral.com is considered by endusers to be a secure portal. There are no hidden cookies. The secure server based "Health-e-mail" and cybrarians who perform the same one-on-one "trust agent" function as real librarians are particularly popular with consumers. Additionally, the electronic medical record, precisely because it is secure, is attracting clientele that doesn't even have diabetes. Many consumers purchase the secure electronic medical record service because of sensitive genomic data or the nomadic demands of work. The provider organization has recently been approached concerning a global multilingual franchise-marketing of this interface.

Licensure around on-line consults with specialists is not an issue because out-of-state clinical on-line encounters are handled by specialists located at a provider organization Canadian hospital affiliate. In fact, the provider organization is following the lead of the drug companies who run their randomized controlled trials outside the US to avoid conforming to FDA requirements.

What these case studies raise is the specter that patients and consumers generally may well be more computer and web-enabled that the practitioners and provider organizations serving them.

6.8 Conclusion

To conclude, this chapter suggests that rather than implementing a top down or bottom up, discreet, piece-meal vertical disease remote monitoring and management program, a provider organization would do well to identify the smallest population of patients placing the greatest demand on medical resources, then instigate a systems-based remote monitoring and management program proactively supporting their overall care. The relative strengths of a systems-based remote monitoring and management model compared with a traditional vertical model focused on specific acute or chronic disease patient populations are significant.

Unlike the old model, the new model accommodates patients with multiple co-morbidities and concomitant psychosocial needs. It also provides interoperable clinical and telecommunications integrated delivery networks that facilitate communication and data capture, management, and mining. With centralized data capture and analysis mechanisms in place, a provider organization can determine if their potential remote monitoring and management candidates are indeed its most *costly* and *needy* patients. Furthermore, once the remote monitoring and management administrative, clinical and telecommunications infrastructure is in place, to meet the *neediest* and most *costly* 1% of high-risk patients, the infrastructure can be scaled up to target meeting the needs of the provider organization's next 5%, 10%, 20% of at-risk patients, and so on. Finally, with this infrastructure in place, provider organizations can market a remote monitoring and management service outside the provider organization to corporations who need assistance managing their costly, high-risk employees.

It would be facile to pretend, that once conceived, the proposed system-based model, like the last piece of a puzzle, just snaps into place. This research establishes that a thorough needs assessment requires an intense investment on the part of the researcher and the provider organization. Yet, the needs assessment is just the first step. The subsequent stages of design and implementation require as much of a commitment to investigative processes, if not more. The tendency in the medical informatics community specific to needs assessment, implementation, and evaluation has been to simplify and abstract rather than embrace the inherent complexity and chaos that characterize each of these stages. This may be because there has been a dearth of tools to assist researchers in traversing this terrain. This dissertation attempts to address that lack by providing the tools -- namely, a needs assessment theory and methodology, a typology of barriers, a framework integrating real and virtual healthcare, and a systems-based model to delivery it.

As important as the tools are the complementary skill sets to utilize them -- skill sets that will keep progress firmly rooted in work/work practice. To this end, Process Architecture precepts and beliefs have been highlighted to facilitate and inform researchers and provider organizations proactive commitment and engagement in change processes. The life cycle of a medical informatics technology is fraught with trial and error. Yet this dissertation has taken the liberty of segueing adroitly from the needs assessment to a model supporting integrated real and virtual

healthcare delivery. Though expedient as an academic exercise, it is understood that, in the real world, digital diffusion in the clinical in the clinical trenches follows a much grittier trajectory.

The dissertation will now conclude with suggestions for further research -- suggestions that potentially will assist fellow researchers in turning that grit into traction.

7. DIRECTIONS FOR FURTHER RESEARCH

7.1 Introduction

This chapter is directed at medical informatics professionals contemplating further research on digital diffusion within provider organizations. The conclusion proposes five potential areas for further research that emerged out of the work presented in this dissertation. The topics are:

1. work/work practice;

2. baseline computer and web enablement tools;

3. typology of barriers to ubiquitous computer and web enablement;

4. framework for integrating real and virtual healthcare delivery;

5. systems-based model for supporting real and virtual healthcare delivery.

The first research topic addresses the much expressed need for theories to ground developments in the field of medical informatics (Bashur, Sanders, & Shannon, 1996; Field, 1996; Kaplan, et al., 2001; Shortliffe, 1998) The remaining topics focus on tool development. The overarching goal of these tools is to provide a comprehensive accessible resource for researchers, developers, and provider organizations working on computer and web enablement. The issues that these tools are designed to address and the environments where these tools are implemented are complex. Progress in tool design and subsequent implementation will require on-going, collaborative input amongst researcher, developers, and end users. Without question, the more numerous and interdisciplinary the contributions are to the development of these tools, the more robust and useful the end products will be.

The five potential research topics will now be elaborated on.

7.2 Work/Work Practice

As evidenced throughout the dissertation, the Process Architecture's precept of work/work practice and the attendant concepts of *the reflective practitioner*, *design inquiry*, *dynamic coherence*, *uneven development*, and, *collaborative engagement*, make an invaluable contribution in guiding and grounding the field of medical informatics. The inherent appeal of Process Architecture relative to medical informatics is that the implementation processes specific to the disciplines mirror one another. To clarify, the application of Process Architecture, to mean the continual modification in meaning through application, mirrors the iterative processes inherent in a medical informatics technology needs assessment and or implementation. That having been said, Process Architecture is not the only source of constructs that can potentially assist us in assessing and guiding change within provider organizations. *Work practice* is yet another formal discipline that might hold out important insights and lessons. In the early 1990s a number of researchers worked on the relationship between computers and practitioners' work/work practice (Aydin & Forsythe, 1997; Fafchamps, Young, & Tang, 1991; Forsythe, 1992; Tang and Patel, 1994). Findings in this dissertation suggest that we would do well to return to and build on that work. This is a seminal area requiring immediate investigation.

As this dissertation demonstrates, it is all too easy for the researcher to blithely pass from the real world of the needs assessment into the fantasy world of a framework integrating real and virtual healthcare and the model supporting it. In other words, in presenting the framework and model I

commit the cardinal transgression of conceptualizing work independent of work practice. Just as the needs assessment is grounded in real processes with real persons, so do the framework and model need to similarly to be taken out into the field and reworked with real persons functioning within a real provider organization.

Last, the survey data presented in Chapter Two suggests that issues around *use* of computer and web technologies constitute a greater barrier to ubiquitous enablement, than computer and web *access* and or *perceived needs*. In other words, at the provider organization studied, presently, a significant number of computer and web technologies are not inherently linked with the end user's work/work practice needs. Boldly stated, until researchers and developers inextricably link medical informatics technologies with work/work practice -- from the conceptualization of a technology through to the iterative evaluation of that same technology, the estimated 80% failure rate for medical informatics implementations will continue.

7.3 A baseline computer and web enablement tool

Chapter Two presents a survey tool used to establish a provider organization's computer and web enablement baseline. To reiterate, the intent of the survey was not to develop it into a standardized assessment tool but rather to customize a broad brush -- a readily accessible survey instrument capable of reflecting back to the provider organization its computer and web access, use, and perceived telecommunication technology needs. That having been said, developing such a tool poses unique challenges for medical informatics researchers and developers.

Findings in Chapter Two suggest that measuring *use*, or *functionality* is particularly problematic. There are two reasons for this problem. The first is that the criteria for or definition of functionality, or usefulness, specific to any given medical informatics technology, is evolving even as we speak. In other words, an accredited level of function one week might not be considered functional enough the following week. This is due, in part, to the constantly evolving culture around the use of these computer and web technologies. Patient's escalating expectations for e-mail communication with their practitioners would be a case in point. The second problem, specific to measuring the functional use of computer and web technologies, is the current lack of granularity in the questions researchers and developers ask. Once again, we have to look at *use* in light of the end user's specific work/work practice. Presently, we ask if the respondent uses e-mail but we have not asked if they know how to organize their e-mail boxes in Microsoft Outlook, send an e-mail attachment, and so on. In other words, the questions we ask specific to a stakeholders' work/work practice must be detailed and specific.

Also germane to developing baseline computer and web enablement tools, is the profession's need for an. on-line forum dedicated to Needs Assessments. The purpose of this dynamic, on-line interface would to be share and leverage our collective knowledge of baseline computer and web enablement survey question design. Such a forum would allow researchers to share their tacit knowledge about what baseline enablement questions to ask -- and how those questions can potentially be unpacked to more accurately assess computer and web access, use, and perceived needs. Rather than reinventing the wheel with each survey, researchers could ask each other: *"Have you assessed this work/work practice? What questions did you ask the respondent?" "In retrospect, what do you wish you had asked?"* and so on. The challenge facing researchers is for the entire survey process, from design onwards, to be ad hoc but detailed enough for the survey instrument to be meaningful. Additional work is needed to identify the processes and infrastructure necessary to develop timely needs assessment survey tools that capture and grade significant and important differences specific to computer and web enablement.

The final baseline tool that I'd like to see developed is specific to the individual practitioner. I call it a "Practitioner Profiler". The "Practitioner Profiler" would be a dynamic, web-based tool that determines a practitioner's level of computer and web enablement and simultaneously allows the practitioner (and the provider organization) to compare the practitioner's current level of enablement with: their personal previous performance levels, their colleagues levels of enablement; the provider organization as a whole, fellow internists, members of the AMA, provider organizations across the country, sites across a global organization, and so on. Data from enablement comparisons, in real time, might not be constitute a pressing research priority. However it is well documented fact that "what gets measured gets done" (Grint, 1997). Moreover, such a tool would be potentially useful in identifying at what site and with what group a technology should be, for example, piloted.

7.4 A typology of barriers to ubiquitous computer and web enablement

In Chapter Three a typology of barriers to computer and web enablement was presented. The typology provides a rudimentary framework for on-going additions to each category of barriers to computer and web enablement. The categories identified are: barriers specific to the provider organization; barriers specific to the practitioner; barriers specific to the administrator; and finally, the barriers specific to healthcare delivery sector. This preliminary typology has the potential to become a robust reference guide, or put more grandly, an on-line virtual resource library of barriers to enablement. Given the subject, the more barriers identified and added to the typology, the more useful a tool the typology will be to a stymied practitioner or administrator determined to tease out what barriers they are experiencing and how to address them.

In addition to the content, the structure of the typology needs to be developed. The current iteration of theme, data, and interpretation is static and crude. Ideally, the typology would be developed into a dynamic web interface with multiple entry levels. For example, existing barriers identified in the typology could be located by theme, description, or analyses. Alternatively, the end user could enter a new theme. The theme would be linked to the data: for example, the description of the event constituting a barrier. Then, the description of the event would be linked to the interpretation or analysis of that same barrier. An adequate search engine would be key to the site's success. Moreover, research would have to be done on the key mesh terms for the typology of barriers.

To conclude, keeping the overarching barrier criteria as generic as possible is central to developing a robust typology. "Barriers to computer and web enablement" provides a broader and less confusing envelop than say, "barriers to telemedicine", "barriers to the web", "barriers to computers", and so on. Moreover, the convergence of web and telemedicine technologies requires an inclusive term like "computer and web enablement."

7.5 A framework for integrating real and virtual healthcare delivery

The framework for integrating real and virtual products, services, and technologies is a classic 2x2 model that compartmentalizes healthcare delivery into four distinct quadrants. The four quadrants constitute permutations on the real and virtual patient, and the real and virtual provider organization. As noted in Chapter Four, any stakeholder in the healthcare delivery system can be substituted for the real and virtual patient, to include real and virtual administrators, practitioners, case managers, social workers, pharmacies, and so on.

Conceptualizing and mapping healthcare delivery into these four distinct quadrants (real patients and real provider organizations; real patients and virtual organizations; virtual patients and real

provider organizations; virtual patients and virtual organizations) allows the entire spectrum of clinical and administrative healthcare delivery stakeholders to identify and discuss potential or current activity undertaken in each of these quadrants. In other words, the framework is a tool for identifying, articulating, and making wholly transparent, stakeholders' real and virtual work/work practice needs.

The dissertation has taken the first of many steps towards realizing this frameworks' potential. Chapter Four gives examples of how the framework can be deployed by the single practitioner profiling his or her practice. The chapter then illustrates how the team or similarly the department, a program and/or the provider organization as a whole can use it. On-going work is needed to develop an accessible, dynamic, on-line library of potential initiatives and applications. A robust library of examples would provide stakeholders with a point of entry into the process of deconstructing healthcare in the real world and reconstructing the appropriate pieces in the virtual world.

Lastly, it is important to study how this tool influences the distribution of power within an organization. The framework has the potential to make stakeholders' espoused agendas transparent, if not public. Additionally, the process of making a work/work process transparent allows dollar figures to be allocated. These attributes of the tool and the processes it engenders will empower some individuals and unmask others. These shifts in the balance of power attributable to use of the framework for integrating real and virtual healthcare delivery warrant further investigation.

7.6 A systems-based model to support real and virtual healthcare delivery

Having developed the framework to help stakeholders envision integrated real and virtual healthcare delivery, the question is, "*How does integrated real and virtual healthcare delivery become a reality*?" Chapter Five presents a model for a systems-based clinical and telecommunications integrated delivery networks. In a nutshell, it provides the information systems and information technology infrastructure to support real and virtual healthcare delivery. As in the case of the baseline computer and web enablement assessment instrument, the *system* is a moving target: technologies evolve then suddenly become extinct; departments or even provider organizations merge, then morph, and merge again; information systems come and go; and the use of guerrilla technologies, such as personal palm pilots, cell phones, laptops, and off-the-shelf video teleconferencing technologies, continues. In a word, the environment that this hypothetical *system* supports is highly variable and unstable. Given the nature of this environment, an argument can be made for small, workable, just-in-time solutions designed to meet the immediate needs of the end user. Infrastructure support could be independent but, if necessary, plug into the system's intranet backbone. This vision for systems-based infrastructure support requires further development and modeling in concert with real practitioners, with real needs, in real settings.

Finally, and specifically relevant to a systems-based model to support real and virtual healthcare delivery is the issue of customization. Customization is an inherent and greatly overlooked attribute that information technologies bring to the table; witness how our personal computer desktops are customized to our individual work/work practice needs. Presently, customization within the provider organization context is seen as a highly suspect deviation from the norm. Resistance to customization, which is in effect resistance to the optimization of a technology, constitutes a barrier. Further research is necessary to determine effective programs for overcoming this stultifying one-size-fits-all end user interface bias. Finally, as in the case of the framework and typology, a library of customized systems-based plug-and-play technologies and applications would be a significant resource.

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APPENDIX A: CHIPP CHRONIC HEALTH FAILURE DETAILED TELEMEDICINE EVALUATION PLAN

DETAILED EVALUATION PLAN FOR THE QUEEN ELIZABETH II HOSPITAL'S CANADIAN HEALTH INFRASTRUCTURE PARTNERSHIPS PROGRAM SUBMISSION:

THE ROLE OF TELEHOMEHEALTHCARE IN THE MANAGEMENT OF PATIENTS WITH CONGESTIVE HEART FAILURE: A DEMONSTRATION PROJECT

by

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July 31st, 2000

THE ROLE OF TELEHOMECARE IN THE MANAGEMENT OF PATIENTS WITH CONGESTIVE HEART FAILURE; A DEMONSTRATION PROJECT

EVALUATION PLAN

1. Project description

This two phase study seeks to demonstrate the role of telehomecare in the management of patients with congestive heart failure (CHF). Phase 1: Sixty patients, all with a primary diagnosis of CHF, recent admission to the Queen Elizabeth Health Sciences Center, and subsequent referral to the specialized CHF Clinic for long-term management, will be included. Patients will be invited to participate in this study where 50% of scheduled visits to the CHF clinic will be replaced by telehomecare. Phase 2: twenty-five patients with recent admission to the Cape Breton Regional Hospital with CHF, and who have been referred to the specialized CHF Clinic at that center, will follow the same protocol.

2. General research questions to be answered by the evaluation

1. Can approximately 50% of current patients' visits in the specialized CHF Clinic be replaced with Telehomecare (CHF/THC Clinic) without compromising optimal care or safety of patients with advanced CHF?

2. Will this telehomecare application remove existing geographic barriers and in doing so increase access to the CHF Clinic?

3. Finally, will the proposed telehomecare application improve healthcare delivery without adversely affecting the families', or health care providers' satisfaction with the care provided by the CHF Clinic?

3. Strategic objectives

The aim of The Canada Health Infrastructure Partnerships Program (CHIPP) is to support the implementation of innovative applications of information and communication technologies (ICT), namely telemedicine/telehomecare and electronic health records, in an effort to bring better health and health services to Canadians. The aim of this project is to replace 50% CHF Clinic visits using a telehomecare technology. In doing so, the study seeks to demonstrate increased access to specialty care (the CHF Clinic), improved quality of care through remote monitoring, decreased costs to both the healthcare system and the patient, and as importantly, demonstrate the acceptability of the telehomecare application to referring physicians and elderly patients.

4. Clinical objectives

The study's clinical objectives are fivefold:

1. Implement innovative ICT in the provision of Telehomecare to patients with CHF.

2. Determine whether Telehomecare in conjunction with a specialized CHF Clinic improves health care delivery to patients with heart failure.

3. Demonstrate the safety and efficiencies with Telehomecare in conjunction with specialized CHF Clinic Management.

4. Demonstrate that the Telehomecare advantages are applicable to patients managed both at a tertiary care center as well as a non-academic regional hospital.

5. Determine that the geographic barrier inherent in our present centralized tertiary care model of health care delivery can be diminished by Telehomecare.

5. Business plan / project management plan

The business plan for this project is included in the body of the application. Typically, the Evaluation Plan would include a statement as to whether and when this telehomecare application would be financially or otherwise sustainable. However, the purpose of this Demonstration Project is not to prove cost-effectiveness or sustainability. That having been said, the study will evaluate if this telehomecare application is more efficient (time saving) and therefore more cost effective from the providers' standpoint, and more convenient and therefore more cost effective from the patients' viewpoint. Please reference the attached Detailed Evaluation Plan: # 5 & #6: Indicators to evaluate/measure.

6. Level and perspective of evaluation

The CHIPP Evaluation questions ensure that the focus of the over-arching research questions and objectives are clinical, institutional, and societal. Each of the eight questions has been incorporated into the overall design of the proposed Evaluation Plan. Additionally, each of the CHIPP Evaluation questions integrated into the Evaluation Plan has indicators to evaluate/measure data relative to the proposed study's objectives. In the final report each of the questions will be answered using findings from the data generated by the study.

The following list cites where the CHIPP Evaluation Questions are presently integrated into the Detailed Evaluation Plan.

CHIPP EVALUATION QUESTION	LOCATION IN THE EVALUATION PLAN
1. Rationale: **.1.1** Why was this project considered a good idea? Is this an idea that should be pursued further? Why?	CHF/THC Clinic may increase access, improve quality with increased monitoring, decrease costs with increased efficiency, and be acceptable to elderly persons and referring physicians. **#15/**pg 12 – 14, **#16/**pg 14 – 15
1.2 What proved to be the most innovative aspects of this project?	The CHF/THC Clinic may prove both scalable and distributable across regional hospitals **#15/**pg 12 – 14
2. Improvements to Health Services 2.1 From the perspective of patients and providers, how does this project affect the quality of services/care provided?	The CHF/THC Clinic may improve outcomes by close monitoring of diet, medication compliance, and additionally, provide timely and ongoing education about their disease. Accordingly, patients may experience increased feelings of self mastery and control. **#15/**pg 13 – 14
2.2 How does this project affect access to, or utilization of, health services?	CHF/THC Clinic may increase access by overcoming geographic barriers and increasing the volume of patients **#15/**pg 13
3.Integration of Health Services **3.1** In what ways does this project foster integration, coordination and/or collaboration of health services across the continuum of care (e.g., from primary care to acute care to community and home care?	CHF/THC Clinic patients can remain in regional communities and be taken care of by their primary care physicians with backup from the academic/tertiary care facility. **#13/**pg 11
4. Health and Related Impacts/Effects **4.1** What kinds of health and related impacts have occurred as a result of your project, and on what basis did you draw these conclusions?	CHF/THC Clinic may increase access, decrease costs, increase quality, demonstrate acceptability, contribute to local economy. **#15/**pg 12 – 14, **#16/** pg 14 – 15, **#17/** pg 15
5. Cost effectiveness 5.1 Does the project contribute to a more cost-effective service than what is currently being provided?	Comparative analysis of in and out-of-hospital costs may demonstrate cost savings for patients and providers. **#5/** pg 7, **#6/** pg 8
5.2 How does the project contribute to a more cost-effective service than what is currently being provided?	CHF/THC Clinic results in increased volume of patients seen by the CHF Clinic. Close, ongoing monitoring results in better outcomes which save money. **#4/** pg 7
6. Lessons Learned **6.1** What lessons have you learned in developing and implementing this project that might be useful to other jurisdictions/regions/settings, and to other programs?	Barriers to and motivators for the CHF/THC Clinic implementation **#14/** pg 11, **#16/** pg 14 – 15, **#17/** pg 15

CHIPP EVALUATION QUESTION	LOCATION IN THE EVALUATION PLAN
6.2 Specify the positive and negative effects or results experienced during the life of your project. What were the consequences of these results, and, where appropriate, how were they dealt with?	The Interim Evaluation evaluates the need for changes in timelines, re-allocation of research resources for the database, project redesign, budget, CHF/THC protocols, and so on. **#11/** pg 10, **#12/** pg 10, **#16/** pg 14 – 15, **#17/** pg 15
7. Technology Performance **7.1** How well has the technology met the project requirements?	Project Partners determine if the teletechnology is safe, reliable, and useful enough to warrant continuing or expanding the service to other types of cardiac patients. **#10/** pg9, **#12/** pg10, **#14/** pg11 - **#17/** pg 15
8. Electronic Health Records **8.1** In what ways has the means for collecting, using and disclosing personal health information been improved to insure privacy?	The project continues to use the personal identifier established with a preceding, successful project. **#2/** pg 6, **#9/** pg 9
8.2 In what ways has the means for health systems security been improved?	*****NA*****
8.3 In what ways are the project participants' (providers, clients, patients, administrators, other) satisfied with the protection of information	Analysis of comparative data indicates that patients need for access to timely quality remote monitoring and management quality care supercedes concerns regarding privacy. **#2/** pg 6, **#9/** pg 9

7. Research design and analysis

As requested by CHIPP please find attached a detailed Evaluation and Data Collection Plan and a chart with concomitant data collection and evaluation timelines.

In addition to on-going data collection using: data entry into the CHF/THC Clinic Database, interviews, and direct observation, three data collection tools will be designed and deployed. Those tools are: 1. A short self-administered questionnaire completed at (v5/or equivalent visit) to determine baseline satisfaction of all three groups of CHF patients, to include, CHF (ICONS) patients providing they can be accessed, CHF Clinic patients (Halifax and Cape Breton), and CHF/THC Clinic patients (Halifax and Cape Breton), 2. Implementation logs/diaries kept by all CHF/THC Clinic participants, and 3. an Overall Satisfaction Exit Survey for all participants and stakeholders/project partners.

Quantitative data analysis will be carried out by the consulting statistician. Groups will be compared using X-2 test for categorical data or unpaired T-test for continuous variables with normal distribution and the Wilcoxon Rank Sum test for data with non-normal distribution. Additionally, data will be compared between the Cape Breton and sites to determine if differences can be detected between the two groups with regards to the overall effectiveness of Telehomecare on the primary as well as the secondary outcome measures.

Qualitative data analysis is articulated in the Detailed Evaluation Plan attached. Recurring themes will be evaluated on an ongoing basis and inform the design of the final Overall Satisfaction Exit Survey scheuled for December 2001.

8. Experimental and comparison groups

Data will be collected on five groups of CHF patients:

1. Comparison group: CHF patients who do not attend CHF Clinic but who are in the ICONS data base. This data collection is done irrespective of the study but provides valuable longitudinal baseline data,
2. Comparison group: CHF Clinic patients in Halifax,
3. Comparison group: CHF Clinic patients in Cape Breton,
4. Comparison group and experimental Group: CHF/THC Clinic patients in Halifax,
5. Comparison group and experimental Group: CHF/THC Clinic patients in Cape Breton.

Outcomes from the three groups, CHF patients in the ICONS registry, CHF Clinic Patients, and CHF/THC Clinic patients will be compared. Additionally, tertiary care (Halifax CHF patients) and regional groups (Cape Breton CHF patients) will be compared with each other.

9. Technical, clinical and administrative processes

Technical, clinical, and administrative processes are monitored extensively throughout the project. Three qualitative data collection strategies are used: 1. all study participants keep semi-structured implementation logs/diaries, 2. in-depth semi-structured interviews with project partners, and a representative cross section of study participants to include but not limited to: patients, their attendant caregivers, referring physicians, specialists, nurses, support staff, and so on, will take place over the course of the study, and 3. the overall satisfaction survey at the end of the study captures both qualitative and quantitative data that, once analyzed will determine if there was a gap between what was planned and what actually happened with the telehomecare technology, clinical processes, and administrative support.

10. Measurable Outcomes

The study is designed to measure both primary and secondary outcomes:

- Primary outcomes: 50% reduction in resource utilization (CHF Clinic visits)

- Secondary outcomes: unplanned re-hospitalization for health failure

Quality of life, patient satisfaction, family satisfaction, referring physician satisfaction, cost analysis, other cardiovascular endpoints including hospitalization for myocardial infarction stroke as well as cardiovascular mortality

Additionally, the Evaluation will report exhaustively on the motivators for and barriers to using this telehomecare application. (Please reference the attached Detailed Evaluation Plan: # 11: Indicators to evaluate/measure.). As requested by CHIPP all positive, negative and unexpected outcomes will be reported.

11. Sensitivity analysis:

The purpose of a sensitivity analysis is to include techniques to assess to what extent conclusions may change if assumptions or values of key variables change. A sensitivity analysis is particularly appropriate in the case of rapidly evolving teletechnologies and the fluctuating costs associated with using them. Throughout the course of this study the telehomecare technology and related costs are expected to remain stable. Failing widespread influenza, the variables in this study should remain relatively stable.

The above having been stated, the Evaluation Plan for this project is sensitive to the fact that the project may not unfold according to design. Following the initial rollout of the CHF/THC Clinic, there is an Interim Evaluation. (Please reference the attached Detailed Evaluation Plan: # 12: Indicators to evaluate/measure.) The purpose of the Interim Evaluation is to assess the need for mid-course corrections and/or adjustments in the study design, budget, timelines, the teletechnology interface, remote management and monitoring protocols, and so on. Finally, complementary qualitative and quantitative methodologies ensures comprehensive, flexible mechanisms and tools for data collection in the event of unforeseen/unexpected events or circumstances.

12. Documentation

The following documentation will be included in or appended to the Final Evaluation Report:

- All methods employed in the evaluation
- Interim and Final Evaluation findings
- Protocols covering all aspects of the CHF/THC Clinic
- Qualitative and quantitative data collection tools developed during the study

THE ROLE OF TELEHOMECARE IN THE MANAGEMENT OF PATIENTS WITH CONGESTIVE HEART FAILURE; A DEMONSTRATION PROJECT	Stage 1 sep/00 – dec/00				Stage 2 dec/00 feb/01				Stage 3 mar/01 – jan/02								Stage 4 feb/02 – apr/02			Stage 5 may/02 – aug/02				
DATA COLLECTION AND EVALUATION TIMELINES September/2000 – August/2002	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
1. Design and develop CHF/THC database for pre & post intervention comparison across three groups: CHF ICONS, CHF Clinic, and CHF/THC Clinic (Halifax & Cape Breton).																								
2. Collect baseline pre-test data on CHF Clinic patients. Use consent form.																								
3. Establish baseline patients' satisfaction with current CHF Clinics in Halifax & Cape Breton (self administered questionnaire v5)																								
4. Collect baseline CHF Clinic Nurse time/motion/work-flow data during patients' CHF Clinic visits																								
5. Determine baseline applicable in-hospital costs (Halifax & Cape Breton)																								
6. Determine baseline applicable out-of -hospital costs (Halifax & Cape Breton)																								
7. Develop qualitative tool to track CHF/THC implementation process (semi-structured diary/log)																								
8. Collect baseline study data determined in #1, on 60 patients enrolled in CHF/THC Clinic in Halifax																								
9. Confirm CHF/THC Clinic informed consent protocols in place, observed, and acceptable to patients																								
10. Establish patients' baseline satisfaction with CHF/THC Clinic (Halifax), at (v5)																								
11. Collect qualitative data on: *Technical, administrative, and clinical processes, (semi-structured diary/log) * Implementation process, iterative redesign of CHF/THC Clinic protocols, **&** Teletechnology software and hardware (interviews/observation)																								
12. Interim Evaluation																								
13. Collect baseline study data determined in #1, on 25 patients enrolled in CHF/THC Clinic in Cape Breton. Steps 8 – 11 are repeated during Stage 3.																								
14. Collect qualitative feedback on the study to date (interviews). Findings from that qualitative feedback are distilled into an overall satisfaction exit survey for all participants and stakeholders																								
15. Collect data on overall satisfaction with the CHF/THC Clinic, the THC technology, healthcare services provided, & lessons learned (exit survey)																								
16. Final Evaluation: assemble all data to date, compile findings into Final Evaluation Report																								
17. * Collect data on partners' decision whether or not to continue with the CHF/THC Clinic * Determine applicability of CHF/THC Clinic for other cardiac conditions																								

DETAILED EVALUATION PLAN FOR THE ROLE OF TELEHOMECARE IN THE MANAGEMENT OF CHF PATIENTS
Stage 1 Pre-enrollment Sep/2000 – Dec/2000
Summary

- Design and develop a database that allows for comparison of CHF patients data (ICONS), CHF Clinic patient data, and CHF/ THC Clinic patient data. The database will also facilitate comparative analysis between QEII and Cape Breton data.
- Establish extant baseline data for CHF and CHF Clinic patients relative to primary and secondary outcomes to be measured.
- Establish extant satisfaction levels with CHF Clinic program: the clients, attendant family/other, specialists, referring primary care physicians, CHF Clinic nurses and staff.
- Develop a qualitative tool (tracking log/diary) for participants to capture data on barriers to and motivators for Stage II CHF/THC Clinic.

Evaluation data to be collected	Timelines	Data from what source	Data collected by	Using what tool	Sample Indicators to evaluate/measure	Role of Project Partners
1. Design and develop CHF/THC Clinic database for pre & post intervention comparison across three groups: CHF ICONS, CHF Clinic, and CHF/THC Clinic (Halifax & Cape Breton)	Sept 00 - Dec 00	Build on basic dimensions captured by ICONS data base	CHF Clinic Staff, project researcher working with statistician, programmer, evaluator, Dept of Health, Caduceus, Queen Elizabeth II	* using ICONS template but adding additional data collection dimensions relative to the study *This new CHF/THC Clinic database must accommodate the collection of qualitative and quantitative data	Broadly stated, measure all baseline dimensions relative to access, quality, cost, and acceptability of current and anticipated CHF/THC services. The data captured has to correlate with the primary and secondary outcomes being measured: **Primary outcomes**: 50% reduction in resource utilization (CHF Clinic visits) **Secondary outcomes**: unplanned re-hospitalization for health failure Quality of life, patient satisfaction, family satisfaction, referring physician satisfaction, cost analysis, other cardiovascular endpoints including hospitalization for myocardial infarction stroke as well as cardiovascular mortality. Additional data to capture includes: educational background, socio-economic status, functional capacity, patient satisfaction, compliance with medications, amount of drug titration required, compliance with diet, short term readmission rates, unscheduled emergency room visits, and so on. Data Capture: assure analysis granularity in the database design: CHF Clinic nurses will need to differentiate between data on patients over and under 70 and those patients' needs relative to education about their disease, diet, medication compliance, and so on.	CHF Clinic: Initiator Queen Elizabeth II: staff in-kind support Dept of Health: ICONS in kind support Caduceus: input on database development
2. Collect baseline pre-test data on CHF patients. Use consent form.	Sept 00 - Jan 01	CHF clinic patients	CHF Clinic nurse	Use CHF/TCH Clinic data base	*Establish extant data baseline on CHF Clinic patients, for example: patient's knowledge of their health status, their understanding of the care options, their compliance with care regimens, the quality, amount, type of information available to patients and so on. *Rank patient's comfort level with consent to take part in a study based on face-to-face monitoring and management. *Do patients have concerns about whether the privacy of personal medical information is protected? * Do patients perceive the personal identifier as secure enough?	**2.** CHF Clinic: initiator Caduceus: to assist in iterative database development

DETAILED EVALUATION PLAN FOR THE ROLE OF TELEHOMECARE IN THE MANAGEMENT OF CHF PATIENTS
Stage 1 Pre-enrollment Sep/2000 – Dec/2000. .....Continued

Evaluation data to be collected	Timelines	Data from what source	Data collected by	Using what tool	Sample Indicators to evaluate/measure	Role of Project Partners
3. Establish baseline patients' satisfaction with current CHF Clinic (Halifax and Cape Breton)	Sept 00 - Jan 01	CHF Clinic patients not in the CHF/THC Clinic Study.	CHF Clinic Nurse, researcher, evaluator	Self administered survey tool completed during CHF clinic visit (v5)	* Patients rate their physical and psychological comfort with the face-to-face CHF Clinic. * Patients rate the convenience of the encounter, its duration, its timeliness, it's cost. (* Note: **cost** dimensions are detailed in #6) * Patients and attending family members rate the skills and personal manner of the consultant and attending primary care physician, and CHF Clinic nurses * Patients rate the explanations provided to them of what their problem was and what was recommended. * Patients rate their concerns about whether the privacy of personal medical information was protected. * Patients rate overall how satisfied they are with the CHF Clinic services they receive.	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Dept of Health: in kind support
4. Collect baseline CHF Clinic Nurse time/motion/work-flow data during patients' CHF Clinic and Collect baseline CHF Clinic Nurse time/motion/work-flow data during CHF/THC Clinic	Sept 00 - Feb 01	CHF Clinic Nurse & CHF/THC Clinic patients	CHF Clinic nurse & project researcher. Statistician, & programmer consulted during iterative design of the database. Evaluator	CHF/THC database Observation	*Collect data on the task, time, workflow and other relative to the age of CHF Clinic patients, and CHF/THC Clinic patients over or under age seventy, time spent on clinical and educational tasks. **Clinical:** take: weight, heart rate, blood pressure; assess diet compliance, medication compliance, clinical status, quality of life **Educational**: dietary advice, importance of compliance with diet, importance of compliance with medication instructions, recognition of worsening symptoms	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Caduceus: to assist in iterative database development
5. Determine baseline applicable in-hospital costs (Halifax & Cape Breton).	Sept 00 - Mar 01	QEII data	QEII staff, & CHF project researcher	Prospective data collection and analysis	* Length of stay, intensive care versus ward bed, out-patient visits, emergency department visits, and so on	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Dept of Health: in kind support

DETAILED EVALUATION PLAN FOR THE ROLE OF TELEHOMECARE IN THE MANAGEMENT OF CHF PATIENTS
Stage 1 Pre-enrollment Sep/2000 – Dec/2000. .....Continued

Evaluation data to be collected	Timelines	Data from what source	Data collected by	Using what tool	Sample Indicators to evaluate/measure	Role of Project Partners
6. Determine baseline applicable out-of -hospital costs (Halifax & Cape Breton)	Sept 00 - March 01	Primary care physician billing data, pharmacy data, patients' charts	CHF project Researcher	With the exception of data relative to billing this data is captured in client's self administered questionnaire (note # 3)	* What are the **costs** for patients and families: direct costs to include, for example, travel & childcare: indirect costs to include, for example, lost work days * Cost to visit to primary care physician/specialist, medication, and so on. * Costs to the hospitals: personnel, equipment, supplies, renovations, administrative services, travel, productivity levels, space. * What is the cost for society overall compared to the alternative(s)? Is the CHF/THC Clinic associated with differences in total healthcare costs, the cost per service, per episode of illness, or per capita? * How did the costs of the application relate to the benefits of the CHF/THC Clinic compared to the alternatives(s)? * Is there a trade-off here? Would lower patient satisfaction levels be acceptable if access was increased?	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Dept of Health: in kind support
7. Develop qualitative tool to track CHF/THC implementation process	Sept 00 – Oct 00	**********	Developed by CHF/THC Clinic researcher evaluator	Semi-structured log/diary for CHF/THC visits	* The purpose of this tool is to capture qualitative data on the barriers to and motivators for CHF/THC Clinic implemented in Stage II. Indicators are detailed in # 11.	CHF Clinic: initiator

DETAILED EVALUATION PLAN
Stage 2: Enrollment (Queen Elizabeth II Health Sciences Center, Halifax, Nova Scotia) Dec/2000 – Feb/2001
Summary:

- Data identical to dimensions collected during traditional CHF Clinic visits, is collected on the CHF/THC Clinic visits.
- All study participants use tracking logs/diaries to capture qualitative data relative to barriers to and motivators for CHF/THC Clinic.
- Data from tracking logs/diaries also informs the iterative design and development process relative to the CHF/THC Clinic protocols, the database, and Caduceus software and hardware
- The Interim Evaluation Takes place at the completion of Stage II/beginning of Stage III.

Evaluation data to be collected	Timelines	Data from what source	Collected by	Using what tool	Indicators to evaluate/measure	Role of Project Partners
8. Collect baseline study data determined in #6, on 60 patients enrolled in CHF/THC Clinic	Dec 00 – Feb 01	CHF/THC enrolled patients	CHF/THC Clinic nurse and visiting THC Nurse	CHF/THC data base	Indicators for the CHF/THC patient cohort are identical to clinical and human factor dimensions identified in the CHF Clinic group #1. Broadly stated, measure all baseline dimensions relative to access, quality, cost, and acceptability of current and anticipated CHF/THC Clinic services.	CHF Clinic: initiator Queen Elizabeth II: staff in-kind

DETAILED EVALUATION PLAN **Stage 2: Enrollment (Queen Elizabeth II Health Sciences Center, Halifax, Nova Scotia) Dec/2000 – Feb/2001…Continued**						
Evaluation data to be collected	**Timelines**	**Data from what source**	**Collected by**	**Using what tool**	**Indicators to evaluate/measure**	**Role of Project Partners**
8. Continued …					Sample sub categories include but not limited to extant: hospitalization utilization, quality of life, functional capacity, patient satisfaction, compliance with medications, compliance with diet, short term readmission rates, unscheduled emergency room visits, and so on. Data capture: Assure granularity in the database design: CHF Clinic nurses need to differentiate between patients over and under 70 and those patients' needs relative to education about their disease, diet, medication compliance, and so on.	support Dept of Health: in kind support Caduceus: input on database development
9. Confirm CHF/THC informed consent protocols in place, observed, and acceptable to patients	Dec 00 – Feb 01	Patients enrolled in the CHF/THC Clinic	CHF/THC Clinic nurse	CHF/THC data base	Rank CHF/THC Clinic patients' comfort level with consent to take part in a study based on face-to-face monitoring and management combined with remote monitoring and management. Do CHF/THC Clinic patients have concerns about whether the privacy of personal medical information is protected?	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support
10. Establish patients' baseline satisfaction with CHF/THC Clinic (Halifax)	Sept 00 - Feb 01	CHF Clinic patients	CHF Clinic Nurse, researcher,	Self administered survey tool completed during CHF/THC clinic visit (V5)	* Patients rate their physical and psychological comfort with the CHF/THC Clinic. * Patients rate the convenience of the encounter, its duration, its timeliness, it's cost. * Patients and attending family members rate the skills and personal manner of the consultant and attending primary care physician, and CHF/THC Clinic and visiting nurses * Patients rate the explanations provided to them of what their problem was and what was recommended. * Patients rate their concerns about whether the privacy of personal medical information was protected. * Patients rate overall satisfaction with the CHF/THC Clinic. services they receive. * Note: **costs** are detailed in #6.	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support
11. Collect qualitative data on: *Technical, administrative, and clinical processes, and * Implementation	Sept 00 – Mar 02	CHF/THC Clinic participants to include: *CHF telenurses, *visiting RNs	* CHF/THC Clinic researcher *Evaluator	Semi-structured tracking log/diary for CHF/THC Clinic visits	* The purpose of the ongoing interview process and participant diaries/logs is to capture qualitative data on the barriers to and motivators for CHF/THC Clinic implemented in Stage II. Potential **barriers** would include: * Computer and web access, connectivity, and functionality issues with individuals and across stakeholders as a group * Dearth of care givers in the home or problematic scheduling of Televisits because attendant caregiver working outside the home * Physical (space/organizational) and technical limitation in clients' homes	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Dept of Health: in kind support

DETAILED EVALUATION PLAN
Stage 2: Enrollment (Queen Elizabeth II Health Sciences Center, Halifax, Nova Scotia) Dec/2000 – Feb/2001...Continued

Evaluation data to be collected	Timelines	Data from what source	Collected by	Using what tool	Indicators to evaluate/measure	Role of Project Partners
11. Continued .... process and iterative redesign of CHF/THC protocols, **&** Caduceus software and hardware		* CHF/THC Clinic patients, *CHF/THC physicians & specialists			* Illiterate clients * Client non-compliance * Referring physicians' concerns re effectiveness * Redefinition of CHF Clinic nurses' job descriptions, changes to work flow, restructuring of the CHF Clinics * Inconvenience for the CHF Clinic nurses, CHF Clinic Specialists * Enormity of the challenge of data capture, sharing, and archiving * Diversity of needs and circumstances among clients * Rapidly evolving teletechnologies (hardware, software, IS systems, peripheral devices) across two institutions (QE II and Cape Breton Hospital) and at multiple sites (physicians' offices, clients homes) in diverse settings (rural and urban). * Concerns about privacy and confidentiality * Clients may not want to be on video or have their environs videoed * Clients may be reluctant to relinquish human contact, * Clients deem CHF/THC Clinic interface too complicated Potential **motivators** for CHF/THC are cost savings, convenience, increased access, maintained or improved quality of care, increased ability to monitor diet, weight, medication compliance, decrease in medication errors, and finally, increased opportunities for timely education of patients on how to manage their disease, all of which may contribute to patients' experiencing increased feelings of self-mastery and control.	Caduceus: input on database development
12. Interim Evaluation	Jan 01 – Feb 01	Review all data collected and available to date	Evaluator	* CHF/THC DB * Semi-structured tracking log/diary CHF/THC visits * Self admin survey tool completed by CHF Clinic and CHF/THC Clinic patients.	* Are mid-course corrections required? If so how are they to be implemented/incorporated into the remaining study design. * Has the CHF/THC Clinic been designed, developed, deployed, and debugged? Is it ready to be rolled out at a second site (Cape Breton)? * Are study objectives and CHIPP Evaluation Criteria # 16 being met? * Investigate, identify, and report back to project's partners, iterative design and development elements that could inform CHF/THC Clinic protocols, further evolutions of the database, and improvements relative to the evolution of Caduceus software and hardware. * How is the teletechnology performing? * Is there adequate support for the hardware and software? * Is the teletechnology company an active participant in the iterative design process? * Is the teletechnology company modifying the interface relative to on-going feedback from participants and stakeholders?	Interim Evaluation feedback for all project partners

DETAILED EVALUATION PLAN
Stage 3: Enrollment (Cape Breton Regional Hospital, Sidney, Nova Scotia) March/2001 – Jan/2002
Summary:

- In essence the focus and rollout of the Evaluation Plan in Stage 3, is a duplication of Stage 2.
- Data collected will be compared with CHF Clinic and Queen Elizabeth II CHF/THC data
- Evaluator initiates on-going interviews with a cross-section of all stakeholders and participants

Evaluation data to be collected	Timelines	Data from what source	Collected by	Using what tool	Indicators to evaluate/measure	Role of Project Partners
13. Collect baseline study data determined in #1, on 25 patients enrolled in CHF/THC Clinic in Cape Breton. Steps 8 – 11 are repeated during Stage 3.	Nov 00 – Jan 02	Identical to Stage 2 #2 - #6	Identical to Stage 2 #2 - #6	Identical to Stage 2 #2 - #6	* Identical to Stage 2 #2 - #6	* Identical to Stage 2
14 Collect all qualitative feedback on the study to date. Findings from that qualitative feedback are distilled into an exit overall satisfaction survey for all participants and stakeholders	Nov 00 – Nov 01	All participants and stakeholders	Evaluator	In-depth semi-structured debriefing interviews	* Are there indicators specific to the CHF/THC Clinic roll out in a regional hospital setting? * Does the study design need to be revisited to accommodate these differences? * What are the lessons learned during this roll out in a regional/non-academic setting? * How does the implementation process at Cape Breton Regional compare to the implementation process at the QEII? * Is CHF/THC Clinic a healthcare service that can be successfully decentralized and implemented in regional hospitals across the province? If not what needs to be done to move in that direction? * Is the CHF/THC Clinic scaleable? If not, why not?	Full cooperation from all project partners, stakeholders, and participants.

DETAILED EVALUATION PLAN
Stage 4: Evaluation Feb/2002 – April/2002

Summary:

- Findings generated by this intensive program of data collection and analysis, will reflect if the study achieved its objectives and primary and secondary outcomes.
- Additionally, the Final Evaluation will report findings relative to the eight CHIPP Evaluation Criteria

Evaluation data to be collected	Timelines	Data from what source	Collected by	Using what tool	Indicators to evaluate/measure	Role of Project Partners
15. Collect data on overall satisfaction, using the Overall Satisfaction Exit Survey regarding the CHF/THC Clinic, the THC technology, healthcare services provided, and lessons learned.	Feb 2002	All study participants and stakeholders	Evaluator	Overall Satisfaction Exit Survey capturing quantitative and qualitative data	* **Evaluating patient's Perceptions**: Were patients satisfied with the CHF/THC Clinic compared to the alternatives? * How did patients rate their physical and psychological comfort with the application? * How did patients rate the convenience of the encounter, its duration, its timeliness, and its cost? * How did patients (family members) rate the skills and personal manner of the specialist, and attending personnel (CHF/THC Clinic nurse and visiting nurse? * Was the lack of direct physical contact with the specialist and CHF Clinic nurse acceptable? * How did patient's rate the explanations provided to them of what their problem was and what was being recommended? * Did patients have concerns about whether the privacy of personal medical information was protected? * Would patients be willing to use the CHF/THC Clinic again? * Overall, how satisfied were patients with the telemedicine service they received? * **Evaluating Practitioners' Perceptions to include: CHF/THC Clinic Nurses, Specialists, referring Physicians, and visiting nurses** * Were practitioners satisfied with the telemedicine application compared to the alternatives? * How did practitioners rate their comfort with the CHF/THC Clinic telemedicine equipment and procedures? * How did the practitioners rate the convenience of CHF/THC relative to scheduling, physical arrangements, and location? * How did practitioners rate the timeliness of consultation results? * How did practitioners rate the quality of the service? * How did practitioners rate the quality of communications with patients? * Were practitioners concerned about maintaining the confidentiality of personal medical information and protecting patients' privacy? * Did practitioners believe the application made a positive contribution to patient care? * Would the practitioners be willing to use the CHF/THC service again?	CHF Clinic: initiator Queen Elizabeth II: staff in-kind support Dept of Health: ICONS in kind support Caduceus: input on database development

15. Continued					* Overall, how satisfied were the practitioners with the CHF/THC Clinic service? **Evaluating access to care:** * Did the CHF/THC Clinic affect the use of services or the level or appropriateness of care compared to the alternative? * What was the utilization of the telemedicine services before, during and after the study period for the target population and clinical problems? * When offered the option of a telemedicine service, how often did the patients: 1. Accept or refuse an initial service or fail to keep an appointment? 2. Accept or refuse a subsequent service or fail to keep an appointment? * What was the utilization of specified alternative services before, during and after the study period for the target population and clinical problem(s). * Was the telemedicine application associated with a difference in overall utilization (e.g., number of services or rate) or indicators of appropriateness of care for specialty care, transport services, services associated with lack of timely care? * Did the application affect the timeliness of care or the burden of obtaining care compared to the alternative? * Was there a difference in the timing of care? Appointment waiting times for referrals to the CHF/THC Clinic? * What were patient attitudes about the timeliness of care, burden of obtaining care, appropriateness of care? * What were the attitudes of attending and consulting practitioners about the timeliness of care, burden of providing care and appropriateness of care? **Evaluating quality of care and Health Outcomes:** * What were the effects of the CHF/THC Clinic on the clinical process of care compared to the alternatives(s)? * Was the application associated with differences in the use of health services? (E.g., emergency department visits, length of hospital stay) * Was the CHF/THC Clinic associated with differences in the appropriateness of services (e.g., increased access) * Was the CHF/THC Clinic associated with differences in the quality, amount, or type of information available to clinicians and patients? * Was the CHF/THC Clinic associated with differences in patients' knowledge of their status, their understanding of the care options, or their compliance with care regimens? * Was the CHF/THC Clinic associated with differences in diagnostic accuracy or timeliness, patient management decisions, or technical performance? * Was the CHF/THC Clinic associated with differences in the interpersonal aspects of care? * What were the effects of the CHF/THC Clinic on immediate, intermediate, or long-term health outcomes compared to the alternative(s)?	

DETAILED EVALUATION PLAN **Stage 4: Evaluation Feb/2002 – April/2002 Continued .....**						
Evaluation data to be collected	**Timelines**	**Data from what source**	**Collected by**	**Using what tool**	**Indicators to evaluate/measure**	**Role of Project Partners**
15. Continued					* Was the application associated with differences in physician signs or symptoms? * Was the CHF/THC Clinic associated with differences in morbidity or mortality? * Was the CHF/THC Clinic associated with a difference in physical, mental, or social and role functioning? * Was the CHF/THC Clinic associated with differences in health-related behaviors, (medication and dietary compliance)? * Was the CHF/THC Clinic associated with differences in patient satisfaction with their care or patient perceptions about the quality or acceptability of the care they received?	
16. Final Evaluation: Assemble all data to date, synthesis findings into Final Evaluation Report	Feb 02 – April 02	From all quantitative and qualitative sources	Evaluator assisted by CHF/THC researcher	* CHF/TCH data base * Findings from self administered survey tool completed by baseline CHF patients, CHF Clinic patients, and CHF/THC Clinic patients * Findings from prospective analysis on data relative to costs * Findings from Semi-structured tracking log/diary for CHF/THC visits * Findings from in-depth semi-structured interviews * Findings from exit survey capturing	**Did the study achieve its objectives?** A. To implement innovative ICT in the provision of Telehomecare to patients with CHF. B. To determine whether Telehomecare in conjunction with a specialized CHF Clinic improves health care delivery to patients with heart failure. C. Demonstrate the safety and efficiencies with Telehomecare in conjunction with specialized CHF Clinic Management D. Demonstrate that the Telehomecare advantages are applicable to patients managed both at a tertiary care center as well as a non-academic regional hospital E. Determine that the geographic barrier inherent in our present centralized tertiary care model of health care delivery can be diminished by Telehomecare **Did the study achieve its outcomes?** **Primary outcomes**: 50% reduction in resource utilization (CHF Clinic visits) **Secondary outcomes**: unplanned re-hospitalization for health failure Quality of life, patient satisfaction, family satisfaction, referring physician satisfaction, cost analysis, other cardiovascular endpoints including hospitalization for myocardial infarction stroke as well as cardiovascular mortality. **Furthermore, did findings elucidate answers to additional questions the study posed?** 1. Which patients are optimal for CHF/THC Clinic monitoring? 2. Is the CHF/THC Clinic interface applicable to a broad range of patients including: the elderly, person's requiring drug titration, persons of varying socioeconomic status and educational backgrounds, and so on.? 3. Can the CHF/THC Clinic be decentralized, become a distributed,	Final Evaluation feedback for all project partners and stakeholders

16. Continued …..				quantitative and qualitative data	scaleable program and service? **Does the Evaluation Report specifically address the eight CHIPP evaluation categories?** This detailed data collection and Evaluation Plan ensure that the data and findings will be available to address each applicable evaluation question raised by CHIPP.	
DETAILED EVALUATION PLAN **Stage 5: Assess CHF/THC Clinic's potential for other appropriate cardiac applications** **Summary:** • Project partners will decide if the CHF/THC Clinic is to continue and if the there are potential cardiac applications for the technology.						
Evaluation data to be collected	**Timelines**	**Data from what source**	**Collected by**	**Using what tool**	**Indicators to evaluate/measure**	**Role of Project Partners**
17. Collect data on project partners decision whether or not to continue with the CHF/THC Clinic Potential applicability of CHF/THC Clinic for other cardiac conditions	May 02 – Aug 02	Meetings between the stakeholders and project partners	CHF/THC researcher Evaluator	Observation Participant observation	**Categories of questions for Comparing Telemedicine to Alternative Health Services** * What were the effects of the CHF/THC Clinic on the clinical process of care compared to the alternative? * What were the effects of the CHF/THC Clinic on patient status or health outcomes compared to the alternative? * What were the effects of the CHF/THC Clinic on access compared to the alternative(s)? * What are the costs of the CHF/THC Clinic for patients, private or government, and other affected parties, compared to the alternative(s)? * How did the patients, clinicians, and other relevant parties view the CHF/THC Clinic, and were they satisfied with the application compared to the alternative(s)? * Can this criteria be use to evaluate the potential applicability of telehomecare for other types of cardiac patients?	Input from all project partners

End Notes

* The term **participants** means all parties involved in the actual study, to include but not limited to: patients, their attendant caregivers, referring physicians, specialists, nurses, support staff, and so on.

* The term **stakeholders** refers to all project partners.

* **Analysis** of results will control for or take into account severity of illness, comorbidities, demographic characteristics, and other relevant factors.

* **Sample indicators to evaluate/measure** are drawn largely from the Institute of Medicine's book edited by Katherine Field, titled, Telemedicine A Guide to Assessing Telecommunications in Health Care, 1996.

APPENDIX B SURVEY SAMPLE FORM

RETURN TO:
Verle Harrop
Telemedicine Task Force
[redacted]

PLEASE RETURN BY: FRIDAY FEBRUARY 4th, 2000.

If you have any questions or concerns please contact: verle.harrop@[redacted].org 781 744 2195

TELEMEDICINE TASK FORCE NEEDS ASSESSMENT SURVEY

The purpose of this survey is twofold:

A. To assess the current level of computer and web usage amongst[redacted] clinical staff, and

B. To identify the web and tele-technology infrastructures required to better support health care delivery as [redacted] moves forward into the 21st Century.

The results of this survey will be e-mailed to all participants.

Thank you for assisting the [redacted] Telemedicine Task Force in this endeavor.

Instructions
Circle the number that represents your response.
Enter text when appropriate.

Definition
NA stands for non-applicable

DEMOGRAPHICS					
1. Name					
2. Your specialty.					
3 Primary practice location:					
4. Gender	1 male	2 female			
5. State the number of years since graduating from medical/graduate school.					
6. State your number of years with [redacted]					
[redacted] AT WORK					
7. Do you have a [redacted] computer in your office?	3 yes	4 no			
8. How often do you use a computer at work?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
9. How often do you use e-mail at work?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
10. How often do you use e-mail to communicate with colleagues?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
11. How often do you use e-mail to communicate with patients?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
12. How often do you get e-mail requests from colleagues for case consultations?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
13. How often do you use e-mail to communicate with [redacted] administration?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
14. How often do you get unsolicited e-mail from patients?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
15. Are you familiar with [redacted] E-mail Communications Policy?.	3 yes	4 no			
16. Do you discuss e-mail protocols face-to-face with patients and have them sign a consent form?	3 yes	4 no	10 NA		
17. Do you have Microsoft Outlook on the computer you use at work?	3 yes	4 no			
18. Rate the training you received on how to use Microsoft Outlook?	46 none	43 not adequate	44 barely adequate	45 adequate	29 more than adequate

19. Do you have a cell phone?	3 yes	4 no			
20. Do you have a Palm Pilot?	3 yes	4 no			
21. Do you have a laptop computer?	3 yes	4 no			
22. Do you use your personal laptop at work?	3 yes	4 no	10 NA		
USAGE AT HOME					
23. Do you use a computer at home?	3 yes	4 no			
(IF YOUR ANSWER WAS NO, GO TO QUESTION #33)					
24. What kind(s) of computer(s) do you use at home?	11 IBM/Clone	12 MAC	13 both	25. Year purchased?	
26. How often do you use e-mail at home?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
27. What e-mail program(s) do you use at home? List all.					
28. Do you access your [redacted] e-mail from home?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily
29. Do you have an e-mail address in addition to the one provided by ?	3 yes	4 no			
30. Do you have technical support at home for your computer?	3 yes	4 no			
31. Who provides that technical support for your computer at home?	14 family	15 friend	16 commercial service	17 oneself	
32. How helpful would it be to have technical and mechanical support from . at home?	47 not at all helpful	48 somewhat helpful	49 helpful	50 very helpful	10 NA
[redacted]					
33. Have you ever made a purchase over the web?	3 yes	4 no			
34. Do you have a personal web site?	3 yes	4 no			
35. How often do you use the web to access medical information?	5 never/rarely	6 monthly	7 weekly	8 daily.	9 multiple x daily
36. What is/are your favorite web site(s) for health information?					
37. How often do you use the [redacted] staff only **intranet**?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily / 10NA
38. How often do you use www.[redacted]rg?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily / 10NA
39. Do you have on-line professional memberships, eg: MEDSCAPE	3 yes / 4 no	**40.** If yes, name the memberships.			
41. Do you have on-line journal subscriptions, eg: NEJM, WSJ?	3 yes / 4 no	**42.** If yes, name the subscriptions.			
43. How often would you take continuing education credits over the web if they were offered on your desktop computer?	5 never/rarely	51 infrequently	24 frequently	25 very frequently	26 always
44. Would you like the option to access live conferences (grand rounds, etc.) from your desk top rather than in person?	5 never/rarely	51 infrequently	24 frequently	25 very frequently	26 always
45. Would you prefer to participate in administrative meetings using video teleconferencing?	5 never/rarely	51 infrequently	24 frequently	25 very frequently	26 always
IF YOU DO NOT HAVE PATIENT CONTACT GO TO QUESTION #60.					
46. Presently, do you have high-risk or chronic disease patients who would benefit from using video teleconferencing for remotely monitoring and managing their **on-going** care in their home?	3 yes	4 no	47. If yes, state the approximate number of patients.		

48. Presently do you have a patient population that would benefit from **short-term** home monitoring and management using a video teleconferencing technology?	3 yes	4 no	49. If yes, state the approximate number of patients.			
50. Presently, do you have high-risk or chronic disease patients who would benefit from 24-hour access to a call center staffed by registered nurses?	3 yes	4 no	51. If yes, state the approximate number of patients.			
52. How receptive would you be to an out sourced call center offering patients 24 hours a day, 7 days a week, access to triage by qualified registered nurses?	18 very negative	19 negative	20 neutral	21 positive	22 very positive	10 NA
53. How receptive would you be to having these call center nurses provide you with the patient's history prior to your office visit with the patient?	18 very negative	19 negative	20 neutral	21 positive	22 very positive	10 NA
PATIENTS AND THE WEB						
54. How often do your patients present with information they have obtained from the web?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily	
55. How often do your patients ask you for web references?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily	
56. What is/are your favorite web site(s) to direct patients to for patient related health information?						
57. Circle the number corresponding to the on-line resources that you refer patients to?	34 health 35 self-help sites 36 courses		37 support groups 38 chat groups 39 assessment tools		40 lectures 41 related links 42 other	
58. Do you direct patients to the [redacted] web site www.[redacted] for medical information?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily	
59. How frequently do you get requests from patients for on-line appointment booking?	5 never/rarely	6 monthly	7 weekly	8 daily	9 multiple x daily	
TECHNOLOGY AND INNOVATION						
60. Do you already have a web or tele-technology in place, operating independent of IS, that you are using to support or deliver health care?	3 yes	4 no	61. If yes, what is this initiative?			
(IF YOUR ANSWER WAS NO, GO TO QUESTION #64.)						
62. Does the initiative have adequate infrastructure support?	3 yes	4 no	63. If no, what infrastructure support do you need?			
64. Do you have a web based innovation(s), to include a clinical or administrative process, product, or service that you would like to develop with [redacted]?	3 yes	4 no	65. If yes, what is the focus of this initiative? 27 clinical 28 commercial 13 both			
66. Do you have patients that would like to partner in this initiative?	3 yes	4 no				
67. Do you have corporate entities that would like to partner with this initiative?	3 yes	4 no				
68. Would you personally like to participate in any future ongoing discussion about tele-health and web based innovations at [redacted]?	30 no interest	31 little interest	32 interested	33 very interested		
COMMENTS						

THANK YOU

APPENDIX C BASELINE ANALYSIS

	A	B	C	D	E	F	G	H	I
1	**Total Practitioner responders - With formula for profiler - master**						4-sex		6-yrspLC
2	**title1=**							5-yrspSchool	
3	Total	% of total		**Practitioners only -(Series 1, blue)**					
4	586	69.28%	Total=	406		male	258	18.72	8.09
5	462	72.94%	physician=	337		female	148		
6	14	0.00%	CRNA	0		total respond	406		
7	53	69.81%	PracticianerRN	37					
8	38	73.68%	Physician Asst.	28					
9	9	0.00%	Optomitrist	0					
10	7	57.14%	Psychologist	4		male	64%		
11	1	0.00%	Research Technicia	0		female	36%		
12	1	0.00%	Director, Cell & Mol I	0					
13	1	0.00%	Physicist	0					
14									
15	**For practitioners only (406) see "SurveyF Practitioner Profiler.xls"**								
16									
17				**Practitioners only -(Series 2,red)**					
18	586	69.28%	Total=	406		male	258	18.72	8.09
19	462	72.94%	physician=	337		female	148		
20	14	0.00%	CRNA	0		total respond	406		
21	53	69.81%	PracticianerRN	37					
22	38	73.68%	Physician Asst.	28					
23	9	0.00%	Optomitrist	0					
24	7	57.14%	Psychologist	4		male	64%		
25	1	0.00%	Research Technicia	0		female	36%		
26	1	0.00%	Director, Cell & Mol I	0					
27	1	0.00%	Physicist	0					
28	a dummy response of 0.001 used in Q to prevent error.								
29	Q14 No 5th option responses therefore rx this as 2x4 rather than 2x5.								
30	Q55 & 59 No 5th option responses therefore rx this as 2x4 rather than 2x5.								
68					**Chi square=**		**0**		
69					**Probability=**		**1**		

	J	K	L	M	N	O	P	Q	R	S	T	U
1		8-oftenoffcomputer		10-emailCollegue		12-emailConsults		14-emailUnsolicit		16-emailProtocol		18-trainOu
2	7-officecomputer		9-oftenemail		11-emaiPatients		13-emailAdmin		15-emailPolicy		17-haveOutlook	
3	399	393	391	389	390	392	391	390	391	388	377	383
4	364	27	72	105	327	300	250	323	154	6	344	247
5	35	4	10	35	25	49	52	43	237	266	33	44
6		20	55	92	31	32	52	23		116		50
7		91	115	84	5	6	30	1				39
8		251	139	73	2	5	7	0				3
9												
10	91.23%	6.87%	18.41%	26.99%	83.85%	76.53%	63.94%	82.82%	39.39%	1.55%	91.25%	64.49%
11	8.77%	1.02%	2.56%	9.00%	6.41%	12.50%	13.30%	11.03%	60.61%	68.56%	8.75%	11.49%
12		5.09%	14.07%	23.65%	7.95%	8.16%	13.30%	5.90%		29.90%		13.05%
13		23.16%	29.41%	21.59%	1.28%	1.53%	7.67%	0.26%				10.18%
14		63.87%	35.55%	18.77%	0.51%	1.28%	1.79%					0.78%
15												
16												
17	399	393	391	389	390	392	391	390	391	388	377	383
18	364	27	72	105	327	300	250	323	154	6	344	247
19	35	4	10	35	25	49	52	43	237	266	33	44
20		20	55	92	31	32	52	23		116		50
21		91	115	84	5	6	30	1				39
22		251	139	73	2	5	7	0				3
23												
24	91.23%	6.87%	18.41%	26.99%	83.85%	76.53%	63.94%	82.82%	39.39%	1.55%	91.25%	64.49%
25	8.77%	1.02%	2.56%	9.00%	6.41%	12.50%	13.30%	11.03%	60.61%	68.56%	8.75%	11.49%
26		5.09%	14.07%	23.65%	7.95%	8.16%	13.30%	5.90%		29.90%		13.05%
27		23.16%	29.41%	21.59%	1.28%	1.53%	7.67%	0.26%				10.18%
28		63.87%	35.55%	18.77%	0.51%	1.28%	1.79%					0.78%
29												
30												
68	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
69	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1	look	20-PalmPilot		22-LapAtWork		24-kindComputer		26-emailHome		28-accessLCfromHom		30-techSup
2	***19-cellPhone***	21-laptop		23-homeComputer		**25-yr purchase**		27-emailClient		29-2ndemailAddress		
3	400	401	401	395	400	344	195	346	223	333	342	344
4	327	70	114	39	346	266	1997.708	74		304	279	159
5	73	331	287	263	54	50		28		5	63	185
6				93		28		95		13		
7								104		10		
8								45		1		
9												
10	81.75%	17.46%	28.43%	9.87%	86.50%	77.33%	100.00%	21.39%	54.93%	91.29%	81.58%	46.22%
11	18.25%	82.54%	71.57%	66.58%	13.50%	14.53%		8.09%		1.50%	18.42%	53.78%
12				23.54%		8.14%		27.46%		3.90%		
13								30.06%		3.00%		
14								13.01%		0.30%		
15												
16												
17	400	401	401	395	400	344	195	346	223	333	342	344
18	327	70	114	39	346	266	1997.708	74		304	279	159
19	73	331	287	263	54	50		28		5	63	185
20				93		28		95		13		
21								104		10		
22								45		1		
23												
24	81.75%	17.46%	28.43%	9.87%	86.50%	77.33%	100.00%	21.39%	54.93%	91.29%	81.58%	46.22%
25	18.25%	82.54%	71.57%	66.58%	13.50%	14.53%		8.09%		1.50%	18.42%	53.78%
26				23.54%		8.14%		27.46%		3.90%		
27								30.06%		3.00%		
28								13.01%		0.30%		
29												
30												
68	**0**	**0**	**0**	**0**	**0**	**0**		**0**		**0**	**0**	**0**
69	**1**	**1**	**1**	**1**	**1**	**1**		**1**		**1**	**1**	**1**

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
1	port	32-wantLCsupport		34-personalWebSite		36-favoriteWebSites		38-LaheyOrgUse		**40-whatOnes**		**42-whatOr**
2	31-techWho		33-webPurchase		35-webMedicalInfo		37-IntranetUse		39-onlineMemberships		41-onlineJournals	
3	267	343	397	397	392	192	386	386	385	68	389	46
4	69	67	265	30	100		215	249	103		61	
5	20	90	132	367	94		67	68	282		328	
6	83	95			147		59	45				
7	95	79			36		29	23				
8		12			15		12	0				
9								1				
10	25.84%	19.53%	66.75%	7.56%	25.51%	47.29%	55.70%	64.51%	26.75%	16.75%	15.68%	11.33%
11	7.49%	26.24%	33.25%	92.44%	23.98%		17.36%	17.62%	73.25%		84.32%	
12	31.09%	27.70%			37.50%		15.28%	11.66%				
13	35.58%	23.03%			9.18%		7.51%	5.96%				
14		3.50%			3.83%		3.11%	0.00%				
15							1.04%	0.26%				
16												
17	267	343	397	397	392	192	386	386	385	68	389	46
18	69	67	265	30	100		215	249	103		61	
19	20	90	132	367	94		67	68	282		328	
20	83	95			147		59	45				
21	95	79			36		29	23				
22		12			15		12	0				
23							4	1				
24	25.84%	19.53%	66.75%	7.56%	25.51%	47.29%	55.70%	64.51%	26.75%	16.75%	15.68%	11.33%
25	7.49%	26.24%	33.25%	92.44%	23.98%		17.36%	17.62%	73.25%		84.32%	
26	31.09%	27.70%			37.50%		15.28%	11.66%				
27	35.58%	23.03%			9.18%		7.51%	5.96%				
28		3.50%			3.83%		3.11%	0.00%				
29							1.04%	0.26%				
30												
68	**0**	**0**	**0**	**0**	**0**		**0**	**#DIV/0!**	**0**		**0**	
69	**1**	**1**	**1**	**1**	**1**		**1**	**#DIV/0!**	**1**		**1**	

	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE
1	es		44-liveConfToDesktop	46-highRiskVTCtoHon		***48-shorttermVTCmor***		50-HighRiskcallCenter		52-receptiveCallCente		54-patients
2	43-webCMEtoDesktop		45-adminMeetTelecon	**47-numberPatients**		**49-numberPatients**		**51-numberPatients**		53-callCenterHistory		
3	391	386	382	333	70	330	73	330	67	336	334	349
4	90	73	114	115	1895	120	1644	183	1972	14	9	48
5	126	108	124	218		210		147		44	26	89
6	136	105	86							85	84	165
7	29	59	40							107	119	43
8	10	41	18							75	77	4
9										11	19	
10	23.02%	18.91%	29.84%	34.53%		36.36%		55.45%		4.17%	2.69%	13.75%
11	32.23%	27.98%	32.46%	65.47%		63.64%		44.55%		13.10%	7.78%	25.50%
12	34.78%	27.20%	22.51%							25.30%	25.15%	47.28%
13	7.42%	15.28%	10.47%							31.85%	35.63%	12.32%
14	2.56%	10.62%	4.71%							22.32%	23.05%	1.15%
15										3.27%	5.69%	
16												
17	391	386	382	333	70	330	73	330	67	336	334	349
18	90	73	114	115	1895	120	1644	183	1972	14	9	48
19	126	108	124	218		210		147		44	26	89
20	136	105	86							85	84	165
21	29	59	40							107	119	43
22	10	41	18							75	77	4
23										11	19	
24	23.02%	18.91%	29.84%	34.53%		36.36%		55.45%		4.17%	2.69%	13.75%
25	32.23%	27.98%	32.46%	65.47%		63.64%		44.55%		13.10%	7.78%	25.50%
26	34.78%	27.20%	22.51%							25.30%	25.15%	47.28%
27	7.42%	15.28%	10.47%							31.85%	35.63%	12.32%
28	2.56%	10.62%	4.71%							22.32%	23.05%	1.15%
29										3.27%	5.69%	
30												
68	**0**	**0**	**0**	**0**		**0**		**0**		**0**	**0**	**0**
69	**1**	**1**	**1**	**1**		**1**		**1**		**1**	**1**	**1**

	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ
1	BringWeb I	56-sendPatientsToWh		58-sendPatientsToLat		60-independantWebTe		62-infrastructureAdequ		64-haveIdeaWithLC		66-partnerI
2	55-patientsAskWebRe	57-webResourcesForF		59-requestAppointmer		**61-whatInitiave**		**63-needWhat**		**65-focusInitive**		
3	344	120	143	339	332	391	17	28	6	359	29	307
4	220			300	312	18		8		35	18	9
5	75			26	17	373		20		324	2	298
6	42			10	2						9	
7	7			2	1							
8	0			1	0							
9												
10	63.95%	29.56%	35.22%	88.50%	93.98%	4.60%	4.19%	28.57%	1.48%	9.75%	62.07%	2.93%
11	21.80%			7.67%	5.12%	95.40%		71.43%		90.25%	6.90%	97.07%
12	12.21%			2.95%	0.60%						31.03%	
13	2.03%			0.59%	0.30%							
14	0.00%			0.29%	0.00%							
15												
16												
17	344	120	143	339	332	391	17	28	6	359	29	307
18	220			300	312	18		8		35	18	9
19	75			26	17	373		20		324	2	298
20	42			10	2						9	
21	7			2	1							
22	0			1	0							
23												
24	63.95%	29.56%	35.22%	88.50%	93.98%	4.60%	4.19%	28.57%	1.48%	9.75%	62.07%	2.93%
25	21.80%			7.67%	5.12%	95.40%		71.43%		90.25%	6.90%	97.07%
26	12.21%			2.95%	0.60%						31.03%	
27	2.03%			0.59%	0.00%							
28				0.29%	0.00%							
29												
30												
68	**0**			**0**	**0**	**0**		**0**		**0**	**0**	**0**
69	**1**			**1**	**1**	**1**		**1**		**1**	**1**	**1**

	BR	BS	BT	BU	BV	BW
1	Patients	68-particip:	69-Comme	70-OurComments		
2	67-corporate partners				Responder	1st v. 2nd
3	306	356	123		406	
4	11	66		1st respond=	257	
5	295	110		2nd respond=	149	
6		133		% 2nd		
7		47		responder=	36.70%	
8						
9						
10	3.59%	18.54%	30.30%			
11	96.41%	30.90%	69.70%			
12		37.36%				
13		13.20%				
14						
15						
16						
17	306	356	123	1st respond=	406	
18	11	66		2nd respond=	257	
19	295	110		% 2nd	149	
20		133		responder=	36.70%	
21		47				
22						
23						
24	3.59%	18.54%	30.30%			
25	96.41%	30.90%	69.70%			
26		37.36%				
27		13.20%				
28						
29						
30						
68	**0**	**0**			**0**	
69	**1**	**1**			**1**	

APPENDIX D SURVEY MASTER ANALYSIS

APPENDIX D: SURVEY MASTER ANALYSES

Appendix D: Analyses, number of disparities, and total populations for sub-group.

Dimensions	Analysis Code	Number of Disparities	Analyses and total members for each group: 586 Surveyed/406 responded		
Practice	S	18	Hospital-based practitioners(283)	versus	CGP**-based practitioners (123)
Location	T	18	Hospital-based MD/PhDs (246)	versus	CGP-based MD/PhDs (95)
Analyses	R	4	Hospital-based non-MD/PhDs (37)	versus	CGP-based non-MD/PhDs (28)
	U	16	Hospital-based male MD/PhDs (180)	versus	CGP-based male MD/PhDs (67)
	V	6	Hospital-based female-MD/PhDs (66)	versus	CGP-based female-MD/PhDs (28)
	EE	6	Hospital-based female-practitioners (96)	versus	CGP-B female-practitioners (52)
	WW	9	Hospital-based generalists (46)	versus	CGP-based generalists (90)
	DD	5	Hospital-based specialists (200)	versus	CGP-based specialists (5)
Practitioner	O	22	MD/PhDs (341)	versus	non-MD/PhDs (65)
Status	AA	17	Hospital-based MD/PhDs (246)	versus	hospital-based non-MD/PhDs (37)
Analyses	BB	10	CGP-based MD/PhDs (95)	versus	CGP-based non-MD/PhDs (28)
	D	9	Male MD/PhDs (247)	versus	male non-MD/PhDs (11)
	C	9	Female MD/PhDs (94)	versus	female non-MD/PhDs (54)
	PP	15	Specialists (205)	versus	generalists (136)
Gender	B	20	Male practitioners (258)	versus	female practitioners (148)
Analyses	N	7	Male MD/PhDs (247)	versus	female MD/PhDs (94)
	FF	4	Male non-MD/PhDs (11)	versus	female non-MD/PhDs (54)
	L	4	Hospital-based male MD/PhDs (180)	versus	hospital-B female MD/PhDs (66)
	M	1	CGP-based male MD/PhDs (67)	versus	CGP-based female MD/PhDs (28)
	YY	4	Male specialists (162)	versus	female specialists (43)
	XX	1	Male generalists (85)	versus	female generalists (51)

APPENDIX D: MASTER SURVEY COMPARER

		sex	6-yrspLC	8-oftenoffcomputer	
			5-yrspSchool	7-officecomputer	9-oftenema
Only the statistically significant different p values have been placed in this matrix					
B.	Gender - Male clinicians(258) v. Female clinicians(148)		21.9 v 12.8	**3.32E-05**	**0.00532**
C.	Female MD/psychol(94) v. Female PractRN/PA(54)		14.8 v 9.1	**1.39E-08**	**0.008** **5.02E-07**
D.	Male MD/psychologist(247) v. male PractRN/PA (11)		22.6 v 8.0	**2.25E-25**	**0.000308**
L	Physicians & Psychologists- LCB/LCN only Male v Female		22.4 v 16.4		
	Males & females n= 180 v 66				
M	Physicians & Psychologists- CGP only -Male v Female		23.4 v 10.5		
	Males v females n= 67 v 28				
N.	Gender MD/PhD only, male v female	**3.86E-76**	22.7 v 14.8		
	males v. females n=247 v 94				
O.	Clinicians only, MD/Phd v. non-MD/PhD	**1.57E-17**		**1.07E-27**	**7.39E-06** **5.44E-15**
	MD/PhD v. non-MD/PhD, n=341 v 65				
S.	Practitioner(MD,PhD,PractRN,PA)-Hosp v CGP		19.0 v 17.9	**0.000154**	**4.91E-11** **1.27E-06**
	hosp v CGP=283 v 123				
T.	Clinicians (MD & PhD) - LCB/LCB v. CGP - Male and Female		20.7 v 20.0	**0.000419**	**1.37E-06** **1.25E-06**
	hosp v CGP =246 v 95				
U.	Clinicians (MD & PhD) - LCB/LCB v. CGP - Male only		22.4 v 23.4	**0.02738**	**7.72E-06** **2.92E-05**
	hosp v CGP = 180 v 67				
V.	Clinicians (MD & PhD) - LCB/LCB v. CGP - Female only		16.4 v 10.5	**0.00502**	***0.009268*** **0.002745**
	hosp v CGP = 66 v 28				derived value
Z	non-MD/PhD hosp v. CGP				0.000842 0.154756
	hosp v CGP =37 v 28				
AA	Hospital MD/PhD v Hospital non-MD/PhD	8.11E-11		3.19E-21	2.47E-12
	MD/PhD v non-MD/PhD 246 v 37				
BB	CGP-based MD/PhD v CGP-based non-MD/PhD	1.19E-07		1.66E-08	0.000562 0.001787
	MD/PhD v non-MD/PhD= 95 v 28				
DD	Hospital-based specialists v CGP-based specialists				0.000397
	hosp v CGP = 200 v 5				
XX Generalist Male v Female (136) replaces X		2E-31			
	male v female= 85 v 51				

							sex		6-yrspLC		8-oftenoffcomputer	
								5-yrspSchool		7-officecomputer		9-oftenema
YY	**Specialist Male v Female (205) (replaces Y)**						1.69E-46					
			male v female= 162 v 43									
WW	**Hospital PCP,peds,GIM, v CGP PCP,peds,GIM (replaces W)**											
PP	**Specialist v PCP(generalist incld Peds) 205 v 136(Replace P)**						0.003714				0.003664	0.017399
			hosp v CGP= 46 v 90									
EE	**Practitioner Female hosp v PCP**						0.003714			0.066712	0.003664	0.017399
			specialist v PCP= 205 v 136									
FF	**Practitioner non-MD/PhD Male v Female (65)**						#DIV/0!			0.000194	1.4E-06	0.001047
			hosp v PCP= 96 v 52									
							7.49E-16					
			male v female= 11 v 54									

APP

	10-emailCollegue		12-emailConsults		14-emailUnsolicit		16-emailProtocol	18-trainOutlook		20-PalmPilot	
	ail	11-emaiPatients		13-emailAdmin		15-emailPolicy		17-haveOutlook	***19-cellPhone***		21-laptop
O											
B.	**0.000563**	**0.00198**		**0.000659**	**0.02643**		**0.0333**	**0.041**	**0.04853**	**0.000874**	**0.00283**
C.	**9.18E-06**					**0.001**		**1.03E-06**	**0.005467**		
D.	**0.0316**					**0.0082**		**2.89E-06**	**1.34E-06**		**0.01621**
L										**0.00761**	
M											
N.		**0.023308**					**0.023877**			**0.02064**	**0.032801**
O.	**7.27E-12**	**0.037773**		**0.000237**	**0.010543**	**7.98E-05**		**5.04E-13**	**0.213866**	**8.88E-06**	**0.000903**
S.	**5.52E-05**		**0.003519**	**0.026481**				**1.58E-06**	**0.03286**		**0.000326**
T.	**7.65E-05**		**0.013251**	**0.021121**				**0.000785**	**0.040144**	**0.024145**	**0.001123**
U.	**0.000535**		**0.028515**	**0.055021**				**0.009935**			**0.004653**
V.	**0.018193**							**0.011819**		**0.02652**	
Z								0.008762			
AA	6.11E-10			0.00036		4.28E-05		9.09E-07		0.000267		0.005344
BB	0.01549							5.21E-06		0.001596	
DD											
XX											

	10-emailCollegue		12-emailConsults		14-emailUnsolicit		16-emailProtocol		18-trainOutlook		20-PalmPilot	
	ail	11-emaiPatients		13-emailAdmin		15-emailPolicy		17-haveOutlook		***19-cellPhone***		21-laptop
YY											0.039374	
WW												
PP								0.017484		0.011435		
EE								0.017484		0.011435		
FF	0.010887							7.95E-06				
										0.00923	0.027292	

APP

	22-LapAtWork	24-kindComputer	26-emailHome	28-accessLCfromHom	30-techSupport	32-wantLCsupport	
	23-homeComputer	**25-yr purchase**	27-emailClient	29-2ndemailAddress	31-techWho		33-webPur
O							
B.				**0.003753**	**0.01753**	**7.81E-09**	**0.0197**
C.							**0.04796**
D.						**0.0021**	
L						**4.91E-05**	
M						**0.006607**	
N.				**0.032099**		**3.1E-07**	
O.				**0.002934**	**0.009761**		**4.35E-05**	**0.004952**
S.						**0.025655**	**0.048272**
T.						**0.05945**	
U.							
V.							
Z						0.002092	
AA				0.005447	0.02319	1.83E-07	0.017578
BB							
DD							
XX						0.000377	

	22-LapAtWork	24-kindComputer	26-emailHome	28-accessLCfromHom	30-techSupport	32-wantLCsupport
	23-homeComputer	**25-yr purchase**	27-emailClient	29-2ndemailAddress	31-techWho	33-webPur
YY					0.00138	
WW						
PP				0.00771		
EE				0.00771		
FF						0.041612
					0.028072	

APP

	34-personalWebSite	36-favoriteWebSites	38-LaheyOrgUse	40-whatOnes	42-whatOnes	44-liveConfToDesktop
	chase	35-webMedicalInfo	37-IntranetUse	39-onlineMemberships	41-onlineJournals	43-webCMEtoDesktop	45-adminV
O							
B.		0.003217	0.006441	0.04216						
C.						0.01116						
D.												
L		0.016975										
M												
N.		0.039416										
O.		0.008248	0.001209	0.004117	0.018772		0.04609					
S.									0.045101	7E-06	0.001148
T.						0.037704			0.027371	0.000151	0.018899
U.						0.009553			0.038446	0.000202	0.007084
V.											
Z	0.021134										0.009676
AA		0.001162	0.007532	0.013192						
BB					0.002814		0.011567				
DD								6.47E-05	0.000482	
XX										

	34-personalWebSite		36-favoriteWebSites		38-LaheyOrgUse		**40-whatOnes**		**42-whatOnes**		44-liveConfToDesktop	
	chase	35-webMedicalInfo		37-IntranetUse		39-onlineMemberships		41-onlineJournals		43-webCMEtoDesktop		45-adminM
YY						0.009889						
WW												
PP						0.023027					0.040081	
EE						0.023027					0.040081	
FF												

APP

	46-highRiskVTCtoHon	48-shorttermVTCmo	50-HighRiskcallCente	52-receptiveCallCente	54-patientsBringWeb	56-sendPatientsToWh
	eetTelecor	47-numberPatients	49-numberPatients	51-numberPatients	53-callCenterHistory	55-patientsAskWebRe	57-webRes
O							
B.							
C.							
D.	0.0229						
L							
M							
N.							
O.	0.040126						
S.	0.007061		0.000375		0.042765		
T.			0.000592		0.042105		
U.			0.000844		0.024529		
V.							
Z	0.008649						
AA							
BB	0.014011						
DD			0.01798		0.008798	0.045544	
XX							

	46-highRiskVTCtoHon	***48-shorttermVTCmo***	50-HighRiskcallCenter	52-receptiveCallCente	54-patientsBringWeb	56-sendPatientsToWh
	leetTelecor	**47-numberPatients**	**49-numberPatients**	**51-numberPatients**	53-callCenterHistory	55-patientsAskWebRe	57-webRes
YY							
WW							
PP							
EE							
FF							
					0.048591		

APP

	58-sendPatientsToLab	60-independantWebT	62-infrastructureAdeq	64-haveIdeaWithLC	66-partnerPatients	68-particip	69-Comme
	ourcesForF	59-requestAppointmer	**61-whatInitiave**	**63-needWhat**	**65-focusInitive**	67-corporate partners	
O							
B.					**0.03419**	**0.01805**	
C.							
D.							
L			**0.016806**				
M							
N.							
O.							
S.			**0.053337**				
T.			**0.016409**				
U.		**0.038431**	**0.005517**				
V.							
Z			#DIV/0!	0.162362	#DIV/0!	#DIV/0!	#DIV/0!		
AA							0.008177	
BB							
DD			#DIV/0!				
XX							

	58-sendPatientsToLat	60-independantWebT	62-infrastructureAdeq	64-haveIdeaWithLC	66-partnerPatients	68-particip	69-Comme
	ourcesFor	59-requestAppointmer	**61-whatInitiave**	**63-needWhat**	**65-focusInitive**	67-corporate partners	
YY			0.023868				
WW							
PP				0.014356	0.038239		
EE				0.014356	0.038239		
FF							

APP

	70-OurComments			
		Responder 1st v. 2nd		(+) **items**
Or				
B.				20
C.				9
D.				9
L				4
M				1
N.				7
O.				22
S.				18
T.				18
U.				16
V.				6
Z				6
AA				17
BB				10
DD				5
XX				1

	70-OurComments			
		Responder 1st v. 2nd		**(+) items**
YY				4
WW				
PP				9
EE				15
FF				6
				4