

Community informatics evaluation categories in healthcare technology projects

By

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Abstract

In Canada, healthcare delivery is a government mandate with vast geographical and population density challenges, an increasing demand, rising costs, and constrained budgets. The use of information and communication technologies (ICTs) is increasingly seen as a solution to these challenges, however funding is often attached to being able to demonstrate the value of the technology. And, there is little published literature on measuring the value of healthcare related ICTs. The need arises for an evaluation framework which encompasses all the elements of ICT design and implementation for success. Through a literature review five evaluation categories from the community informatics (CI) literature, were identified and then formulated into a questionnaire. Funding partners were asked to evaluate their various types of healthcare ICTs using these categories and were followed up with a telephone interview to discuss their assessments of the evaluation categories in determining the value of healthcare-related ICT projects. Four main themes emerged regarding the categories: First, value is individually defined and difficult to define on a global scale. Second, the categories may have an order that promotes a logical implementation plan and foster its use as a tool to ensure elements of good design and sustainability factors. Third, the categories and descriptor questions would benefit from being worded at a lower comprehension level and expanded to better reflect a questionnaire format. Fourth, all the categories were stated as valuable as they add an often missed qualitative piece of evaluation. These evaluation categories form a framework for evaluating the value of healthcare ICTs.

CHAPTER ONE

Introduction and Literature Review

Healthcare delivery in Canada is a government mandate with challenges of large geography and sparse population density to overcome in delivering equal access, timely, and comprehensive healthcare services. In addition, spiralling healthcare costs and increasing demands on the healthcare system, all add to the burden of delivering world class healthcare (Lluch, 2011). The solution to these obstacles is often tied to the promises of information and communications technologies which tout increased quality, efficiency, and safer more equitable care (Greenhalgh & Swinglehurst, 2011; Dal Molin, 2011). ICTs in healthcare, also called eHealth, encompass technologies which use the internet and related technologies to organize and deliver healthcare services. Technologies like the Electronic Medical Record (EMR), Telehealth, Telemedicine, Applications (Apps) and tablet technologies all fall into this category. The use of these technologies allow for improved delivery of and access to health care advice for remote regions, reduced costs in travel and improved communications between patients and providers (Catwell & Sheikh, 2009). To this end, “since 1995 the Canadian federal government has invested roughly \$900 million in its various connectivity programs” (MacDonald, Longford, & Clement, 2012, p. 393) with various degrees of success (MacDonald & Clement, 2012; Peddle, 2012).

Several issues arise to dull the shine of the promises heralded by the increasing use of ICTs in healthcare (Research Markets, 2012; Kable, 2007; Lluch, 2011). Changes in federal funding policy delegating some healthcare delivery to non-government agencies, budget cuts (MacDonald, Longford, & Clement, 2012), the failure of ICTs in meeting expectations (Greenhalgh & Swinglehurst, 2011) and the increasing pressures to meet government-mandated quantitative performance targets for continued funding (MacDonald, Longford, & Clement,

2012) all conspire to add to the challenges of effective and sustained ICT use in healthcare delivery. Despite these difficulties “the development of electronic clinical records, Telehealth and Telemedicine in addition to health applications for mobile devices, have revolutionized the way information is created, stored, accessed and used within healthcare” (Bath, Sen, Raptis, & Mettler, 2012, p. 11). Given that the use of ICTs is increasingly the new way we deliver healthcare (Ruxwana, Herselman, & Conradie, 2010), it becomes more important to systematically demonstrate the value of healthcare ICTs on their intended community (Shore, et al., 2014; Clement, Gurstein, Longford, & Shade, 2012; Picard, Ronchi, & Vickery, 2011).

However, there is surprisingly little published in literature on the evaluation of ICTs. In addition, some researchers suggest that the evaluation of technology in healthcare has been flawed (Halford, Obstfelder, & Lotherington, 2009). Picard et al. (2011) state that “the data on which to base decisions is largely missing” (p.149) and identify the urgency in developing evaluation tools which go beyond the traditional and integrate a multidisciplinary approach to ensure sustained and economically sound ICT projects in healthcare.

The purpose of this research is to examine five evaluation categories garnered from a community informatics (CI) literature review, and how they reflect the value of healthcare ICTs from the funder perspective. Thus, the research question guiding this inquiry is, ‘What are ICT funders’ assessments of the evaluation categories in determining the value of healthcare-related ICT projects?’

Literature Review

MacDonald et al., (2012) note that the federal government’s vision and policy for supporting ICTs in Canada has changed over the last decade. Despite an increasing reliance on government funding for ICT projects, cost-cutting policies in the 1990’s deflected responsibility for delivering these services to non-profit and community network organizations. This has

resulted in increasing pressures to meet performance targets. In conjunction with these changes, federal funding for ICT projects shifted away from core funding to short term funding agreements conditional on accountability and success. Within this new reality, the non-profit sector is increasingly expected to not only deliver the government mandate of service on less money, but also to deal with the “inconsistent and competing reporting and accountability requirements” (MacDonald, Longford, & Clement, 2012, p. 407) of multiple government and non-government funder partners. The outcome of the new federal funding model is that there is a strong experimental element to these government-funded ICT initiatives which depends more on success measures and meeting quantitative targets to continue funding and less on long term funding for sustained ICT healthcare service delivery. Thus the funding model and the service delivery expectation, that being sustained quality healthcare, are mismatched creating a greater pressure to show value and success for continued funding. “Failure to meet expected performance targets is viewed as an embarrassing sign of incompetence and it risks undermining the organization’s ability to win the next funding award” (MacDonald, et al., 2012, pp. 413; Clement, et al., 2012).

The pressure to show the value of ICTs in healthcare is not just a product of government policy but an increasing public expectation as greater numbers seek healthcare information and services online (Moll & Fritz, 2012). Hudson (2012) suggests that the broadband networks are increasingly important for delivery of healthcare and other social services. Internet growth and use in Canada is rising with on average seventy-three percent of Canadians online (Wong, 2012). In a survey on Canadian community networks and their use, eighty-three percent of respondents had searched for health-related information at some time with twenty-eight percent seeking that information at least once a week and eight percent seeking health related information daily (Moll & Fritz, 2012). They further suggest that respondents stated “new ICTs have very quickly

assumed a very important place in their lives and this is expected to increase as the internet becomes increasingly integrated into the daily information stream” (Moll & Fritz, 2012, p. 73). In 2007 a Canadian physician survey found that twelve percent of Canadian general and family practitioners used electronic medical records (EMRs) exclusively; by 2010 that number had increased to twenty-seven percent (Bassi, Lau, Hagens, Leaver, & Price, 2013). While the perceived benefits of these ICTs are driving adoption, Bassi et al. (2013) suggest this adoption does not necessarily translate to success; rather they suggest organizations need to evaluate and demonstrate the value these ICTs have on the healthcare system through evaluation tools.

Ramirez (2007) suggests that traditional methods of evaluation for ICT projects aim to demonstrate a direct link between investments and results, however this fails to demonstrate the ICT impact on the social wellbeing of a community. ICT project evaluations have been traditionally based in the experimental or clinical trials model of research focusing on perceived factors affecting the value of the ICT including the technical, cost-benefit analysis, user acceptance and patient outcomes (Greenhalgh & Swinglehurst, 2011; Picard, Ronchi, & Vickery, 2011). While these types of indicators may have some value, Greenhalgh & Swinglehurst (2011) suggest one cannot study a technology in isolation of its social context. This view is supported by Peiris, Usherwood, Weeramanthri, Cass, & Patel (2011) who suggest that a narrow focus on effectiveness limits the sociological inquiry into the value of ICTs and will not assess the influence on other dimensions of healthcare quality nor garner understating of the real world conditions which impact on the uptake of ICTs. Dal Molin (2011) views healthcare systems as ecosystems which require ICT strategies which match the adaptive and complex nature of healthcare. Ramirez, Aitkin, Kora, Richardson, and Lee, (2005) further suggest that the performance measurement axiom of “What you measure is what you get” implies that those projects where social and economic development results are measured are more likely to be

successful and sustained. Ripamonti, De Cindio, and Benassi (2005) evaluate online communities in terms of economic sustainability and suggest that the economic value is the community perceived benefits of ICTs, which can only be evidenced over time and is a factor of relationship building. This creates a gap between what is traditionally evaluated and what might need to be evaluated to demonstrate the value of ICTs on healthcare in a socio-technical context.

Where success equals value, elements of ICT design and execution plans need to be included in any evaluation (Participant interview, 2014). The design and implementation process of an ICT application affect its success and sustainability (O'Neil, 2002) and thus the measurement system that evaluates it. Since as much as seventy-five percent of ICT initiatives in corporate settings fail to deliver the expected results (MacDonald & Clement, 2012) a balance of top-down and bottom-up development of the ICT implementation needs to occur. Important ingredients to the success of ICT initiatives include community support and engagement; collaborative partnerships with government and non-profit sectors; effective implementation strategies and supportive infrastructures to enable continued iterative redesign strategies over time (Clement, et al., 2012; Chaves & Rollefstad, 2012; O'Donnell, et al., 2010). Ramirez (2010) also identifies the lived experience of those involved in implementing ICTs in healthcare, creates a 'moment of truth' which translates the human face of technology-mediated health services and reflects a dimension of program effectiveness. Thus the new face of evaluation may benefit from a multidimensional approach, having elements of design and implementation in a socio-technical context (Picard, et al., 2011). Since the advent of the Internet and Web 2.0/3.0 technologies, healthcare has increasingly added ICTs to the repertoire of strategies to deliver healthcare services. While numerous healthcare related ICTs have been published covering everything from electronic medical records (EMR), Telehealth and Telemedicine, healthcare applications (Apps) for mobile devices and healthcare information websites (Bath, et al., 2012),

most focus on project description or clinical outcome data and not on a comprehensive assessment (Picard, et al., 2011). The following is a review of published healthcare related ICTs literature and the methods of evaluation they present.

Evaluation Frameworks for Healthcare ICTs

A classic example of the traditional approach to project evaluation is outlined in a document originally designed for the Department of Canadian Heritage but adapted for healthcare activities. It uses a project management approach and a step by step guide to designing and measuring outcomes. While it is an easy read, well written, and comprehensive guide, it clearly focuses on a traditional evaluation approach of using varying levels of outcome measurements (Coyne & Cox, 2004).

Le Goff-Pronost & Picard, (2011) propose an evaluation framework which is based on five specific categories: strategy, technology, quality and usage, organization and economics. They began with a literature review on evaluation tests which resulted in a list of items relating to the value of projects in the ITC for health field. These were converted into a questionnaire and used in qualitative semi-structured interviews as applied to ICT projects. Their conclusion was that ICT evaluation frameworks need to be multidisciplinary and multidimensional to truly capture the value of healthcare ICTs.

A study protocol proposed by researchers in Malaysia plan to use both quantitative and qualitative methods as applied to two Telehealth case studies in government primary health clinics. They seek to explain the facilitative factors and the barriers to a successful implementation of Telehealth application. To do this they will be evaluating the scope of the services offered by Telehealth, evaluating the process of design and implementation and the role Telehealth plays in supporting primary healthcare services in Malasia. The resulting best

practices observed and lessons learned are proposed as the basis for an evaluation framework to understanding the value of Telehealth in Malaysian communities (Marzuki, Ismail, Mohsein, & Ehsan, 2012).

An Indian study was conducted in 2010 to understand the adoption rate of e-health solutions. They used a survey of resources, staff perceptions and organizational ICT supports as well as a mathematical model to identify significant factors for analysis on organizational preparedness for ICT deployment and adoption. They postulate this as a framework of evaluation to assist with ICT adoption (Chattopadhyay, 2010).

Telehealth and Telemedicine

Telemedicine uses communications and information technology to deliver health and health care services and information over large and small distances (Piccot, 1998, as cited in National First Nations Telehealth Research Project [NFNTRP], 2001). The potential for Telehealth has been explored in Canada for decades, but it has only been since the mid-90s that there has been significant Telehealth activity (NFNTRP, 2001). This activity prompted federal initiatives, and along with key drivers such as health care reform and increased ICT capacity, spawned the emergence of many provincial and territorial projects and networks (NFNTRP, 2001). Canada Health Infoway Incorporated (CHII) is the entry point for Telehealth services in Canada (Gideon, Nicholas, Rowlandson, & Woolner, 2009) and includes technologies that provide live video conferencing, store-and-forward solutions, and tele-monitoring solutions. In Canada, there were nearly 260,000 Telehealth events, which included 187,385 clinical events, 44,600 educational events, and 27, 538 administrative events. Ontario accounted for more than one-half of all Telehealth events (Canada Infoway, 2011).

Lavoie and Williams (2009) note that Telehealth has the potential to address several key health care barriers experienced by First Nations groups living in remote Canada. For First Nations communities, the impetus for Telemedicine is to improve their access to health services. Additionally there is a direct link between accessibility of health and wellness services and First Nations health status noting higher hospitalization rates where services are lacking (Gideon, et al., 2009). In examining the opportunity which exists for use of Telehealth as an ICT solution, Lavoie, and Williams (2009) identify some key issues to address in planning and implementing such a technology. Understanding optimal funding models and being able to measure indicators of success are identified as important factors for sustainability. In addition they suggest the need for a whole system approach to planning and assessing health gains both from the technology side and the community side in order to improve healthcare outcomes for First Nations. Gideon, et al. (2009) document that successful Telehealth projects in Canada are managed by First Nations health bodies and have established financial and operational commitments from surrounding health regions, health providers and engaged provincial and federal partnership agreements to ensure sustained program efforts. In addition they note the critical success factors for implementation of Telehealth ICTs as the following:

- (1) Engagement of community and federal/provincial/territorial governments,
- (2) Taking advantage of 'what we know',
- (3) Development process must be community friendly and in a language communities understand,
- (4) Most of the planning needs will be at the front end,
- (5) Recognize the varying degrees of engagement by communities,
- (6) Coordinating body needs to know the communities,
- (7) Recognize the role of a local champion to promote Telehealth at the community level,
- (8) Develop rationale for Telehealth from

different perspectives like education, health services and governance. (Gideon, et al., 2009, p.15).

A form of Telemedicine, mobile health monitoring has become more commonplace (Shintaro, Castaneda, Sanz, & Eysenbach, 2013). This study reviewed the perspective of clinicians in adopting the use of mobile monitoring. Using a questionnaire survey, researchers identified ICT perceived value, time-place flexibility and compatibility as the determinates of successful uptake of this Telemedicine ICT.

Lluch (2011) reminds us that despite the research invested in implementing tele-healthcare systems in England and Scotland, many remain in pilot stages where further understanding is needed to ensure efficient and effective implementations. She further suggests the need for a holistic approach to understanding the nuances of the impact of tele-healthcare systems. Given that Telehealth is one of the earliest ICTs in healthcare, it is not surprising that a standardized lexicon of measures would be forthcoming in this area first. Shore et al. (2014) outline a series of outcome measures for evaluating tele-mentalhealth using a consensus panel. A table of thirty-eight measures are suggested encompassing patient safety, satisfaction surveys, technology evaluation, usage, cost avoidance, economic markers and clinical indicators with accompanying definitions, suggested measures and considerations. Under the section defining value, they noted there was no consensus on measure definition. This study is encouraging in the thought process of evaluation for Telehealth and Telemedicine and begins to address the multidimensional focus necessary to be comprehensive. However, the list of measures is quite long and potentially less useful in application due to workload in gathering the data.

Electronic Medical Records (EMR)

Newman & Frank (2013) outline a project involving the Australian national e-health record system, citing that while the public funding approaches one billion dollars in the development and implementation of this e-health record system, the recently published score card evaluating the system provides only some statistics regarding elements of the technology like the number of e-health records. It falls short in evaluating the meaningful use of the system to date. A second EMR project described in Helmer's paper (2010 cited in Newman & Frank, 2013) began in 2009 and is used for follow up and vital sign monitoring. No mention of an evaluation measure is specified although the paper also outlines several other e-health projects where clinical indicators are the measure of success. In Australia, electronic health records have been trialed in remote areas and been beneficial in connecting a mobile community of aboriginal peoples. Moo and Fletcher (2007, as cited in Newman & Frank, 2013) outline the secure network which houses summary patient data and allows authorized user access. The measure of success was described as the percent of voluntary patient participation. In the United States, Sequist, et al. (2007) surveyed clinicians and health centers to assess attitudes towards the implementation of the federally funded EMR in rural and remote First Nation settings. Korean researchers published a study on a mobile EMR to realize point of care treatment. The measures of success was cited as usage statistics (Park, Lee, Shin, Kim, Han, Kwon & Kim, 2014).

Mobile Health Applications (mHealth)

Mobile health or mHealth is defined as the use of mobile communication technologies for healthcare purposes (Sheehan, Lee, Rodriguez, Tiase, & Schnall, 2012). Sheehan et al. (2012) studied four mobile devices in terms of their usability factors for gathering healthcare information in the adolescent population. The evaluation framework followed the FITT format (Fit between Individuals, Task and Technology) and evaluated three categories. Their

conclusions were that mobile technologies for healthcare should consider the human interface with technology.

The onslaught of medical Apps often overwhelms users. Peck (2011) outlines a website and app which offers sorted medical apps for different professions, technologies and subspecialties. A ninety day trial and review by a multidisciplinary group of practitioners prefaced the grouping and sorting of over seven-thousand medical apps and outlined the features, cost and benefits to allow for a more informed and useful choice. Many of the medical apps available or in use in healthcare, use clinical outcome measures to evaluate the technology. Franko (2013) suggests that many of the apps available to healthcare clinicians lack a consistent validation process to ensure risk mitigation in their use. Several options have been tried from individual clinician validation which is not sustainable given the volume of apps, federal regulation efforts and a medical app certification process which ensures security and content validation. None have been settled upon thus Franko (2013) recommends continued efforts of clinicians to peer review medical apps and applauds the efforts to date. Buijink, Visser, & Marshall, (2013) agree that the current medical apps lack as sound evidence base and recommends increased clinician involvement in their development and federal guidelines and regulations to increase their reliability. While Buijink et al. (2013) identify the need to evaluate the value of medical apps for quality and safety, no recommendations on how were identified. Kabachinski, (2011) focuses on the regulation efforts of the FDA to improve medical apps. Van Velsen, Beaujean, & van Gemert-Pijnen (2013) go further in identifying three strategies for improved medical apps: use open source information as a gateway for medical apps, standardize the content and personalize the apps to make them individually relevant. In a study by the IMS Institute for Healthcare Informatics, forty-thousand medical apps were reviewed with ninety percent showing a low functionality score. They identified a lack of clinician input as a factor in

the confusing landscape but made specific app improvement and research recommendations for evaluation including “producing outcome based evidence based on observational studies and randomized trials” (NA, 2014, p. 17). In Korea, physician researchers published on the lessons learned from developing apps. They reported on the usage statistics as a measure of success but recommend that with development of an app, a monitoring system is needed for evaluation (Park, et al., 2013). Nursing also cautions on the use of apps for healthcare, citing warnings to review the efficacy and impact on patient safety as concerns. This UK study did not however, identify specific ways of measuring those concerns but through a literature review identified several areas of caution for nursing use (Moore, Anderson, & Cox, 2012).

Use of cell phones in developing countries has proven to assist in many healthcare delivery uses (Prue, et al., 2013). Prue et al. (2013) document the use of cell phones to improve malaria detection in Bangladesh. The program asked cell phone users to call if family members were ill with suspected malarial symptoms. Healthcare workers then went out to the reported ill families to take blood tests for malaria. The measures of success looked at the clinical indicators of correctly diagnosed malaria cases with cell phone use. An Australian study looked at the implementation challenges if mobile electronic data services in healthcare. Using a multiple case study method, they reviewed the feedback from healthcare workers, clinicians and consumers to make implementation recommendations (Tsai & Kong, 2013). Indonesian researchers investigated the use of mobile phones with midwives looking at the effective use and value to the community. Through focus groups and interviews over three phases, they advance the value of ICTs framework for mobile technology (Chib, Lwin, Ang, Lin, & Santoso, 2008)

In 2011, iPad use in healthcare for apps and health education started to emerge in literature. The initial review of this technology focused on the technology features and usability as a means of deciding its value (Coombs, 2011). Italian researchers (Marceglia, Bonacina,

Zaccaria, Pagliari, & Pinciroli, 2012) identify the increased use of iPad or tablet technology citing sales data from 2010 as fifteen thousand units to a projected one hundred thirty-nine units in 2015. This descriptive study reviews the various uses and benefits of tablet technology and apps but does not suggest ways to enumerate their value. Tablet technology is evaluated on features and the benefits of its use in healthcare education are outlined in the nursing study done on tablet and e-reader technology (Brusco, 2011). A further nursing study on the benefits of tablet technology, compares two brands and assess them on their technological features and usability. This study did not look at their actual value beyond identifying the potential of the technology in improving workload and continuity of care (Duffy, 2012).

Online Healthcare Websites, Resources and Health Education

There is a growing body of literature regarding health support online (Loader & Keeble, 2004). One example is the Informing Neighborhood Health Information Outreach project, whose goal was to facilitate access to electronic health information resources at five community clinics serving the homeless and poor in Houston Texas. They placed internet-connected workstations at each clinic and did staff training such that this ICT became integrated into workflow for improving clinic staff knowledge in advising healthcare options for clients. The resources provided went beyond medical care to touch on housing, transportation, nutrition, childcare and eldercare and other needs identified in a disenfranchised urban population (Huber & Varman, 2006). This was a provider centric application of an ICT given it was accessed solely as a provider resource for community and not community accessible. Similarly, Pomerantz, Muhammad, Downey and Kind (2010) outline a health literacy project which incorporates the design of community telecenters in collaboration with library organizations and community healthcare workers. The intent of this coalition was to promote health literacy and overcome

inequities of access to healthcare information. It used a collaborative process of design with community agencies and representatives to develop partnerships for health literacy support. The project applied a technology solution to a provider identified need. The evaluation of the health literacy project consisted of a daily activity journal, pre and post test questionnaire and a mail back survey. While some qualitative evaluation elements are incorporated, value is determined by the evaluators and not the users.

Seeking the best form of communicating healthcare information to an Australian aboriginal community, Lushington, Cook, Steen, Wyld and Snowden (2009) used a PODcast ICT to respond to healthcare provider identified recurrent medical conditions in the aboriginal population. Interestingly their analysis of the socio-cultural community context of an oral communication tradition, helped design the ICT application. No evaluative component was specified in their paper. Jarvis-Sellinger, Ho, Novak Lauscher & Bell (2008) examined an e-health initiative (a tele-learning center) in the Tl'azt'en First Nations based on the use of ICTs to address socio-cultural, geographical, policy, and cost factors to health. They recognized that community culture played a part in the planning of this initiative and worked with the community members to understand the effects of the ICT application. Relationship building is central to developing a community and the ICT fostered these cross-generational intercommunity relationships for shared traditional and nontraditional learning on health issues. The project effected ongoing meaningful training opportunities which supported capacity for future skill development and allowed community driven leadership and governance for sustainability. They identified the collaborative multi-agency partnerships as a factor of success. The project evaluation by the community members and partners identified the process as successful and it has since stimulated other technology based projects. This description of an e-health ICT

application fits with many of the multidimensional elements of a successful implementation. A community satisfaction survey was the main evaluative component of a Kansas immunization technology project as applied before and after an ICT training session (Paschal, Oler-Manske, Kroupa, & Snethen, 2008), again supporting the need for understanding value from the community perspective.

In their literature review of ICTs in primary healthcare, Newman and Frank (2013) mention three papers which review the quality of health information online. They “review the methods and approaches used to evaluate effectiveness” (p.267) of healthcare information on websites supporting pregnant mothers and other healthcare subgroups.

Background to the Evaluation Categories

Chaves and Rollefstad (2012) proposed an evaluation framework consisting of five categories that were derived by combining 1) the principles of CI design, 2) a literature review and 3) an overarching Participatory Evaluation Theory (PET) as applied to the Keewaytinook Okimakanak Telehealth (KOTH) project (Kakapetum, 2005; Fiser, Clement, & Walmark, 2006). The hypothesis behind the development of the five evaluation categories is that many government and non-government funded healthcare ICT projects are not sustained due to the lack of a comprehensive evaluation framework which considers the social context, ICT design and implementation in defining project value (Chaves & Rollefstad, 2012).

While this literature review is not exhaustive, it does give a flavor of the increasing use of ICTS in healthcare as well as the developing call in the last two to three years, for a better way of evaluating the value of these technologies. That being said, attempts at creating a comprehensive and standardized framework for evaluation, remain scarce (Chib, Lwin, Ang, Lin, & Santoso, 2008). Defining project value needs to go beyond traditional evaluation to include a

multidimensional approach with elements of ICT design, partnerships, collaboration with community and structures for supporting sustainability (Picard, Ronchi, & Vickery, 2011). Cost-benefit analysis is often the approach to understanding the impact of an ICT (Greenhalgh & Swinglehurst, 2011) however medical errors or patient harm which is prevented, as well as the mental well being and social impact on a community are often intangible and difficult to measure (Dal Molin, 2011); in addition, ICTs on a large scale are often initially very costly to implement (MacDonald & Clement, 2012; Halford, Obstfelder, & Lotherington, 2009).

CHAPTER TWO

Methodology

Researcher Interest

My interest in this research evolved over the course of several career changes as a nurse. Early in my career in a critical care unit, the job of caring for patients was not only about knowing the intricacies of how the human body heals and current treatment for medical ailments, but also about the interface of us as humans with the life saving technology used to deliver that care. As the level of sophistication for medical treatments has increased, so too have the technologies we use to deliver that care. More complex technologies increase the potential for medical error in the technology interface, in communication between providers and in large system changes designed to improve care at the bedside. A great part of my job to ensure patient safety was to know all the ins and outs of how to use monitors, invasive control devices like external pacemakers and Intra Aortic Balloon Pumps, artificial heart machines and complex intravenous infusion devices. If I used these technologies incorrectly, harm to my patient could result. Technology is a big part of being a nurse and finding work-arounds to keeping a patient safe in a complex healthcare system where sophisticated technologies abound and where communication is sometimes misunderstood became the norm.

I became interested in quality improvement and trained to use techniques and technology to improve systems of care, prevent patient harm and deliver better healthcare service. Here again, the change management strategies often employed the use of technologies however, proving their value remained elusive. I progressed to a national job in quality improvement assisting healthcare providers to make system changes where I developed a special interest in evaluation. I was part of a national body tasked with measuring and evaluating system change. This fostered further education in evaluation. Evaluating the benefits to a system of care to prove

the value of a change was increasingly part of my job in the face of provinces committing healthcare dollars to quality improvement projects and technology. During my Masters in Communication and Technology, I partnered with another nurse for a Community Informatics paper looking at a case study example where using technology improved a First Nations community initially by improving access to medical care through Telehealth. The project evolved to include multiple ICTs which improved the social determinates of health in an array of First Nations communities. We developed the five evaluation categories from a literature search and made recommendations as to its potential for describing the value of ICTs in healthcare. This research study takes those recommendations and begins the first step to understanding their use and value in the real world.

Method

Using a descriptive qualitative method, this study aimed to understand ICT funders' assessments of the evaluation categories in determining the value of healthcare-related ICT projects. The descriptive qualitative method has a theoretical tenant of naturalistic inquiry (Mayan, 2009) at its roots which aims to uncover "straight and largely unadorned answers to questions of special relevance to practitioners and policy makers" (Sandelowski, 2000, p. 337). This method seeks to explore a wide range of responses to a research question traditionally, with the use of purposeful variation sampling and a 'who, what, where, when and why' approach to understanding the phenomenon. This study incorporated a convenience sampling technique focusing on the ICT funders in order to obtain participants. Through minimally to moderately structured open-ended interviews, this approach is characterized by simultaneous data collection and analysis whereby each influences the shape of the other to reflexively grow a greater

understanding of the studied phenomenon between the researcher and interviewee. The end result of this method is a descriptive summary with little abstraction or interpretive theory (Sandelowski, 2000).

Recruitment

The research was granted ethical approval from the University of Alberta Ethics Committee. The initial criteria specified that only direct government funders of the healthcare technologies would be eligible. Access to these government funders and getting their agreement to participate was limited possibly due to their workload and time constraints. Because of this, the enrolment criteria were expanded to include those healthcare-related ICT projects which had funders who were associated with, but not directly reportable to the government. While this expanded the scope of those eligible for participation, it did not negatively affect the research design given the government funding model changes and delegation to non-government agencies to achieve the healthcare delivery mandate.

After Ethics Approval had been granted, potential participants were identified through five sources: websites, the Community Informatics Canada list serve, the Community Informatics Researchers list serve, Dr. Michael Gurstein, Executive Director Centre for CI Research Development Training and Editor in Chief of Journal of Community Informatics, and his recommended CI healthcare colleagues, as well as from conference proceedings on technology projects in healthcare. Email invitations were issued to potential participants outlining the research and the request to apply the five evaluation categories to their project. If potential participants were interested in participating, they were asked to contact the researcher by phone or email. (See Appendix A for the email invitation). The purpose of the phone call or email was to ensure they met the inclusion criteria, discuss expectations for participation, and answer any questions they may have.

Once participants verbally, or via email, agreed to participate, participants were emailed an information letter and consent form (See Appendix B for consent form). Their consent was signed, PDF'd and emailed to myself. I signed the consent form; PDF'd it and saved it onto an encrypted USB stick. The final consent with both signatures was then returned to the participants via email for their records.

The participant flow outlining the dates and progression of the research process in this study is represented in Table 1 in Appendix C.

Participant characteristics

Each participant had to meet the following criteria to be included in the study: 1) Be a primary contact representing the government agency partners or not for profit agencies funded and/or endorsed by government, involved in partnering with the community in a technology related healthcare project; 2) Be involved in or have access to information about the planning, implementation and evaluation of said technology related healthcare project; and 3) Be at a mature stage in the project. See Appendix A for the full email invitation outlining the criteria.

Seven individual recorded telephone interviews were conducted. Each person interviewed had a primary role in the project implementation and some also had responsibility for evaluating the implementation and success of the technology as applied to the community. In two circumstances, two individuals attended the interview, thus a total of nine persons were involved in actual data collection.

The seven technology projects were varied and included the creation of Apps, the implementation of tablet technology for healthcare workers, EMR implementation, mobile technology for remote diagnosis, and the use of remote technology for medical education via distance.

The persons interviewed were project managers, directing the technology implementation, innovators or developers of the technology.

Data collection

Data collection was achieved using an intervention, applying the five evaluation categories to their healthcare ICT project, and a one hour audio-recorded follow-up phone interview with accompanying interview notes.

After receiving each participant's signed consent, the instructions to apply the five evaluation categories to the healthcare ICT project were sent via email. After applying these categories each participant then contacted me via email to schedule the one hour telephone interview. At the beginning of each interview, each participant was given a briefing which reminded them of the fact the conversation was to be recorded, the recording would be encrypted and saved on a encrypted USB drive, that their identity would be anonymous within the report and that they would be able to refuse to answer any question and withdraw from the study up to one week after the interview. See Appendix D for the briefing reminders covered at the beginning of each interview.

Wiles (2012) suggest that in social research, confidentiality is operationalised by strategies to ensure anonymity but cautions that this does not cover all the issues of confidentiality. Participant anonymity was ensured in three ways: The interview MP3 recordings were saved on an encrypted USB drive; the interview notes with identifiers were scanned and saved to the encrypted USB drive with the paper copies shredded; data analysis and data included in the report were all de-identified. Confidentiality was additionally ensured through the informed consent process approved by the Ethics Committee at the University of Alberta, refraining from mentioning other participant particulars or projects during serial data collection

and removing detailed descriptions of technology projects, roles and geographic areas in the report.

A general interview guide approach was chosen as the type of interview format to gain insight into how these evaluation categories ring true in application (Turner, 2010). In choosing this type of qualitative interview, I felt it fit best with the type of information I was trying to collect given the structured approach to the intervention and the evaluation categories. This format still allowed the flexibility to follow the participants lead where they felt the information shared was important (See Appendix D for the general interview questions).

Participants were asked to describe how they used the evaluation categories in understanding the value of their technology. The general interview questions were: 1) Describe your health-care related ICT project and your role. 2) Describe your experience in applying the five evaluation categories to your healthcare ICT project. 3) What aspects of these evaluation categories most resonated with you in describing the value of your healthcare ICT project? 4) What other descriptors, aspects or categories might you include to describe the value of your healthcare ICT project? (See Appendix D for an outline of the interview guide). The researcher followed the threads of the discussion which the general questions stimulated, thus allowing a depth of information unique to each successive interview. Kvale (1996) describes the qualitative research interview as a conversation where “the interviewer is open to new and unexpected phenomena” and outlines several types of interview questions to elicit deeper responses in understanding the interviewees experience. I used several of these types of questions within the interviews and kept the types of interview questions with examples from his book near to refer to during the interview process.

During each interview, interview notes were taken recording key words, quotations, thoughts and perceptions of the interviewee. The interview notes were each between six to nine

pages long. Within the interview itself the researcher used participant checks (Mayan, 2009, p.111; Kvale, 1996, p.145) to clarify or correct researcher assumptions and interviewee statements.

The audio-recorded interviews were between sixty and seventy-five minutes and were not transcribed, rather preserved in MP3 format and reviewed concurrent to data analysis. Data collection ceased when saturation was reached.

Mayan (2009, as cited in Morse, 2000) suggests that sample size in qualitative research is a matter of reaching saturation; that place where no new data is observed with subsequent interviews. She further suggests saturation is more quickly obtained where the quality of the data is good, the scope of the study is narrow, the nature of the topic is easily grasped, and the participants are well versed with the subject and where those interviewed speak about their personal experience.

The following outlines how this study conformed to published observations on achieving saturation quickly when speaking of sample size.

Good data quality. Each one hour telephone interview was conducted and audio-recorded in MP3 format to ensure data quality and integrity. This allowed repeated replay during data analysis to ensure the context and intent of participant comments were maintained. Detailed interview notes were hand written at the time of the interview, again, supporting the quality of the data assisting in reaching an early saturation.

Narrow study scope. The participants were given an instruction sheet (See Appendix E for the instructions for applying the five evaluation categories) outlining the requested intervention and the single research question, thus the scope of this study was specific and narrow. By giving clear instruction and having the participants focus on a single research question, ensured the information gathered from each participant was focused.

Knowledgeable participants. Each participant was primarily involved in the technology project and in a role which required in depth knowledge of its inception, implementation and evaluation. Participants were therefore knowledgeable about their project and the specifics which would help answer the research question.

Participant speaks to their experience. Each participant was asked to use the evaluation categories to evaluate their healthcare-related ICT project and then interviewed on their experience. Reporting on their experience of using the evaluation categories, gave a measure of confidence that the data in the interview was real-world knowledge.

The saturation point in this study was reached with a limited number of interviews in part due to the study design which conformed to published literature on reaching saturation early (Mayan, 2009 as cited in Morse, 2011). By the seventh interview several themes were confirmed and little new data was emerging.

Evaluation Categories. The application of the evaluation categories was used to answer the research question, “What are ICT funders’ assessments of the evaluation categories in determining the value of healthcare-related ICT projects?” The five evaluation categories have been reworded into questions and expanded in description to facilitate their application. (See Appendix E for the full participant instructions).

Category 1. What value does the community assign to the ICTs and their implementation? Do not focus solely on cost-savings or efficiencies as measures. While they are important to consider, healthcare ICT projects must also evaluate the impact of the project with a community’s perceived ability to participate and enable ICTs to support their self-identified health care needs (Gurstein, 2007). Within this category, questions which may help to outline the value of the ICTs from the community perspective are:

- What did the community identify as their priority needs?;
- How well does the community say the ICTs met those identified needs?;

- What changes does the community see as a result of the ICTs both positive and negative?;
- What do the community members say about their ability to use and adapt the ICTs in the future?.

Category 2. What efforts were used to involve the community in the design, implementation and evaluation of the ICTs and how effective were they to illicit community engagement? Evaluation should include qualitative data which illustrates the extent of community involvement in the implementation and program design of the ICT application. Designing an ICT intervention or program involving one or perhaps two influential persons in a community does not lend to a sense of community ownership nor a sustainable long term solution. Rather, methods to involve a good cross section of the community population throughout the process, increases the likelihood of increased use of the ICTs as well as fostering a more customized implementation for better community fit (Crilly, Keefe, & Volpe, 2011). This potentiates the sustainability of the project (Rideout & Reddick, 2005). Consider asking questions like:

- Who from the community was involved in each phase of the project?;
- How much of their input was incorporated into the project?;
- Did the engagement methods reach every level of the community, giving all the opportunity to have input into the project phases?;
- What do the community members say about their involvement in each phase of the project?;
- Were there iterative redesign strategies based on community input?.

Category 3. How effective was the ICT implementation in its ability to build on existing structure and allow future community-directed adaptations? Effectiveness of the implementation and design of health care ICT can be measured by how it has leveraged existing ICT infrastructure, or is designed to scale to expand future capacity. Rideout and Reddick (2005) suggest that one reason many ICT applications fail to be sustained is that their implementation strategies don't allow for flexibility. In other words, the initial need for the technology changed but no strategies of adaptation were initialized as the social context and local needs changed.

Strategies like partial redeployment or shifting of resources could address potential future adaptations of the ICT application. Salvador and Sherry (2004) give an example where local conditions in a remote community often have long lasting power outages requiring the use of a generator. Knowing the capacity of that generator to supply electricity for the added use of the ICT would be important to maintaining an effective service. Should the ICT application be expanded to meet other needs in the future, what power needs might be anticipated? Thus building on the existing structures and considering what would be needed in the future to support the ICT, is essential. Questions relating to existing structures may include:

- What broadband speed currently exists?;
- What service provider coverage exists and how well is it accessed?;
- Do the local community members know how to use any existing hardware including knowing how to repair it?;
- How do community members gain formalized access to experts outside their community should their needs change in how to expand the use of the ICT application?.

Category 4. *To what degree do multi-stakeholder partnerships exist to ensure sustainability?* Evaluation should consider the extent the health care ICT navigates and creates supportive partnerships and collaborations with varying levels of stakeholders to ensure sustainability. Given most healthcare ICT projects are efforts to operationalise government mandates, the funding models of which are connected to election cycles with broad goals and short timeframes; it stands to reason that longevity in funding arrangements is unlikely. Thus to build sustainability in ICT projects and community investments one solution is to engage multiple stakeholders whose collaborative support in both expertise and funding would secure longevity in the ICT application and ultimately sustained potential for the goal of community improvement (Rideout & Reddick, 2005). In evaluating this category some questions might include:

- Who are the private and corporate stakeholder groups which have a common goal of the project and an ability to contribute in expertise and or funding?;
- What relationship do these stakeholders have in the design and implementation of the ICT application?;
- Were they contacted and engaged?;
- If not, how might these groups be leveraged at this point?.

Category 5. How well were the patterns of social capital and socio-cultural context within the community leveraged in the design and implementation of the ICT? Patterns of social capital and socio-cultural factors which exist in a community affect the uptake and sustaining factors in ICT adaptation and thus should be considered in ICT design and implementation. Woolcock (2001, as cited in Pigg & Crank, 2004, p. 60) defines social capital as “... norms and networks that facilitate collective action”. Since communities are a series of social networks, they have inherent assets which provide connecting structures to build upon. Technology augments and extends those connections which already exist. By mobilizing existing social network connections within the community and accessing those skills and assets in the implementation of the ICT applications, the success and sustainability of the project are greatly enhanced (Williams & Durrance, 2008). If for example the ICT application of Telehealth were directed to improving newborn infant care, understanding who the informal maternal leaders are within the community and who and how they communicate with the other mothers, would be important information to plan the design, access, audience and implementation of the technology. To evaluate existing social networks and structures within the community the following questions may be helpful:

- Who are the informal leaders within the community?;
- How do they influence and communicate with other community members?;
- What formal structures currently exist to disseminate information and connect community members?;
- What barriers exist which prevent community communication and connection?;
- How well does the ICT overcome those network disconnects?.

Data analysis

Srivastava and Hopwood (2009, p. 76) stated that “the role of iteration in qualitative data analysis, not as a mechanical task but as a reflexive process, is key to sparking insight and developing meaning.” They propose the use of 3 questions to prompt this reflexive process: 1) What are the data telling me? 2) What is it I want to know? (According to the research questions and hypotheses) and 3) What is the relationship between what the data are telling me and what I want to know?

Each of the seven audio-recorded interviews was analyzed according to Srivastava and Hopwood (2009) within the same day up to two days after the interview reviewing both the recordings and the interview notes to ensure accuracy and the proper context of the quotations. The information for each interview was compiled into an electronic document using direct quotations with bullet point notations to clarify context or meaning after reviewing that portion of the audio-recording (See Appendix F for the individual interview analysis format). I also recorded my thoughts on the quality of the interview and noted any concerns or observations I felt may be relevant. The whole reflexive process prompted different questions for the next interview to further understand a theme or nuance in the data.

Within the same format, all seven interviews were color coded to reflect the order of the interviews and then collated and grouped with similar thoughts under each category for each reflexive question (NA, 2007, May). Interestingly all participants chose to convey the importance of the evaluation categories by ranking them. To varying degrees this was reflected in the collated themes. Figure 1 is a visual illustration of the data analysis method on a micro to macro level.

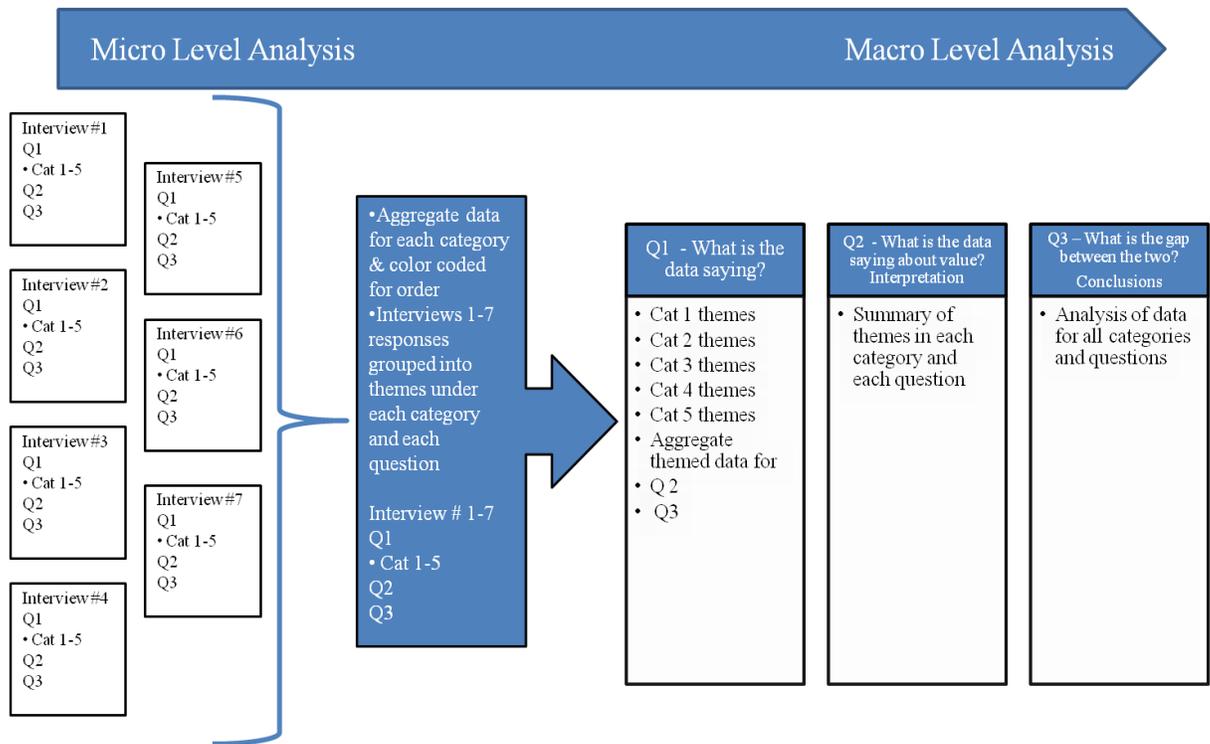


Figure 1. Illustration of the Data Analysis Process (Reflexive questions from Srivastava & Hopwood, 2009)

The collated and themed data was then inserted into a table under column one reflecting question 1 -What is the data saying? The themes were then summarized into the second column answering question 2 – What is the data saying about the research question - What are ICT funders’ assessments of the evaluation categories in determining the value of healthcare-related ICT projects? Finally, the third column reflected question 3 – What is the gap? Conclusions were drawn about the themes that emerged and the value of each category as well as the overall usefulness of the categories to express value in healthcare-related ICTs. See Appendix G for Table 2 Macro Level Data Analysis.

Rigour

Mayan (2009) suggests that the trustworthiness and rigour of qualitative research is rooted in verification. She identifies five basic strategies to ensuring “the findings are worth

paying attention to” (p.100): *Researcher responsiveness* – the ability of the researcher to respond with flexibility and creativity to the evolving data; *Methodological coherence* – the congruence of the chosen method, sampling and analysis technique relative to the research question; *Sampling* – an adequate sample to match the method and create data saturation; *Concurrent data collection and analysis* – which allows the researcher to uncover and follow emerging unique themes; and *Thinking theoretically* – looking at the data at both a macro and micro level (p.p.108-111). Graneheim and Lundman (2004) suggest that a further measure of trustworthiness in qualitative research lies in choosing participants with a variety of experiences thus increasing the likelihood of gathering a rich expanse of information to look at the research question from a variety of aspects. In regards to researcher responsiveness, each interview was reviewed to preserve accurate quotations and context during data analysis which preceded the next interview and generated iterative questions in future interviews. Nuances in the interview were followed up in subsequent interviews.

A convenience sample was used to obtain participants, targeting funders of the technology. While this is not in keeping with the method of purposeful sampling, it was necessary to obtain participants with the expanded inclusion criteria. Concurrent data collection and analysis were done iteratively using Srivastava and Hopwood’s (2009) three reflexive questions. Upon analysis, questions to pose in the next interview were identified to further explore themes. Within the individual interview data analysis, all responses were collated under each evaluation category and grouped reflecting similar thoughts. Srivastava and Hopwood’s (2009) three reflexive questions were then applied to the aggregate data to come up with the concluding statements. In this way the data was reviewed on both a micro level and a macro level leading to well supported conclusions. The research participants within this study varied in

role, profession, healthcare-related ICT and in geography, allowing a wide variety of perspectives in looking at the research question.

Chapter 3

Results

The results of this study are presented in detail for each of the five evaluation categories as well as in answer to the research question using Srivastava and Hopwood's (2009) three reflexive questions. Below is the summary of results for each evaluation category and for each of the reflexive questions. Participants themselves volunteered the category ranking without prompting from the researcher; I included this in the results given it reflects how participants viewed the evaluation categories in importance to defining value. The descriptor questions were included to facilitate understanding of the categories. Interestingly, these categories could have been applied by developing different measures within each or by using the descriptor questions as a partial questionnaire. All participants chose to apply the categories using the descriptor questions as a partial questionnaire. How participants applied the categories, though not specified in the instructions, was consistent in that all used the clarifying questions within each category as a questionnaire to evaluate their projects. All participants evaluated their projects retrospectively using their knowledge of the projects, their evaluation data from previous and their expert opinions in anticipating the answers to some of the questions. This created a level of confidence that the instruction sheet while broadly defined was clearly consistently interpreted.

The definition of 'community' was left to each participant's individual interpretation and was very project specific. The main focus of the research question was not on the type of technology or community these categories evaluated, rather on a broader theme of understanding what were ICT funders' assessments of the evaluation categories in determining the value of

healthcare-related ICT projects. Data analysis was consistent across community definitions and projects.

Q1. What is the data saying?

Category 1. What value does the community assign to the ICTs and their implementation? Participants' comments about this category revealed very clearly that value is defined individually and cannot be defined on a global scale. They identified that value to the community is foundational and is underlying all the other categories. In addition, the qualitative nature of the categories is helpful to understanding the outcomes at the community level both positive and negative. One participant suggested that the technology itself affects or influences how a community define value. "People are influenced/biased towards the hype of new and better versus what features are important or valuable to their goals."

Participants outlined that understanding the needs of the community, while time consuming, are important to defining the impact of the technology on the community. It affects the design and implementation of the technology as well as promotes buy-in and fosters sustainability.

Funders can fairly readily outline the benefits of their technology to the community in a global sense which suggests there may be a disconnection between what the community perceives as a need and what the funder perceives. "It showed there is disconnect between management expectations and what nurses on the ground need."

There is value to directly asking the positive and negative impact of the technology from the community perspective where this assisted specifically in the design and implementation of the technology.

Finally, the ranking of the importance of this category seems to be variable with several ranking it as first or third in importance; however there may be a stepped order to the categories

which assists in implementation. One of the participants summarized it this way, “you have to find out why and what the community wants, their barriers and what they currently have, in order to implement.”

Category 2. What efforts were used to involve the community in the design, implementation and evaluation of the ICTs and how effective were they to illicit community engagement? This category had a more varied summary of ideas. The most robust being that involving all levels of the community in design and implementation was important as it affected the level of adoption and ownership of the technology as well as influencing the usefulness of the technology and barriers to its use.

Another prevalent idea was that the unique characteristics and age demographics of the community may play a role in influencing the design of the technology to fit the community need thus increasing the uptake of the technology promoting a level of sustainability.

Several participants suggested that an iterative redesign strategy for implementation better meets community needs. While some felt that having a pre-evaluation discussion regarding community involvement in design may be important.

Community input alone doesn't necessarily lead to sustainability; rather a good implementation plan and a community led product are both necessary. Having influential community members lend support, validates the technology and promotes further participation.

From a funder perspective, the value of community member's perception of their involvement may be seen as a nice surprise or part of a necessary “to do” for implementation.

This category ranked second highest in value in an evaluation framework as it contributed the most to a useful product and an iterative implementation plan which influences a greater level of sustainability. There were some comments that Categories #1 and #2 had some overlap and went “hand in hand”.

Category 3. How effective was the ICT implementation in its ability to build on existing structure and allow future community-directed adaptations? All participants identified it was important to consider the existing infrastructure which influences implementation strategies, identifies the potential negative impacts of an implementation and affects the final outcome to the community in terms of usability. This category identifies the potential negative impacts of an implementation and affects the final outcome to the community in terms of usability of the technology. As one participant suggested, “this category introduces more things to consider for a good implementation”; another added that this category proved to be more important and greater in scope than anticipated.

It was suggested to clarify this category by including an environmental scan to understand the existing structures in relation to the needs of the community.

Looking at existing structures assisted in designing for future adaptations to meet future community needs and highlighted barriers and additional support structures necessary for sustainability.

The government decision system within healthcare and the urban/rural and remote healthcare sectors house constraining factors which impede or slow implementation. These constraints were not readily prompted or identified in this evaluation category.

Keeping the technology useful in a quickly evolving market is necessary for sustainability and was noted to be important.

This category was ranked as a tie for first or third in importance to an evaluation plan as it encompasses community needs, barriers and existing infrastructure for implementation. Once again the participants ranking of the evaluation categories highlighted some potential overlap.

Category 4. To what degree do multi-stakeholder partnerships exist to ensure sustainability? This category was stated as less applicable to some and that it may be project specific in its importance although some level of IT support was seen as crucial for sustainability. Interestingly, those respondents had the same level of government involvement with the same technology implemented in different provinces.

The majority of participants felt that creating partnerships is crucial to understanding community needs, obtaining permissions for forward movement of any implementation and may create a motivating competition between departments which helps spread the technology. Those with higher level of government involvement with the project saw this category as more facilitative than contributing to a positive outcome.

Partnering was seen as a strong word, meaning involved in the business of implementation; alternative wording of relationship and community understanding and influencers may be more descriptive of this category. Additionally, it was noted that the younger generation may become of greater importance in creating relationships as they are likely to increase as future influencers to technology in healthcare.

Maintaining relationships by showing value promotes an iterative supporting structure and sustaining factors which look to future expanding use of the technology. In other words, “What else can we do with it (the technology)?” was a question prompted by identifying the value of the initial technology to the partners.

The standards of healthcare don’t always lend to easy partnerships online and may create constraints in technology uptake or promotion. This was seen as specific to one ICT project which was very clinically based.

Fewer felt that partnerships ensure the expertise to make the project useable and successful. While another felt “stakeholders didn’t sustain or influence uptake, it was the

healthcare workers themselves and their individual engagement that made it happen.” This category may have a greater variance in importance depending on the type of technology and the community involved; was ranked fourth or fifth out of five in importance.

Category 5. How well were the patterns of social capital and socio-cultural context within the community leveraged in the design and implementation of the ICT? Some participants related this category to networks and committees and felt it was less important and not necessarily applicable. These were similar large system implementations of projects with a large government oversight. This Category may have some project specific variance as to its importance if social networks, committees and structures already exist.

Some thought this category had implications for influencing the spread and sustainability of the outcomes of the technology; “it goes beyond the one targeted person like a ripple effect”; People really are the best and most important asset; because of this people who know our technology is spreading”.

Knowing the socio-cultural context of the community was seen as important for successful implementation and “guarantees you will have support to execute your plan.”

This category may overlap with Category #2 in knowing the needs of the community. There is a perceived age context – the younger generation is more online.

Participants identified variances in ranking this category from second, third, fourth or fifth which may reflect a project specific component or an individual bias on the value of the community’s norms as it affects the technology.

Q2. What is the data saying about the research question? -What are ICT funders' assessments of the evaluation categories in determining the value of healthcare-related ICT projects?'

The qualitative nature of the Categories emphasized a community perspective on value as one part of a comprehensive evaluation. As one participant put it, "it is the reason the quantitative numbers are as they are". The technology itself influences how the community defines value; value is individually defined. Overall, value is difficult to define on a global scale and certainly not with one question. These categories helped illuminate an additional facet of value for a successful design, implementation and evaluation but failed to elicit the individual value as they are too high level.

There may be a rank order to the categories which would outline a natural project implementation plan. This was seen in several participant responses and their reasons for ranking each category's importance. "In these questions (speaking of the evaluation categories) it covers my plan and justifies my path for designing and implementing this technology." Another participant put it this way, "I ranked #1 & #3 (categories) as tied for first as you have to find out why and what the community wants, their barriers and what they currently have, in order to implement. Category #2 was ranked second in importance as you have to get everyone involved to keep it going and make and adapt changes. Category #5 was next as it is key to know what people are saying and how it is going. Category #4 was ranked last as it didn't affect the outcome, it was individual user uptake that kept sustainability." In addition, participants saw some overlap in the categories, seeing similarities in categories #1 and #3 as well as categories #1 and #2 as having overlap. Table 3 outlines the ranking of the evaluation categories based on participant perception of importance.

Table 3

Participant Ranking of Evaluation Categories

Participant	Ranking in Importance				
	First	Second	Third	Fourth	Fifth
Participant 1	Category 3	Category 2	Category 1	Category 4	Category 5
Participant 2	Category 1	Category 2	Category 4	Category 3	Category 5
Participant 3	Category 4	Category 3	Category 2	Category 1	Category 5
Participant 4	Category 3	Category 2	Category 4	Category 1	Category 5
Participant 5	Category 2	Category 5	Category 3	Category 4	Category 1
Participant 6	Category 1 & Category 3	Category 2		Category 5	Category 4
Participant 7	Category 1	Category 2	Category 3	Category 4	Category 5

Note. Participants ordered according to the date order of their interview

The overall evaluation categories resonate with real world experience and highlight some gaps in the understanding between community needs and funder value. However, the categories are unbalanced and more geared to understanding the positives of an ICT project. As well, the framework lacks the business questions which assist in an implementation and execution plan. Greater clarity in wording at a more simplified level would assist in understanding the categories. The questions were a good format to outline and focus the attention to what matters.

Q3. What is the relationship between what the data are telling me and what I want to know in my research question?

The order of the categories which influence community involvement for meaningful design, effective implementation and sustaining factors might suggest that if more detailed questions and descriptors were added, the evaluation framework itself may become a tool for sustainability factors to consider for technology implementation. This framework may also have some value as a pre-discussion tool for creating community awareness and understanding the baseline knowledge and experience of the technology.

Several suggestions for improvement would assist in further refining these categories as an evaluation framework defining value. First, the evaluation categories didn't encompass the influence of the social capital of the technology itself; this may need to be included in the questions or descriptors of Category #5. By adding a more explicit understanding of the age demographics of the community and how it might influence the uptake of the technology, it would improve the usefulness of the elements of design and implementation outlined within the evaluation categories. Targeting the wording of the general category titles to a lower level of understanding would assist in the value and comprehension for applying the evaluation categories in an evaluation.

The question and descriptor format were well liked and could be improved upon by including questions regarding the execution plan of an ICT project. While "the questions are pointed and designed to seek outcomes," "the descriptors and categories might have different interpretations based on evaluator's background". Creating greater clarity in the categories regarding the positive and negatives and specifically identifying strategies for overcoming system barriers, would greatly improve these evaluation categories and facilitate its use as a tool for design, implementation and sustainability of healthcare-related ICT projects.

Overall, three of the seven participants (audio-recorded interviews) identified they would use these evaluation categories in future ICT implementations as part of a robust qualitative evaluation plan citing that the categories have an order that assists with the design, implementation and sustainability of a technology project. One participant planned to use these categories and specifically the descriptor questions as part of a dialogue with community members pre-project and ongoing as a tool to assist with meeting community needs for future ICT implementations.

Chapter 4

Discussion and Conclusion

Discussion

Four overarching themes became evident in answer to the research question of ‘what are ICT funders’ assessments of the evaluation categories in determining the value of healthcare-related ICT projects?’

First, value is individually defined. As one participant put it, “value is different for everybody” and as such, value is difficult to define on a global scale. These categories helped illuminate an additional facet of value for a successful design, implementation and evaluation but failed to illicit the individual value as they are too high level. That being said, the sum of the evaluation categories do resonate with real world experience and highlight some gaps in the understanding between community needs and funder value.

Second, the evaluation categories may have an order that promotes a logical implementation plan and foster its use as a tool to ensure elements of good design and sustainability factors. Several participants commented on the overlap of some categories which would support the notion of a progressive order to the evaluation categories. With greater clarity on wording, more specific attention to balancing the positive and negative descriptor questions including those involving structures, resources and system constraints, these evaluation categories may assist in future healthcare-related ICT implementation plans.

Third, the evaluation categories and descriptor questions would benefit from being worded at a lower comprehension level and expanded to better reflect a questionnaire format. This would increase the understanding and usefulness in applying the evaluation categories as an evaluative tool. While the evaluation categories hinted at evaluating the positive and negative

impacts of the technology, further clarity and more explicit questions and descriptors would promote a more balanced approach to evaluation within this framework.

Fourth and lastly, all the evaluation categories were stated as valuable in varying rank as they add a qualitative piece of evaluation which forms the foundation of an evaluative plan.

“The qualitative piece is always lacking within an evaluation from the funders perspective and without it you don’t get the full story of the impact and unintended outcomes at the community level. Numbers are important but you really need the qualitative information – it makes or breaks a project. These categories reflect the reason the numbers in quantitative measures are as they are” (Participant interview quote).

These data also confirmed the implicit hypothesis in the developmental literature (Chaves & Rollefstad, 2012) supporting the evaluation categories. That being that the evaluation categories have elements of design, implementation and sustainability factors which foster healthcare-related ICT project success. Interestingly, this study design was structured very similarly to the Le Goff-Pronost & Picard (2011) evaluation framework study (albeit much more simply) basing a questionnaire type format in the value criteria developed from a literature review. However, it differed in that Le Goff-Pronost & Picard (2011) focused their framework on successful implementation and project goals to describing the ICT value, using a scaled questionnaire.

Limitations

Data collection and recruitment for this study occurred simultaneously over a period of thirteen months. In dealing with issues of trustworthiness, Graneheim and Lundman (2004) suggest that there is a risk of inconsistent data collection with extensive data collection or when collection extends over a long period of time. Given the extended timeframe of this research

study the notion of inconsistent data collection may have some validity. However within the iterative data analysis process the opportunity to revise interview questions and develop deeper understandings through the reflexive questions, may have mitigated this risk.

The final interview audio-recording failed resulting in the loss of about 10 minutes of interview time. The detailed interview notes assisted in filling in that missed time on the audio-recording however some nuances of the data for this seventh interview may have been lost. To compensate, the data analysis for that interview was completed within the hour of the interview being done so much of the verbal exchange was fresh in my memory.

With some participants, the generalities of the evaluation categories were discussed in answer to their questions on the initial contact phone call. This may have introduced some bias having prior knowledge of the categories and may have positively influenced their consent to participate. Having refused to share the detailed instructions and evaluation categories to another potential participant did result in their being unwilling to participate.

Conclusion

As seen in the literature review, the use of ICTs in healthcare is extensive, varied in type and increasing in use. Given that ICTs are shaping the healthcare delivery system as we know it, the need for improved understanding of the value these ICTs affect, is paramount to healthcare delivery. This study contributes to that knowledge in recommending five evaluation categories which assist in defining value and include elements of design, implementation and sustainability factors which have been identified as contributors to success. By including a variety of ICTs within this study, it gives a wide lens on the potential of these categories in assisting with healthcare ICT evaluation however the transferability of this study is limited due to small sample size and study design to answer the value question versus to what different technologies these categories might best apply.

As part of the knowledge dissemination strategy, a copy of the final research paper outlining the research results was offered to each participant as a means to convey a shared learning experience. All participants did request a copy of the final paper and were eager to use the results in their future ICT project implementations. In addition, the PDF copy of the final research paper was posted to both the Community Informatics Canada list serve and the Community Informatics Researchers list serve which represent CI workers and organizations worldwide.

Next Steps

Several additional steps could potentially improve and further understand the value of these five evaluation categories as a means to providing an evaluation framework for healthcare ICTs. As suggested within the context of the study findings, refining the wording of the categories to a more common language level would be a first step. Creating a more formalized questionnaire format which would include a greater specificity of questions to prompt evaluation of the impact both positive and negative of the ICTs would balance the evaluative framework. Using these findings to order the evaluation categories in a progression from pre-evaluation to design to implementation, this format could possibly be retested as a tool for successful ICT implementation and evaluation.

The question of what types of ICTs these categories best suit remains unanswered. Designing a study with that research question in mind, could further inform the value of these evaluation categories. Further study to understand the fit the categories might have in relation to different types of technologies, different healthcare sectors, different ICT project scopes and the differences between direct government funders and associated government funders is needed.

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Appendix A

Invitation to participate in Community Informatics research

What we are trying to accomplish?: To explore how well five evaluation categories derived from a Community Informatics (CI) literature review, reflect and capture the value of technology related healthcare projects (the use of technology to improve the determinants of health for a community) from the perspective of the project partners.

The Research Question (RQ): What are ICT funders' assessments of the evaluation categories in determining the value of healthcare-related ICT projects?

Why this is important?: We are increasingly using technology to facilitate improved healthcare delivery in remote and disadvantaged communities (Ramirez, 2008). However, measuring success and effective design of CI projects has been sparsely documented in literature (O'Neil, 2002). Healthcare CI projects are designed to empower disadvantaged communities whose welfare is often the mandate of government agencies. That being the case, government funding for technological solutions to garner efficient, effective and easy-to-access healthcare often default to an overlaid technology with no clear way of measuring effectiveness. Government goals are often not well aligned with community needs, thus it is difficult to evaluate their effectiveness and consequently, with little measure of success evident, these projects become easy targets for funding cuts (Rideout & Reddick, 2005). Many community improvement Information & Communication Technologies (ICTs), where significant resources have been invested, may be in jeopardy for lack of a comprehensive evaluation.

What we are asking you to do?: This research data are being collected as part of a graduate thesis. Participants will be asked to use each of the evaluation categories to evaluate their project. After this, I will contact you for a telephone interview and ask you questions about your experience applying the evaluation categories. The interview will take approximately one hour and is based on four open-ended questions. The interviews will be recorded but not transcribed. You are able to opt out or refuse to answer any question at any time during the interview and you may withdraw from the study up to one week following our telephone interview. You will need to sign an informed consent which will be emailed to you in order to participate in this research.

How will this benefit you?: The results of the research will be shared with all participants in the form of a final research report with all data reported as aggregate to maintain confidentiality. Understanding how well this evaluation framework fits in "the real world" offers opportunity for the participants to use this research to further document their project success and justify continued or future funding. In addition, we will learn what elements are important to participants to describe the value of the projects they fund. In essence we anticipate a deeper understanding of the meaningful and important categories to include within a CI evaluation framework for projects which may assist in improved ICT healthcare project design.

Do I and my project qualify to participate?: Research participants must: 1) Be a primary contact representing the government agency partners or not for profit agencies funded and or endorsed by government, involved in partnering with the community in a technology related

healthcare project; 2) Be involved in or have access to information about the planning, implementation and evaluation of said technology related healthcare project; 3) Be at a mature stage in the project.

Appendix B

Consent Form

You are being asked to take part in a research study to explore how well five community informatics (CI) evaluation categories reflect and capture the value of technology related healthcare projects from the perspective of the project partners. We are asking you to take part because you expressed an interest after receiving the email invitation. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

What the study is about: The purpose of this study is to learn what are ICT funders' assessments of the evaluation categories in determining the value of healthcare-related ICT projects? You must meet the following criteria to take part in this study: 1) Be able to speak and understand English well; 2) Be a primary contact representing the government agency partners or not for profit agencies funded and or endorsed by government, involved in partnering with the community in a technology related healthcare project; 3) Be involved in or have access to information about the planning, implementation and evaluation of said technology related healthcare project; 4) Be at a mature stage in the project.

What we will ask you to do: This research data are being collected as part of a graduate thesis. If you agree to be in this study, we will ask you to apply the five Community Informatics evaluation categories to your technology related healthcare project. We will email you an information sheet to assist you with that portion of the research. After you have evaluated your project using these categories, we will arrange to conduct a one hour phone interview with you at your convenience. The interview will include four main questions regarding your experience in applying the five evaluation categories to your project. The interview will take about one hour to complete. With your permission, we would also like to digitally record the interview.

Risks and benefits: There is the risk that you may find some of the questions about the application of the evaluation categories to be sensitive.

The benefit to you is this study offers opportunity to further document your project success which may support continued or future funding. In addition, you would be contributing to a broader knowledge which you could apply in future technology related healthcare project designs.

Compensation: There is no compensation for participating in this study.

Your answers will be confidential. The records of this study will be kept private. In any sort of report we make public we will not include any information that will make it possible to identify you. Research records will be kept on an encrypted USB memory stick; only the researchers will have access to the records. If we digitally record the interview, after it has been reviewed and analysed, we will keep the digital MP3 recording on the encrypted USB memory stick in a locked file cabinet for the required period of five years at which time it will be destroyed.

Taking part is voluntary: Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide to take part, you are free to withdraw up to one week following your interview.

If you have questions: The researchers conducting this study are Tanis Rollefstad, RN, BN, Masters of Arts in Communication and Technology (MACT) candidate and primary researcher and Dr. Maria Mayan, Assistant Director, Community-University Partnership for the Study of Children, Youth and Families, Associate Professor, Faculty of Extension, University of Alberta. Please email any questions you have now.

If you have questions later, you may contact Tanis Rollefstad at rollefst@ualberta.ca or by phone at 1-306-693-2442. You can reach Dr. Mayan at mmayan@ualberta.ca or by phone at 1-780-492-9209. If you have any questions or concerns regarding your rights as a participant, or how this study is being conducted, you may contact the Research Ethics Office at 780-492-2615. This office has no affiliation with the study investigators.

You will be given a copy of this form to keep for your records.

Statement of Consent: I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

Your Signature _____ Date _____

Your Name (printed) _____

In addition to agreeing to participate, I also consent to having the interview tape-recorded.

Your Signature _____ Date _____

Signature of person obtaining consent _____ Date _____

Printed name of person obtaining consent _____ Date _____

Appendix C

Participant Timeline Data

Table 1.

Participant Timeline Data

Research Activity	Persons Involved in the Research Study							
	Ethics	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7
Proposal submitted	Feb 1/13							
Proposal accepted	Mar 4/13							
Revision criteria submitted	Mar 07/13							
Revision criteria accepted	Mar 13/13							
Initial invitation email		Mar 14/13	Mar 26/13	Jan 26/14	Feb 3/14	Jan 26/14	Jan 26/14	Jan 26/14
Interest email or phone call		Mar 21/13	Mar 26/13	Jan 29/14	Feb 6/14	Jan 28/14	Jan 27/14	Feb 19/14
Consent Signed		Mar 27/13	Jul 10/13	Feb 6/14	Feb 21/14	Feb 18/14	Feb 14/14	Mar 14/14
Measure category instruction sent		Mar 27/13	Jul 10/13	Feb 10/14	Mar 5/14	Feb 24/14	Mar 24/14	Mar 14/14
Interview date		Apr 4/13	Aug 28/13	Mar 12/14	Mar 13/14	Mar 31/14	Apr 16/14	Apr 30/14
Thank you email or phone call		Apr 4/13	Aug 28/13	Mar 13/14	Mar 13/14	Apr 13/14	Apr 16/14	Apr 30/14
Research paper shared	Jul /14	Jul /14	Jul /14	Jul /14	Jul /14	Jul /14	Jul /14	Jul /14

Note. Participants are numbered according to the date order of their interviews

Consent dates are the dates participant signed the form

Appendix D

Interview Guide

Briefing:

- Thank You! I will be recording our conversation as outlined in the consent, so as to review for analysis. The Recording will be electronic and saved on an encrypted USB drive.
- Just a reminder that no comments made in today's interview will be identifiable to you in any way.
- You can refuse to answer any questions without bias & can withdraw from the study up to 1 week post today's interview.
- The focus of our discussion today is to see how well the categories are reflective of a meaningful evaluation. The specific project evaluation results are not the main focus.
- I will give you a chance to add comments and ask questions at the end of the interview. Before we get started are there any concerns?

Main questions:

1. Can you tell me about your project and your role in it?
2. Describe your experience and the process you used in applying the 5 evaluation categories.
3. What aspects of these evaluation categories most resonated with you in describing the value of your healthcare project?
4. What other descriptors, aspects or categories might you include to describe the value of your healthcare project?

Debriefing:

- Do you have any further comments or anything you would like to add?
- Do you have any questions?
- Once all interviews are analyzed and conclusions drawn a report will be completed. If you would like a copy of this report with the results, I would be happy to share that with you.
- The deadline for completion of this research is August 31st, 2014. I hope to have all completed earlier however that is the latest everything will be completed.

Thank you again and it has been a pleasure discussing this work with you getting your valuable input.

Appendix E

Instructions for Applying the Five Evaluation Categories

The request is for you to apply each of the five Community Informatics (CI) evaluation categories to your technology related healthcare project. In other words, use these categories and questions to evaluate your project; record your answers as preparation for the one hour interview which will be scheduled at a mutually agreed upon time. After you have evaluated your project with these categories, you will then be asked four interview questions by phone. The five evaluation categories have been reworded into questions and expanded in description to facilitate the application of these evaluation categories:

1) *What value does the community assign to the Information & Communication Technologies (ICT's) and their implementation?*

Do not focus solely on cost-savings or efficiencies as measures. While they are important to consider, Healthcare ICT projects must also evaluate the impact of the project with a community's perceived ability to participate and enable ICTs to support their self-identified health care needs (Gurstein, 2007). Within this category, questions which may help to outline the value of the ICTs from the community perspective are: 'What did the community identify as their priority needs?'; 'How well does the community say the ICTs met those identified needs?'; 'What changes does the community see as a result of the ICTs both positive and negative?' and 'What do the community members say about their ability to use and adapt the ICTs in the future?'.

2) *What efforts were used to involve the community in the design, implementation and evaluation of the ICTs and how effective were they to solicit community engagement?*

Evaluation should include qualitative data which illustrates the extent of community involvement in the implementation and program design of the ICT application. Designing an ICT

intervention or program involving one or perhaps two influential persons in a community does not lend to a sense of community ownership nor a sustainable long term solution. Rather, methods to involve a good cross section of the community population throughout the process, increases the likelihood of increased use of the ICTs as well as fostering a more customized implementation for better community fit (Crilly, Keefe, & Volpe, 2011). This potentiates the sustainability of the project (Rideout & Reddick, 2005). Consider asking questions like: ‘Who from the community was involved in each phase of the project?’; ‘How much of their input was incorporated into the project?’; ‘Did the engagement methods reach every level of the community, giving all the opportunity to have input into the project phases?’; ‘What do the community members say about their involvement in each phase of the project?’; ‘Were there iterative redesign strategies based on community input?’.

3) *How effective was the ICT implementation in its ability to build on existing structure and allow future community-directed adaptations?*

Effectiveness of the implementation and design of health care ICT can be measured by how it has leveraged existing ICT infrastructure, or is designed to scale to expand future capacity. Rideout and Reddick (2005) suggest that one reason many ICT applications fail to be sustained is that their implementation strategies don’t allow for flexibility. In other words, the initial need for the technology changed but no strategies of adaptation were initialized as the social context and local needs changed. Strategies like partial redeployment or shifting of resources could address potential future adaptations of the ICT application. Salvador and Sherry (2004) give an example where local conditions in a remote community often have long lasting power outages requiring the use of a generator. Knowing the capacity of that generator to supply electricity for the added use of the ICT would be important to maintaining an effective service. Should the ICT application be expanded to meet other needs in the future, what power needs

might be anticipated? Thus building on the existing structures and considering what would be needed in the future to support the ICT, is essential. Questions relating to existing structures may include: ‘What broadband speed currently exists?’; ‘What service provider coverage exists and how well is it accessed?’; ‘Do the local community members know how to use any existing hardware including knowing how to repair it?’ ‘How do community members gain formalized access to experts outside their community should their needs change in how to expand the use of the ICT application?’.

4) *To what degree do multi-stakeholder partnerships exist to ensure sustainability?*

Evaluation should consider the extent the health care ICT navigates and creates supportive partnerships and collaborations with varying levels of stakeholders to ensure sustainability. Given most healthcare ICT projects are efforts to operationalise government mandates, the funding models of which are connected to election cycles with broad goals and short timeframes; it stands to reason that longevity in funding arrangements is unlikely. Thus to build sustainability in ICT projects and community investments one solution is to engage multiple stakeholders whose collaborative support in both expertise and funding would secure longevity in the ICT application and ultimately sustained potential for the goal of community improvement (Rideout & Reddick, 2005). In evaluating this category some questions might include: ‘Who are the private and corporate stakeholder groups which have a common goal of the project and an ability to contribute in expertise and or funding?’; ‘What relationship do these stakeholders have in the design and implementation of the ICT application?’; ‘Were they contacted and engaged?’; ‘If not, how might these groups be leveraged at this point?’.

5) *How well were the patterns of social capital and socio-cultural context within the community leveraged in the design and implementation of the ICT?*

Patterns of social capital and socio-cultural factors which exist in a community affect the uptake and sustaining factors in ICT adaptation and thus should be considered in ICT design and implementation. Woolcock (2001, as cited in Pigg & Crank, 2004, p. 60) defines social capital as "... norms and networks that facilitate collective action". Since communities are a series of social networks, they have inherent assets which provide connecting structures to build upon. Technology augments and extends those connections which already exist. By mobilizing existing social network connections within the community and accessing those skills and assets in the implementation of the ICT applications, the success and sustainability of the project are greatly enhanced (Williams & Durrance, 2008). If for example the ICT application of Telehealth were directed to improving newborn infant care, understanding who the informal maternal leaders are within the community and who and how they communicate with the other mothers, would be important information to plan the design, access, audience and implementation of the technology. To evaluate existing social networks and structures within the community the following questions may be helpful: 'Who are the informal leaders within the community?'; 'How do they influence and communicate with other community members?'; 'What formal structures currently exist to disseminate information and connect community members?'; 'What barriers exist which prevent community communication and connection?'; 'How well does the ICT overcome those network disconnects?'

The **research question** is: What are ICT funders' assessments of the evaluation categories in determining the value of healthcare-related ICT projects? For any questions you may have you may contact Tanis Rollefstad via email at rollefst@ualberta.ca.

Appendix F**Individual Interview Analysis****Evaluation - Interview #X****Q1. What is the data saying?****Category #1****Category #2****Category #3****Category #4****Category #5****Q2. What is the data saying about the research question - What are ICT funders’****assessments of the evaluation categories in determining the value of healthcare-related ICT projects?’****Q3. What is the relationship between what the data are telling me and what I want to know in my research question?**

.This prompts me to ask the following questions in the next interview:

-

My thoughts on the interview:

Appendix G

Macro Level Data Analysis

Table 2

Macro Level Data Analysis Table

What is the data saying?	What is the data saying about value? Interpretation.	What is the gap between the two? Conclusions
<p>Category #3 Implementation & existing structure future adaption</p> <p>"This category highlighted the lack of appropriate support and infrastructure in my project. Having these support structures and connectivity are critical for any successful ICT implementation."</p> <p>"This category is important, very important... by building on existing structure it forces you in a certain direction, like a constraint - do you need to rethink the type of implementation?. It introduces a lot more paths."</p> <p>"This category introduces more things to consider for a good implementation."</p> <p>"Infrastructure and connectivity was a problem. This was a very important part of the implementation and evaluation as identifying the negatives"</p> <p>"In the implementing stage, we would have taken more time to ensure a good product before going live... we realize it was important after the fact, some of the factors were beyond our control. We are nurses not marketers or business people."</p> <ul style="list-style-type: none"> • There are business practices for implementation that we are learning is important. <p>"The internet is absolutely crucial to technology so it is something essential to an evaluation. We don't have a wireless router so community can't access the internet on their phones."</p> <p>"The category didn't directly trigger the thought of an environmental scan, it is too broad, but because of my past experience with the needs of the patients and doctors, I understood this to be part of this category."</p> <p>"This was a category we knew we had to address but it turned out to be bigger than we thought, more needed to be added, the scope of the IT issues were bigger than anticipated"</p> <p>"I thought the example in a rural community really resonated with our experience"</p> <ul style="list-style-type: none"> • Validates the explanation's importance for category clarification <p>This category was seen as essential. They started with building on the existing structures but needed to upgrade, add additional personnel and training to make it work.</p>	<p>Having the appropriate support and infrastructure is very important to a successful technology implementation.</p> <p>This category introduces more things to consider for a good implementation"</p> <p>Considering the existing infrastructure influences implementation strategies, identifies the potential negative impacts of an implementation and affects the final outcome to the community in terms of usability.</p> <p>This category may be clarified to include an environmental scan to understand the existing structures in relation to the needs of the community.</p> <p>This category proved to be more important and greater in scope than anticipated.</p>	<p>Consider the existing infrastructure influences implementation strategies and required processes/resources for present and future application of the technology; It identifies the potential negative impacts of an implementation and affects the final outcome to the community in terms of usability of the technology.</p> <p>Identifying and including implementation strategies to overcome constraining factors within the healthcare system is important to clarify in this category as implementation success or speed can be compromised.</p>