

Identification of Best Practices for Evidenced-Based Telehealth in British Columbia



Submitted to:
Provincial Health Services Authority

By:
Dr. Kendall Ho, Associate Dean and Director UBC, CPD-KT
Dr. Sandra Jarvis-Selinger, Principal Investigator, Research Director, UBC, CPD-KT
University of British Columbia,
Division of Continuing Professional Development and Knowledge Translation

Vancouver, British Columbia, Canada
Ph: (604) 639-4657 Fax: (604) 630-0827
Email: sandra@cpdkt.ubc.ca
Web: www.cpdkt.ubc.ca

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Submitted by

Dr. Kendall Ho, Principal Investigator, Associate Dean and Director
Dr. Sandra Jarvis-Selinger, Principal Investigator, Research Director

Edited by

Dr. Sandra Jarvis-Selinger, Research Director
Helen Novak Lauscher, Assistant Director of Research

Researched and written by

Kate Carty, Researcher
Elmira Chan, Researcher
Abhirami Gunasingam, Researcher
Ryan Payne, Researcher
Kerenza Plohman, Researcher

Contributors

Yolanda Liman, Researcher
Elizabeth Stacy, Researcher
Jacqueline Gullion, Researcher

IDENTIFICATION OF BEST PRACTICES FOR EVIDENCED-BASED TELEHEALTH
IN BRITISH COLUMBIA

Review of the Literature

Primary Document

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I. Introduction

Overarching Objective of this Literature Review

Review the recent (2000-2005) literature on how videoconferencing supports clinical encounters and health professional education.

Research Questions

- What key lessons can we derive from the literature on the use of videoconferencing for telehealth?
- Which videoconferencing applications are beginning to show promise or potential?
- What are the potential effects of videoconferencing on patient care and health professional education?

Components of this Report

Primary Document

The **Primary Document** represents a synthesis of findings from the review of literature. This document gives a comprehensive overview of findings and is accompanied by supporting documentation for reference and in-depth information. Findings are organized according to salient **lessons learned**; **necessary conditions** for success; and **promising applications** in the realm of videoconference applications for telehealth. These synthesis sections are organized according to **clinical** and **educational** contexts. The **Primary Document** includes other synthesis sections, which discuss the following aspects of this literature review:

- Findings regarding videoconference based telehealth in the **Aboriginal Context** in Canada;
- The **Patient Perspective** on engaging in videoconference based telehealth;
- Salient **Policy** findings and implications;
- Findings related to **Financial** analyses and implications gleaned from the body of literature; and
- A **Conclusion**, which highlights directions for future research.

The Primary Document is intended to be used in conjunction with the **Evidence Companion**.

Evidence Companion

This document is a thorough compilation of the reviewed literature. The evidence companion is organized by chapter, according to context. The first two chapters present evidence on the Clinical Context and the Educational Context. The reader is encouraged to refer to the Evidence Companion while reading the Primary Document to understand the breadth and complexities of the body of evidence. The Primary Document attempts to articulate the most salient themes in the literature, while the Evidence Companion provides an in-depth and comprehensive repository of evidence organized by context.

Supporting Documentation

This report is accompanied by a series of appendices as well as a complete list of references¹. These resources include appendices of search terms for published sources (Appendix A), a bibliography (Appendix B) as well as links to relevant grey literature (Appendix C).

II. Objectives of this Literature Review

The overarching purpose of this literature review is to provide British Columbia's health policy makers, health administrators and health professionals with an evidence-based foundation for informed decision-making about videoconferencing for telehealth. The literature review has three primary objectives, each with related research strategies/and or research questions. The objectives along with the research strategies and questions are as follows:

Objective 1

Review the recent (2000-2005) literature on how videoconferencing supports clinical encounters and health professional education.

Research Strategies:

- Examine the evidence (from case reports, randomized controlled trials, etc.) and contextualize these studies' results and recommendations on the basis of current evidence
- Examine the telehealth policy literature focused on successful adoption or implementation of videoconferencing-based telehealth

Objective 2

Review the recent (last 5 years) literature on how videoconferencing supports clinical encounters and health professional education in Aboriginal communities.

Research Strategy:

- Examine the evidence and policy literature on videoconferencing-based telehealth in Aboriginal communities

Objective 3

On the basis of this literature review, answer the following questions:

Research Questions:

- What key lessons can we derive from the literature on the use of videoconferencing for telehealth?
- Which videoconferencing applications are beginning to show promise or potential?
- What are the potential effects of videoconferencing on patient care and health professional education?
- What are the necessary conditions for successful implementation of videoconferencing for telehealth?

¹ Referencing follows American Psychological Association (APA) style guidelines. The reference list is organized alphabetically by author.

The literature review will assist stakeholders in determining the most effective approach to implementing videoconferencing-based telehealth in B.C., as well as how to prioritize the many applications of this technology for patient care and health professional education. It is hoped that this literature review will enable the adoption of an evidence-based best practice model in BC.

III. Method

Published literature pertaining to videoconference telehealth applications was identified via a systematic search of databases (see Appendix A). The research team included four members each responsible for searching and reviewing literature in a specific health care domain. For example, one researcher was responsible for psychology databases, while another searched medical literature databases. The team engaged in an instructional session with a biomedical librarian to refine search techniques for maximum yield of relevant research. The literature search was limited to the years 2000 through 2005 and included studies limited to human subjects (i.e., veterinary medicine was not included). Sampling of health care contexts was purposive; for example, dentistry was purposely not included as it is not under the purview of provincial health care. Only English language literature was included in the search, beginning with Canadian, and branching out to studies carried out in the US, the United Kingdom, Australia and others. It is interesting to note that videoconference was deemed a mesh term in 2004.

The search strategy began with a comprehensive keyword search of databases, retrieval and review of abstracts, and retrieval of full text articles. The citation lists of articles were also scanned for relevant sources falling in the appropriate range of publication years. In addition, grey literature including policy documents, unpublished reports and conference proceedings were included. A listing of grey literature and associated web links accessed via Internet searches can be found in Appendix C. In addition, the last five years of the *Journal of Telemedicine and Telecare*, a premiere telehealth journal, was hand searched for relevant articles pertaining to videoconference applications of telehealth. The authors of the report reviewed the searches independently and as a team to group the findings thematically and by field.

IV. Lessons Learned

Key Lessons Learned refers to the salient learning points drawn from the studies reviewed in the literature. These lessons took the form of both program successes to be replicated and program pitfalls to be avoided. The following analysis is intended to inform future program development.

a. Lessons Learned: Clinical Context

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|--------------------------------------|
| <i>Lessons Related to Technology</i> |
|--------------------------------------|

The reviewed literature sheds light on lessons learned related to incorporating new technologies into the workflow of health care providers. Central issues include the selection of videoconferencing technologies to meet the operational demands of the specific health

care field, provision of technical support, and training for end-users of videoconferencing equipment.

Lesson: Match equipment and technology specifications to the needs of the specific field

In order to provide health care services via videoconferencing, there are certain technological requirements that must be satisfied. According to the literature, medium to high bandwidth² was needed in most health care contexts to establish adequate audio and visual clarity (Justo et al., 2004; Tachakra, Lynch, et al., 2000). The need for higher bandwidth was especially pronounced in visually ‘dynamic’ fields such as emergency medicine or physiotherapy, in which three-dimensional visual communication is essential for care delivery (Engbers, Bloo, Kleissen, Spoelstra, & Vollenbroek-Hutten, 2003; Tachakra, Jaye, Bak, Hayes and Sivakumar, 2000). High bandwidth was essential in fields that rely on a high degree of audio as well as visual acuity. For example, teledermatology consultants rely on high resolution imagery to make accurate diagnoses (Nordal, Moseng, Kvammen, & Lochen, 2001). This need was less pronounced in more ‘static’ health care fields in which the consultant interacts with a relatively stationary patient while making a diagnosis. Fields described as ‘static’ include homecare and telepsychiatry - where care delivery is not contingent upon the consistent flow of high resolution images (Arneart & Delesie, 2001; LeRouge, Garfield, & Hevner, 2002).

Lesson: Consider the compatibility and awareness of technology capacities across rural and urban telemedicine sites in the development and design of programs

Technological compatibility between remote and urban sites was an important factor in clinical service delivery. Selection of technology systems in some pilot projects was dependent upon the technological infrastructure of the remote community (Ricci et al., 2003; Rosina, Starling, Nunn, Dossetor, & Bridgland, 2002). Within Canada, this is particularly salient given the geography and population distribution. In some remote First Nations and Inuit communities, ISDN based line connections often do not exist; Health Canada, 2004c). In this circumstance, it is necessary to use wireless technologies such as satellite. Satellite technologies are extremely expensive to operate (e.g., approximately \$500 per hour in Nunavut) and are highly vulnerable to weather conditions (Cornish et al., 2003). Research indicates that the need for technology compatibility is a central barrier to connecting remote communities with expert consultation. Compatibility requires that substantial monies be invested in upgrading the infrastructures of remote communities, or the technologies utilized must continue to correspond to the lowest common denominator in terms of infrastructure (Health Canada, 2004c).

Lesson: Dedicated and available technical support at startup promotes the development of technological competency – “A stitch in time saves nine”

The provision of ongoing technical support is critical to the success of videoconference based telemedicine initiatives. Several pilot studies demonstrated that it is impractical to rely on doctors or nurses to troubleshoot and/or fix technological issues that arise during clinical consultations (Gagliardi, Smith, Goel and DePetrillo, 2003; Ricci, 2002). Dedicated technical support staff are required to enable caregivers to perform their clinical roles and minimize

² high bandwidth was typically defined as 384 kbits per second

their roles as troubleshooters (Engbers et al., 2003). Technical support was found to be of particular importance during the startup phase of implementation when the status of the program is most fragile. During this phase, dedicated and committed staff are required to ensure the pilot ‘gets off the ground’ (Brebner et al., 2004).

Lesson: Approximate face-to-face encounter to the utmost

Overall, the telemedicine encounter is best experienced when it closely approximates a face-to-face interaction. The most common drawbacks cited by patients and practitioners alike are the visual and auditory elements of videoconferencing. Shortcomings include poor illumination, “choppy” movements, and a slight delay in audio reception resulting in individuals speaking over one another (Mitchell, Myers, Swan-Kremeier, & Wonderlich, 2003). Evidence suggests that patients and practitioners alike are able to quickly and easily adjust to these difficulties (Mitchell et al., 2003; Patterson, 2005). Moreover, once patients become accustomed to this new mode of communication, they report that they find themselves conversing as if they were in the same room. Elford et al. (2000) and Elford, White, St,John, Maddigan, and Ghandi (2001) exemplified the adaptability of audio to suit a particular clinical context in pediatrics. Because children tend to be active and move around a lot, microphones were placed strategically around the consult room to capture the child’s voice without having to make him stay still.

Lessons Related to Telemedicine Adoption

One theme that emerged from the literature relates to challenges of maximizing user acceptance and adoption of this modality of service delivery. For health providers and patients alike, findings pointed to the need for strategies to maximize the efficacy of videoconferencing in clinical contexts.

Lesson: Maximize end-user comfort and build competency through adequate and effective training

The literature suggests that steps need to be taken to ensure that users are in a position of comfort, competence and readiness to use the equipment. Failure to provide users with opportunities to become comfortable with equipment usage inhibit user uptake (Moehr et al., 2005). Further, health care providers may be somewhat resistant to the introduction of videoconferencing during the implementation phase of a pilot (Jennett, Jackson, et al., 2003) and grow increasingly resistant when encountering technical challenges early on (Ricci, Caputo, Callas, & Gagne, 2005). Adequate training should be offered to ensure that potential users have successful videoconferencing experiences early on to encourage adoption. Training is also required to smooth the transition from traditional to virtual service provision. Videoconferencing can necessitate a shift in duties from the remote site to the consultant site. In this situation, personnel must be adequately trained in the operation of the equipment as well as their new roles and responsibilities as virtual caregivers (Wakefield, Buresh, Flanagan, & Kienzle, 2004). Finally, given that each program is unique, technology training must be context specific and designed to reflect the given needs and idiosyncrasies of practice particular to the health care community incorporating videoconferencing (Campbell, Harris and Hodge, 2001; Fortin, Gagnon, Cloutier, & Labbé, 2003; Hitchcock & Hitchcock, 2005).

Lesson: Implement strategies to maximize practitioner buy-in

Important strategies for fostering practitioner enthusiasm and investment in telemedicine included identifying and engaging champions who are prepared to promote the initiative to others (Brebner et al., 2004; Leonard, 2004a; Jennett, Yeo, Pauls, & Graham, 2003). Another strategy for maximizing buy-in is the promotion of (and contribution to) the evidence base demonstrating the effectiveness of videoconference methods (Fortin et al., 2003; Hockey, Yellowlees, & Murphy, 2004). If program design is informed by adequate and appropriate needs assessment, the fit of the program with the clinical context is maximized as is the likelihood of its sustainable integration into the existing workflow (Fortin et al., 2003; Moehr et al., 2005).

Lesson: Promote evidence related to provider satisfaction and the efficacy of videoconferencing to build enthusiasm

The provision of high quality services was a source of concern for providers as they moved into the realm of clinical videoconferencing. Naturally, health care professionals were invested in providing care to patients that was equal to the quality of care provided face-to-face in terms of diagnostic accuracy and patient health outcomes. The existing literature demonstrated that from a provider's perspective equity of care was possible. Several studies demonstrated that the diagnostic accuracy achieved via videoconferencing is quite high (Eedy & Wootton, 2001; Tachakra, Lynch, et al., 2000; Wootton et al., 2000) and enables practitioners to treat patients both rapidly and appropriately (Rogers et al., 2001, Kon & Marcin, 2005). Studies that assessed inter-rater reliability between remote and face-to-face settings demonstrated that videoconferencing allows virtual providers to make the same diagnosis as their face-to-face counterparts in the vast majority of cases (Elford et al., 2000; Hitchcock & Hitchcock, 2005; Tachakra, Lynch, et al., 2000). Furthermore, referring providers were typically positive about the potential of videoconferencing to reduce unnecessary patient transfers and maintain care within a patient's home community (Smith, Batch, Lang, & Wootton, 2003; Ricci et al., 2003).

Lesson: Empower patients by informing and discussing the benefits of telemedicine

Videoconferencing equalizes service provision to rural and remote areas as these patients benefit greatly from savings in both time and money by accessing care via videoconferencing. In some cases, these patients are unable to access care if travel is required (Davis, Howard, & Brockway, 2001a; Persaud et al., 2005). This underlines the importance of making videoconference based care a reality for isolated populations. Videoconferencing positively impacts aspects of doctor-patient communication as well. Evidence shows that patients like to have their family physician involved in a specialist consult to ensure the specialist is thorough and understands their situation and that videoconferencing enables this (Nordal et al., 2001). Additionally, videoconferencing contributes to the patients' sense of empowerment and anonymity in communications with health care professionals (S. Simpson, 2001). The use of videoconferencing allows for increased continuity of care, which positively impacts patient health and disease management (Chumblor et al., 2005; Vontetsianos et al., 2005) While some patients may be wary of or unreceptive to engaging in a videoconference consult, this barrier can be overcome with increased exposure and familiarity (Guillén et al., 2002; Demiris, Speedie, & Hicks, 2004).

Lesson: Develop and practice effective strategies for interpersonal communication and relationship building in videoconferencing

Criticisms of videoconference based care delivery often related to the lack of personal or physical contact. Providers highlighted the fact that videoconferencing falls short in situations that require the practitioner to touch the patient, perform chest auscultations or palpate wound areas (Khoja, Casebeer, & Young, 2005; Nguyen et al., 2004; Nordal et al., 2001). Additionally the lack of personal contact appeared to increase the ‘professional distance’ that exists between patients and providers (Miller, 2002). Practitioners have in some cases stated that videoconferencing impeded their ability to impart empathy to the patient, which served to further depersonalize the doctor-patient interaction (May et al., 2001; Mitchell, Robinson, McEnvoy & Gates, 2001; Simpson, Bell, Knox, & Mitchell, 2005). Another salient challenge identified by providers related to patient receptivity to videoconferencing. For example, communicating with elderly patients was identified as particularly challenging (Laflamme et al., 2005; Nordal et al., 2001). Finally, some specialists expressed concern that increased use of videoconferencing could potentially isolate them from the patient population and relegate them to a purely virtual consultant role (Eedy & Wootton, 2001).

Organization and Systems Level Lessons

Lessons related to organizational factors impacting the success and sustainability of telemedicine programs are discussed in the following section.

Lesson: Understand and prepare for challenges created by videoconferencing

The use of videoconferencing creates some organizational challenges for health care providers. Coordinating the participation of the various practitioners involved in the virtual care giving process requires considerable organization and thought (Ellis & Mayrose, 2003). Consideration must be paid to the development of protocols for usage of the system, provision of training and the availability and maintenance of equipment to maximize success (Brebner, Brebner, Rubbick-Bracken, 2005; Ellis et al. 2003). Another challenge relates to the scheduling of ad hoc or unplanned consultations. As multidisciplinary care requires complex organization, video-consultations can be difficult to establish late at night when providers and technical support personnel are hard to reach (Weiner et al., 2003) or in situations when several practitioners are simultaneously required to respond to acute patient needs (Moehr et al., 2005). The existing literature suggests that video-consultations are most effectively administered when scheduled in advance or when protocols exist to ensure the 24/7 preparedness of the involved health care professionals (Ricci et al., 2003).

Lesson: Capitalize on unintended positive consequences of videoconferencing – team based care

Coordinating specialists, nurses, patients and general practitioners in the context of a videoconference consult presents temporal and logistical challenges, which can inhibit multidisciplinary care provision (Ellis & Mayrose, 2003). However, in some cases, videoconferencing itself created a new context for team based management. That is, because videoconferencing enabled all members of the health care team to communicate simultaneously when they otherwise would not have done so, thus fostering collaborative, multidisciplinary patient management (Chan, Woo, Hui, & Hjelm, 2001; Delany Jacob,

Ledema, Winters, & Barton, 2004; Vontetsianos et al., 2005). Additionally, multidisciplinary communication resulted in more distributed participation across the care giving team than was evident in telephone communication. This approach translated into more effective case management and decreased term of treatment for patients (Gelfand, Geffken, Halsey-Lyda, Muir, & Malasano, 2003; Wilson et al., 2004).

Lesson: A context for collaboration and building expertise

In some cases, the aforementioned multidisciplinary approach expanded the roles of remote practitioners. Through participation in videoconferences, remote practitioners were able to gain knowledge and experience which allowed them to handle more complex patient situations in the future and become less reliant on expert consultation (Brebner et al., 2005; Tachakra, Dutton, et al., 2000). Specialists in these types of cases stated that the aforementioned expansion in clinical expertise could not have been achieved through simply transferring the patient. Finally, videoconferencing expedites provider response, both in cases of one-on-one, and multidisciplinary service provision. This was found to be of particular value in cases where acute medical attention was essential and patient transfer risky (Rogers et al., 2001; Ricci et al., 2003; Schwaam et al., 2004).

Lesson: Videoconference-based programs have the potential to level the service provision playing field

Remote providers were typically positive and enthusiastic about the ability of videoconferencing to connect them with expert consultation in situations where immediate care was required. In fields such as emergency medicine and stroke neurology providers reported that being able to connect with experts improved both their diagnostic confidence and ability to perform their role (Ricci et al., 2003; Schwaam et al., 2004). This theme was pronounced in rural centres in which physicians in non-specialized facilities (such as minor accident units) were required to provide specialized care for which they were not trained (Campana, Jarvis-Selinger, Ho, Evans, & Zwimpfer, 2004; Kon & Marcin, 2005). In essence, both rural providers and virtual consultants felt that videoconferencing offered the potential to reduce the existing discrepancies between rural and urban service provision. It is contented that rural and remote areas have must have equitable health service and therefore have the same entitlement to face-to-face care as consumers in urban areas (Gelber, 2001). Moreover, maximum effectiveness is often achieved when used in combination with face-to-face contact (e.g., in the case of telepsychiatry) (Gelber, 2001; Kuulasmaa et al., 2004) and should not be promoted as the total solution to the issue of isolation from mainstream services (Gelber, 2001; Mitchell et al., 2001; Simson et al., 2002).

Lesson: Policy issues need to be addressed for widespread integration of videoconference based care

Medical legal issues surrounding inter-jurisdictional practice and liability were identified as obstacles to service provision (Ellis & Mayrose, 2003; Health Canada, 2004c; Muttitt, Vigneault and Loewen, 2004). Several studies identified a lack of adequate reimbursement mechanisms as a barrier to specialist participation (Ellis & Mayrose, 2003; Jong & Kraishi, 2004, Karlinsky, 2000).

Lesson: Combine adequate funding with incremental growth

Adequate, long term funding is required to ensure that a program is maintained. Long term success requires that governing bodies make telemedicine initiatives a priority and integrate

them into their existing financial frameworks (Hilty, Luo, Morache, Marcelo & Nesbitt, 2002; Tang & Helme, 2000). With respect to program sustainability, pilot studies have shown that gradual program growth is related to success, whereas large scale implementation is potentially overwhelming and can result in participant rejection/withdrawal (Moehr et al, 2005; Health Canada 2004c ; Simpson, Doze, Urness, Hailey, & Jacobs, 2001a).

Lesson: Meeting operational feasibility requirements

Sufficient operational size (in terms of the number of consultations performed) was identified as being critical to program sustainability. Firstly, the program must generate a large enough workload to maintain the skill and confidence levels of all users (Brebner et al., 2004). Secondly, as the fixed costs of establishing telemedicine programs is substantial, a ‘critical mass’ of workload is required to justify the expenditures on the equipment (Persaud et al., 2005; Rumpsfeld, Arild, Norum, & Breivik, 2005). Several studies identified a ‘threshold point’ at which a sufficient volume of consultations occurred to make videoconference based consultation as cost-effective as face-to-face consultations. Financial analysis established that programs that are able to operate beyond this identified threshold point will become increasingly more cost effective than their face-to-face counterparts for both patients and providers (Persaud et al. 2005, Wootton et al., 2000).

b. Lessons Learned: Education Context

The Interface of Technology and Pedagogy

The reviewed literature demonstrated that videoconferencing is a viable modality for health professional education. Videoconferencing allows for providers from various disciplines to exchange information and increase knowledge about other disciplines. This has occurred within Canada and abroad at reduced costs, consumed less physician time and resulted in improved community service capacity (BC telehealth program, 2004). From the learner’s perspective videoconferencing represents a viable method of educating health professionals, especially those working in isolated areas with limited access to continuing professional education opportunities. Learner satisfaction with videoconference delivery was generally quite high in the studies reviewed (Haythornthwaite, 2002; Mea, Carbone, Greatti, & Beltrami, 2003; Ricci, Caputo, Callas, & 2005). Additionally, evidence that suggests the videoconference modality facilitates knowledge gain in participants on par with face-to-face delivery (Rees & Gillam, 2001; Reznik & Ozuah, 2004; Stain et al., 2005).

Lesson: Reduce technical glitches to increase educational value and perceived value

Teaching, managing equipment and performing clinical skills all at once creates challenges for clinical instructors (Aanestad, Rotnes, Edwin, & Buanes, 2002). For this reason successful execution of videoconference based Continuing Medical Education (CME) required that dedicated technical support staff were available to maintain the equipment and support the technological needs of users (Aires & Finley, 2000; Gaglardi et al., 2003; Ricci et al., 2005; Allen, Sargeant, Mann, Fleming, & Premi, 2003). Minor technical issues were demonstrated to reduce the value participants attach to a seminar; therefore, the importance of minimizing technological glitches as well as having a back-up plan to deal with technical problems is essential (Mea et al., 2003).

Lesson: Work effectively with “what you have”

Poor visual resolution, audio lag, microphone muting and other problems associated with low broadband reduced the quality of educational program delivery (Allen, Sargeant, & MacDougall, 2002; Kingsnorth, Vranich, & Campbell, 2000). When communities lack the technological infrastructure to support ISDN based connections, standard internet connection has been demonstrated to be a suitable replacement (Sackett, Campbell-Heider, & Blyth, 2004).

Lesson: Capitalize on interactive features offered by the technology

Novel uses of technologies to increase the interactivity of educational programs had a positive impact on participation. In one study the use of mobile, voice activated cameras resulted in increased participant communication and interaction (Stain et al., 2005). Providers highlighted that videoconferencing was a unique modality for the provision of educational content and that one cannot simply apply face-to-face educational methods. Would-be educators need to be trained in using this technology in a fashion maximizing its interactivity and minimizing artificiality in order to ensure the participation of the audience (Allen, Sargeant, MacDougall & Procter-Simms, 2002; Tachakra, Newson, Wootton, & Stinson, 2001).

Lesson: Maximize learner engagement with interactivity, content relevance and effective use of the technology.

Klein, Davis and Hickey (2005) found that in order for a learner to accept the videoconference modality: presentation quality must be high; issues must have immediacy; and the session must be interactive. Dedicated technical support and the presence of a telemedicine coordinator are necessary for sessions to run smoothly (Aires & Finley, 2000; Himpens, 2003a). While learners often report that they find videoconferencing effective, the opportunity to interact with colleagues face-to-face is highly valued (Davis & McCracken, 2002; Krupinski, Lopez, Lyman, Barker, & Weinstein, 2004). Additionally, a combined approach, which utilizes both videoconferencing and ‘hands on’ participation is suggested, as hands on experience is related to clinical skill acquisition and development (Barufaldi, Giangiacomo, Paltrinieri, & Toni, 2003; Lynch et al., 2004). Instructors should be cognizant of the needs of their intended audience and the program should be tailored accordingly (Cornish et al., 2003; Hilty, Marks, Urness, Yellowlees & Nesbitt, 2004; Martin & Klotz, 2001).

Lesson: Videoconferencing can bring people together and situate learning in the community

A principal benefit cited in several studies was that videoconferencing allowed learners to engage in continuing professional development within their home community, and allowed them to gain skills within their practice environment (Lynch et al., 2004; Martin & Klotz, 2001; Ward, Rey, Mobley, & Evans, 2003). Further, there is value in implementing education at the point of care that is relevant to the learners’ daily practice. This situated learning can be supported by videoconferencing in the community (Abrahamian, Schueller, Mauler, Prager, & Irsigler; 2002). Another benefit of videoconference based CME is its ability to bring together rural providers from across a region and reduce feelings of isolation (Fukue, Ando, & Mitani 2000; Jin, Ishikawa, Sengoku, & Ohyangi, 2000). This networking made possible through videoconferencing fosters communities of practice, which support skills sharing amongst participants (Faulkner & McClelland, 2002; Smith, Batch, Lang, & Wootton, 2003).

V. Necessary Conditions for Success

Conditions necessary for success represent the recommendations or “best practice tips” for the implementation of the videoconference components of telemedicine programs. While certain minimum requirements exist across contexts, additional conditions may also be required for a specific field of telemedicine. The general necessary conditions for telemedicine are outlined in the following sections. In addition, the necessary conditions for specific fields are also discussed as appropriate.

a. Necessary Conditions: Clinical Context

Visual conditions for an effective videoconference environment

Placement of the video monitor is a vital factor for successful videoconferencing. The optimal position is with the video monitors and camera placed four feet in front of the patient at eye level (Mitchell et al., 2003; Tachakra, Newson, et al., 2001; Tyrell, Couturier, Montani, & Franco, 2001). The physician’s upper body (not just a “talking head”) should be fully visible to convey confidence and authority (Onor & Misan, 2005; Tachakra, Newson, et al., 2001). Positioning of the patient, furniture, test material and other objects should be planned in advance (Tyrell et al., 2001). The colour scheme of the room can make a dramatic difference to the quality of the transmitted image (LeRouge, Garfield, & Hevner, 2002; Major, 2005). For example, brightly colored walls in the videoconference room may produce distortion in the way skin colour is transmitted (LeRouge et al., 2002; Major, 2005). The background of the room should be plain with muted or pastel colours such as light blue (Major, 2005; Onor & Misan, 2005; The Centre for Telehealth at the Mental Health Evaluation and Community Consultation Unit [MHECCU], n.d.). The environment should foster comfort and trust; it should be comfortable and clean, adequately lit and free from clutter (Manning, Goetz, & Street, 2000; Tyrell et al., 2001).

Visual conditions must match the needs of the practice context

Low cost videoconferencing equipment may be unacceptable for situations where visual cues are important (Graham et al., 2000). In fields that depend greatly on visual cues, the video quality is of utmost importance. For instance, the skin colouration associated with a particular dermatological disease can indicate the specific stage of the disease. If the video does not accurately portray colouration, there is a risk of misdiagnosis (Nordal et al., 2001). Whereas high visual acuity is important in certain fields, a slight loss of definition in detail would not be as important in other fields, for example in a mental health consultation (LeRouge et al., 2002).

Visual conditions specific to telepsychiatry

Dark-coloured clothes are preferred over white as they are soothing rather than glaringly bright and potentially disturbing for the patient (Onor & Misan, 2005; MHECCU, n.d.). The way the doctor dresses can also affect the relationship with the patient. Some contend that it is important to define the physician’s status in order to create a distance between the doctor and the patient and professional clothing is one way to achieve this (Manning et al., 2000). Position of the monitor is also important; if the monitor is located so that it creates the illusion that the therapist is in a superior position (i.e., looking down on the patient) the dynamic can become problematic (Mitchell et al., 2003; Tachakra et al., 2001). Therapists

have commented that the videoconference context can make it more difficult to read body language and eye contact. It is also important to keep the patient engaged and prevent them from shifting away from the view of the camera. In addition, it is imperative that patients do not wear anything that obstructs the view of their face or casts shadows (Mitchell et al., 2003; Tyrell et al., 2001).

Visual conditions specific to Emergency Medicine

The majority of reviewed studies assert that the visual aspect of videoconferencing is critical for the care of trauma patients. Live audio-visual communications technology is a must for the delivery of virtual care to trauma patients. Ricci et al. (2003) described the limited utility of store and forward technologies in the fast-paced trauma context. Although store and forward methods provide the practitioner with visual information, in the field of trauma the authors found that only immediate, “up-to-the-minute” information is of value to care providers.

Technical Conditions and Requirements for Successful Clinical Teleconsultations

It is important that clinicians are familiar and confident with the technical side of the system before conducting remote clinical interviews and evaluations (Tyrell et al., 2001). Equipment should be tested regularly before each consultation to ensure that the sound and image quality is sufficiently clear for all sites (Tyrell et al., 2001). Technical issues in rural and remote areas relate to availability of technical infrastructure and cost to bring the infrastructure to these areas (Health Canada, 2004c).

Technical requirements in the general practice context

High bandwidth videoconferencing is needed for many medical exams that require invasive procedures (e.g., telesurgery), real-time motion-detection (e.g., cardiac monitoring), and real-time specimen analysis (e.g., pathology) (LeRouge et al., 2002).

Technical requirements specific to telepsychiatry

Just as in the traditional consultation, both practitioner and patient must feel sufficiently at ease to establish and maintain a trusting relationship. Mitchell et al. (2003) also note a number of instances in the literature in which the therapy sessions have been abruptly disconnected and although this can be highly disruptive, immediate telephone contact with the patient is the most appropriate course of action. A special concern in telepsychiatry is running over the allotted time while essaying to effectively deal with a suicide crisis. Although canceling a subsequent appointment or going over the allotted time is possible in face-to-face therapy, this may not be an option in telemedicine (Mitchell et al., 2003). Another condition to ensure the success of telepsychiatry is the inclusion of all participants. For example, it is important to keep all participants in view on the screen, and allow for equitable engagement. The authors noted that those not on screen/camera tended to gradually drop out of the discussion. If it is not possible to view everyone on the screen then it is best to change the angle of view frequently to include everybody in the discussion (Kuulasmaa, Wahlberg, & Kussimaki, 2004).

Technical requirements specific to emergency medicine

Several studies described necessary conditions for success in the delivery of trauma care to isolated populations. Firstly, certain technological conditions must be realized, especially in the case of “telepresence.” Telepresence requires a novel two-camera system to allow the virtual practitioner to have a multitude of views. Virtual clinicians in a pilot project reported that at times, insufficient camera coverage impeded their ability to view the emergency room scenario; however, the authors concluded that this problem could be resolved with the purchase of additional cameras (Tachakra, Lynch et al., 2000). Dedicated ISDN lines are required to operate videoconferencing systems with sufficient bandwidth for the delivery of remote trauma care. Although more advanced telecommunications systems are available, perhaps ISDN-based communication represents the most readily workable communications solution given the technological infrastructures of rural communities. Rogers et al. (2001) found that ISDN-based videoconferencing was an ideal mode of communication because the service was available to rural hospitals participating in the study.

Technical requirements specific to home care

The available body of literature indicates that certain conditions must be met in order to ensure that home care delivery occurs properly. Firstly, patients must possess sufficient mental resources and technological skills to operate the equipment (Laflamme et al., 2005). This is especially true in the case of patients who are living by themselves and lack the support of a family member or caregiver to assist them. Home bound or institutionalized patients require the support of a caregiver who can assist them in communicating via videoconferencing (Hauber & Jones, 2002). Technological requirements exist in this context as well. Traditional videoconferencing equipment requires an ISDN connection, which may or may not be available in the homes of home bound patients. Video-telephony, which offers a lower quality image operates over a ‘plain old telephone system’; requires limited technological resources. The typical video-telephony system requires that the home bound patient has a standard telephone line and a television (to project the image) (Arnaert & Delesie, 2001).

Confidentiality Requirements for Clinical Videoconference Applications

Confidentiality is another issue of concern when using telemedicine (Mitchell et al., 2003; Tang Chiu, Woo and Hjelm., 2001). Tang et al. (2001) suggested that informed consent should also include a discussion of possible limitations to confidentiality based on the technology. Moreover, explanation of the videoconferencing equipment and procedures may also ease concerns about privacy or confidentiality a patient may have (Frueh et al., 2000; Major, 2005). Personnel who may be handling confidential material and greeting the patients must be carefully trained in issues of confidentiality. Policies should also be in place to stipulate how to document and store telehealth records. In addition to that, telemedicine services should use secure lines in order to ensure ethical treatment of patients (Health Canada, 2004c).

The environment in which telemedicine occurs must also be controlled to maintain a patient’s confidentiality. Audio in videoconferencing is typically at a higher volume than normal speech and the risk exists for discussions to be overheard (Mitchell et al., 2003). For instance in a study by Simpson, Bell, Knox and Mitchell (2005) some of the sites used were not ideal for therapy purposes because there was a lack of privacy due to a lack of sound-proofing. Rooms used for videoconferencing may lack the warmth and comfort of a typical psychotherapy

room. It is recommended that signs are put up on the doors to indicate a videoconferencing session is in progress (MHECCU, n.d.).

Relationship and Communication Conditions: The Case of Telepsychiatry

Several studies highlight the challenges that videoconferencing may introduce to the therapeutic environment. Onor and Misan (2005) compared the dynamics of doctor-patient interviews conducted face-to-face versus interviews conducted via videoconferencing. The authors assert that in the face-to-face setting, the doctor-patient relationship is influenced by a number of contextual variables such as the physical environment, doctor's clothing and the patient and physicians perspective of the therapeutic environment. The introduction of videoconferencing has altered the setting in which the doctor-patient interaction occurs, reducing both the amount of personal contact and risk of objectifying the patient (Elford et al., 2000; Onor & Misan, 2005).

Relationship and communication factors in telepsychiatry

Therapeutic rapport is very important in therapy and therefore concerns were raised over the ability of the practitioner to establish and maintain rapport with the client in such a technology laden environment (Cowain, 2001; Hilty et al., 2002). Patients have commented that they have felt awkward expressing their emotions via videoconferencing (Mitchell et al., 2003). Facial expressions are more prone to misunderstanding and misinterpretations as reduced resolution of the images can make it difficult to discern expressions and gestures (Kuulasmaa et al., 2004). Verbal communication is also important in telemedicine because it is often difficult to appreciate non-verbal behaviours on the screen. Observations, ideas and opinions should be expressed verbally and the practitioner should try to verbally elicit the attitudes and opinions of their patients in ambiguous situations (Kuulasmaa et al., 2004; Tachakra & Rajani, 2002).

Therapists have also voiced concerns about being able to express empathy and being able to connect with their patients (May et al., 2000; Simpson et al., 2005). Positive utterances should be used by the therapist to convey willingness to listen and empathy. Therapists should also lead the interview and avoid 'dead air' time that may result in anxiety (Onor & Misan, 2005). Discussing technical aspects of videoconferencing can help enhance therapeutic alliance. It is useful to spend sufficient time on discussing such matters at the beginning of treatment to eliminate any hesitancy on the part the patient caused by the presence of the equipment (Chua et al., 2001b; Frueh et al., 2004; Kuulasmaa et al., 2004). In addition, Tyrell et al (2001) stated that if the remote clinician greets the patient by name, introduces him or herself and explains the purpose of the meeting then therapeutic rapport should not be a problem (Tachakra et al., 2001; Tyrell et al., 2001).

Necessary Conditions Related to Organizational Readiness

Jennett, Yeo, Pauls and Graham (2003) defined organizational readiness for telemedicine as related to planning and workplace environment. Four major themes related to telemedicine readiness are strategic planning, needs assessment and analysis, business plan, and leadership readiness.

Strategic planning for managing change

The introduction of telemedicine is often disruptive and intrusive in the work place. The entire organization needs to be receptive to this change; therefore, a change management plan needs to be in place (Jennett, Yeo, et al., 2003). Indeed, resistance to change can be one of the factors that contribute to failure of a telemedicine program. In order for telehealth to be sustainable, considerable ground work is required to engender confidence about the utility of such a service (Hockey et al., 2004). Developing a telemedicine strategic plan indicates planning readiness. In order to understand the client population and their health-care problems, the strategic plan should include a needs assessment and analysis (Health Canada, 2004c; Jennett, Yeo, et al., 2003).

Needs assessment and evaluation grounded in the context

A needs assessment can identify why telemedicine is the best way of meeting the needs of the population (Jennett, Yeo, et al., 2003). In a study by Boydell, Greenberg and Volpe (2004) the importance of being sensitive to the cultural and geographical context in the delivery of telemedicine services is underlined. It is essential to understand the “social ecology” (p. 165) of the community. Contextual factors included location, local availability of services and resources, language and culture, and skill level of service providers. Implementation strategies need to be tailored to environmental conditions of the practice and take into consideration the providers’ perceptions of the technology (Campbell, Harris & Hodge, 2001).

Practical business plan

A business plan includes the levels of detail and comprehensiveness of the program, cost-benefit and financial sustainability. Funding is necessary to support initial costs and to sustain the service beyond implementation (Hilty et al., 2002; Jennett, Yeo, et al., 2003; Tang et al., 2001). Challenges related to practitioner reimbursement (Ellis & Mayrose 2003; Health Canada, 2004c) and inter-jurisdictional licensure (Rogers et al. 2001; Ricci et al. 2003) must be addressed. Policy regarding consultant remuneration should be in place because without it, a telemedicine project is not likely to be sustainable (Fortin et al., 2003; Jong & Kraishi, 2004).

Stakeholder Involvement

It was recommended to include all stakeholders in the development and evaluation of telemedicine programs (Boydell et al., 2004). Moehr et al. (2005) in an analysis of the BC telehealth program identified some challenges that providers faced in incorporating videoconferencing into the EMS work environment. These included a poor fit between the telehealth services provided from Vancouver and the established service patterns of participating rural hospitals to other clinical centres: “When telemedicine applications do not match the needs of users, the equipment is inevitably used badly or abandoned” (Jennett, Yeo, et al., 2003, p. 29).

Champions and leadership

Senior-level administrative support is critical for the success and sustainability of telemedicine services and the development of partnerships (Brebner et al., 2004; Jennett, Yeo et al., 2003). Organizations need to demonstrate their ability to form partnerships, to revise partnerships over time and to develop partnerships in accordance with the scope of telemedicine services (Jennett et al., 2003). Having the support of key individuals can also

help to increase user acceptance. (Leonard, 2004b). Many programs have failed due to inadequate support from program champions (Hilty et al., 2002).

Evidence-based education on the efficacy of telemedicine

Clinicians must be educated about the advantages of clinical videoconferencing in order for implementation to be successful; this was discussed in the context of telepsychiatry (Gelber, 2001; Leonard, 2004a). Reluctance to use videoconferencing needs to be further explored in order to successfully implement videoconferencing in clinical practice (Hockey et al., 2004). The importance of exploring acceptability was highlighted in a study by Grealish et al. (2005), who found that staff were not willing to use telemedicine routinely, despite regular workshops, training on the equipment, and knowledge that patients and their families accepted the modality.

Workplace readiness and staff preparation – staff involvement and ownership in training

Workplace readiness is characterized the ability to implement the planned telemedicine services and the ability to cope with the changes that result from this service (Health Canada, 2004a). Human resources and structural readiness are key components of the workplace environment. Human resource readiness involves preparing staff, having a telemedicine coordinator, and a change management plan (Jennett, Yeo, et al., 2003; LeRouge et al., 2002).

Adequate personnel supported to do their jobs

The importance of having a telemedicine coordinator has been highlighted as a key element of a successful implementation (Health Canada, 2004c; Jennett, Yeo, et al., 2003). In addition, training must be provided to clinicians and technical staff (Frueh et al., 2000; Gelber, 2001; Leonard, 2004a). This was noted in a study by Simpson et al. (2005); oftentimes administrative staff at the remote site had no experience using videoconferencing and had to be instructed step-by-step. Moreover, if the person in charge of the videoconferencing system was on leave, nobody else at the remote site knew how to use the equipment competently. Training and support must be consistently available especially in rural/remote settings with high staff turnover (Watson et al., 2001). When developing a telemedicine program, it is also imperative to make provisions for professional on-site clinical support (Bouchard et al., 2004).

Resolving policy issues

Unresolved policy and funding issues have been stated as significant barriers to the implementation and success of telemedicine (Health Canada, 2004c). Organizational policies also need to be in place to cover: reimbursement of practitioners, liability, jurisdiction, and licensing (Health Canada, 2004c; Jennett, Yeo, et al., 2003). Provincial health care operates on a fee-for-service basis; however, policies for practitioner reimbursement have yet to be fully developed (Health Canada; 2004c). According to Health Canada (2004c), most jurisdictions have policies to reimburse physicians for telehealth; however, these policies are not inclusive enough to fully compensate for the realities of the telemedicine consultation. For instance, the physician payment schedule in the province of Saskatchewan does not include payments to compensate for delays caused by technical difficulties. Although most jurisdictions have policies in place for telemedicine, there is no fee-for-service for videoconferencing in British Columbia or Ontario. Licensing is another issue to be addressed.

Policies need to be in place for cross-jurisdiction licensing requirements (Health Canada, 2004a; 2004c).

Standards and guidelines

In order for videoconferencing to be implemented in the future, guidelines and standards must be established to ensure effective and ethical treatment of service recipients (Hilty et al., 2002; Leonard, 2004a; Monnier, Knapp, & Frueh, 2003). Canadian standards and clinical practice guidelines, as well as best practices for telemedicine need to be developed (Health Canada, 2004c). There are currently no standards for the minimum bandwidth needed for effective transmission. Bandwidth has ranged from 128k/bits to 384 k/bits and studies have used a variety of different videoconferencing systems from PC based to satellite linked.

Organizational conditions related to emergency medicine

In the case of emergency medicine, Brebner et al. (2004) identified organizational requirements for the successful operation of remote emergency systems. In this evaluation of an accident and emergency telemedicine system in Scotland, it was found that workload must be sufficient to maintain the skill and confidence levels of the staff that use the service. There must be a commitment at the main centre for service provision and the videoconferencing equipment must be user-friendly (Brebner et al., 2004; Jennett, Yeo, et al., 2003). The staffing and training implications of treating patients locally as opposed to sending them to the central facility for treatment must be also be addressed (Brebner et al., 2004). Ellis and Mayrose's (2003) evaluation of the SUNY emergency telemedical system highlights the need for the coordination of human resources in service delivery. The authors asserted that one of the greatest challenges in delivering videoconference-based care is related to gaining the participation of multiple practitioners on a 24 hours/seven days a week basis.

In addition to necessary conditions for clinical practice we have outlined certain necessary conditions for videoconferencing for educational purposes. These are discussed in the following section.

b. Necessary Conditions: Education Context

Understanding the Education Cycle: Planning, Delivery and Evaluation

Shershneva and Olson (2005) found that in order to utilize telemedicine more effectively, guidance about how to plan, deliver and evaluate effective learning activities is required. The authors believe that quality standards for education programming. The authors reviewed five sets of standards for education programming in the context of distance education. The objective of the review was to determine the purposes the standards were meant to serve and the processes by which they were established. Three major themes resulted from the analysis: 1) none of the sets of standards addressed all of the issues relevant to telemedicine education; 2) there are some important aspects that are missing altogether including patient confidentiality; and 3) standards generally provide a framework for defining high quality without guidance of how a standard applies in their setting.

Dedicated Technical Support

As technical problems increase so do complaints from program participants (Ricci et al., 2005), therefore it is important to have dedicated technical support (Gaglardi et al., 2003; Allen et al., 2003). Allen et al., (2003) identified the following technical factors as barriers to fruitful discussion in the tele-education context: poor video/audio quality, improper use of microphone muting, and audio lag. Mea et al. (2003) found that minor technical issues can reduce the perceived value of a seminar. If used properly, the inclusion of mobile- and voice-activated cameras can increase interaction (Stain et al., 2005).

VI. Promising Applications

Promising applications are those clinical and educational applications of videoconferencing where the research reviewed demonstrated that as a minimum, they were deemed effective for their intended purpose and met with considerable degree of patient and provider satisfaction. In addition, promising applications included those applications whereby minor changes to the current configuration or environment would facilitate considerable improvement to the existing programs. Finally, promising applications include those that according to the research have the potential for future growth and development based on factors such as patient demographics or health system reconfiguration.

a. Promising Applications: Clinical Context

Improving Access for Providers

Connecting GPs with specialists for consultation

From the studies reviewed, it can be surmised that videoconferencing holds promise for connecting General Practitioners to Specialists in order to consult regarding diagnosis, treatment and ongoing care for their patients (Aarnio, Rudenberg, Ellonen & Jaatinen, 2000; Davis, Howard, & Brockway, 2001; Grutske, Balch, Rogers, & West, 2000; Jong & Kraishi, 2004). However, there is very little evidence to suggest that videoconferencing holds much promise as a means of delivering clinical services from a general practitioner to his or her patients. GPs in Australia for example, preferred the telephone finding it more immediate and convenient to use (Robinson, 2002).

Facilitates immediate feedback in a specialist/GP consult

In many cases, the promise of videoconferencing applications is in the immediate feedback it enables between a specialist and general practitioner (Jong & Kraishi, 2004). In some cases, this immediate feedback reduced the need to transport patients for more definitive care (Brebner & Brebner et al., 2002; Tachakra, Hollingdale & Ucke, 2001; Fortin et al., 2003) and in some cases enabled the specialist to direct the treatment from a distance (Campana et al., 2004; Ricci et al. 2003; Rogers et al. 2001; Tachakra, Jaye, Bak, Hayes, & Sivakumar, 2000).

Augmenting rural and remote emergency services

One particular specialty field where videoconferencing holds promise is Emergency Medicine. Live interactive and, in some cases, on demand videoconferencing provides support to rural and remote generalists for trauma and emergency situations that may exceed local capabilities (Latifi, Muja, Bekteshi, & Reinicke, 2004; Ricci et al., 2003; Rogers et al., 2001).

Improving Access for Patients

Providing access to specialists for patients in rural and remote areas

Videoconferencing reduces time and travel required by both patients and healthcare providers and facilitates access to services, particularly in rural or remote areas (Fortin et al., 2003; Smith, Batch, Lang, & Wootton, 2003; Brown-Connolly, 2002; Marcin et al., 2004). Several of the videoconferencing programs reviewed were created in order to eliminate distance as a barrier to health care, to improve access to specialist services and expertise, and to reduce travel and minimize disruption for patients and their families who otherwise would be required to leave their communities to access care. Videoconferencing holds promise in enabling patient access to specialists who are in limited supply in rural, remote or northern communities for example in dermatology, rheumatology, orthopaedics and neurology. In radiology in particular, videoconferencing has been used to address the current shortage of these specialists (Kaidu et al 2004; Myers, 2005).

Comparable or better than face-to-face for patients

Videoconferencing was found to show promise in physiotherapy as it was preferred by patients over face-to-face service delivery (Russell, Buttrum, Wootton, & Jull, 2004) and patients appreciated the convenience and savings associated with not having to travel to obtain care (Lemaire, Bourdrias, Greene, 2001). Similar findings were apparent in Rheumatology as patients were satisfied with videoconference service delivery finding it comparable to face-to-face (Davis, Howard, & Brockway, 2001). In addition, patients with limited mobility preferred videoconferencing as it reduced much of the frustration and difficulties associated with accessing care (Guest, Rittey, & O'Brien, 2005; Herbert, Jansen Brant, Hailey, & van der Pol, 2004; Valero, Arredondo, del Nogal, Rodriguez, & Frias, 2000). Further, much promise is shown in videoconferencing for language translation and for the hearing impaired (Azarmina & Wallace, 2005; Jones, Gill, Harrison, Meakin and Wallace, 2003).

Patient access to pharmacy service in rural and remote areas

In remote locations without a local pharmacy, videoconferencing facilitates patient access to pharmacy services. The research reviewed suggested that videoconferencing represents a strategy to improve the delivery of pharmacy services for people in remote locations and shows promise in facilitating interactions among patients, dispensing doctors and pharmacists (Nissen & Tett, 2003; Clifton, Byer, Heaton, Haberman, & Gill, 2003).

When rapid access is required...

In addition, videoconferencing holds promise in child psychiatric services which require rapid access to a specialist (i.e., psychiatrist) (Setterberg et al., 2003). Similarly, videoconferencing was found to be promising in other situations that required immediate intervention or diagnosis by a specialist for example, in the provision of stroke care (Schwamm et al., 2004) and in situations where the reliability of an assessment degrades with the passing of time (Foster & Whitworth, 2005).

Enables degree of anonymity for patients in 'close knit' communities

Telemedicine may also provide confidentiality and anonymity for the patient. In small communities, patients may be on familiar terms with the clinician outside of the practice. Telemedicine with a remote clinician may therefore provide greater confidentiality than a face-to-face session (Mitchell et al., 2003; Shore & Manson, 2004).

Telepsychiatry and special populations

The studies reviewed suggested that in telepsychiatry, promising applications include the use of videoconferencing for service delivery with children as they are familiar with the television screen format (Elford et al., 2000; Nelson, Barnard & Cain, 2003). In addition, the use of videoconferencing for psychiatric service delivery to judicial settings like prisons shows considerable promise, as it reduces risks associated with transporting patients in order to access psychiatric services. Inmates have entitlement to mental health services and telepsychiatry can provide these services at a minimal risk and cost to the government and the general population (Zaylor, Whitten, & Kingsley, 2000).

Technological Considerations and Clinical Context: "The Right Tool for the Job"

Diagnostic sophistication and quality of communication for complex dermatology cases

In the field of teledermatology there are two dominant technologies used to deliver services to remote populations -- videoconferencing and store and forward. The reviewed evidence suggests that teledermatology holds great diagnostic potential in the appropriate circumstances. Store and forward technologies are cheaper, require less technological resources to operate than videoconferencing and are more convenient to use (less need to coordinate schedules of participants) and therefore show promise in basic service provision for less complex cases (Eedy & Wootton, 2001). However, videoconferencing is promising in more complex dermatology cases as it offers a superior degree of diagnostic accuracy and provides clinicians with better diagnostic information with which to evaluate patients (Loane et al., 2000; Nordal et al., 2001). Additionally, videoconferencing allows the Specialist, GP and patient to interact simultaneously (Eedy & Wootton, 2001) which, according to patients, improves the quality of the communication (Hicks et al., 2003).

Video-telephony for homecare service delivery

Videoconferencing for homecare service delivery is a promising application as the health care sector strives toward deinstitutionalization of care, increased community and home based care and greater emphasis on patient self-management (Canadian Society of Telehealth, 2000; Mickus & Luz, 2002). The controversy in homecare appears to be which form of audiovisual communication is best suited for the services to be delivered. Video-telephony shows promise because of market factors -- it is cheaper than videoconferencing and commercially available to home care patients (Arnaert & Delesie, 2001). Video-telephony works well to support non-urgent single provider to patient communication, reduce isolation and loneliness and connects patients to their families (Savenstedt, Brulin, & Sandman; 2003) and to their peers (Ezumi et al., 2003).

Real-time video shows promise to facilitate diagnosis and documentation

Specialties that require a high degree of visual acuity like rheumatology require videoconferencing technologies with high bandwidth (Graham et al., 2000). Likewise, it was found that for more complex or demanding cases in Orthopaedics real-time videoconferencing was preferred over asynchronous methods and physician confidence in diagnosis was higher with videoconferencing over asynchronous modes (Baruffaldi, Gualdrinin, & Toni, 2002). Telepathology, which employs the use of real-time video streams from gross examination and microscopy does not save time but does show promise for documentation, second opinions and education (Hutarew, Dandachi, Strasserm, Prokop, & Dietze, 2003).

Chronic disease management and team-based care

The incidence of chronic diseases like diabetes, chronic obstructive pulmonary disease (COPD) and certain cancers is increasing, resulting in a growing need for multiple care providers to be involved in the patient's ongoing care and management. Several studies demonstrated that videoconferencing has the potential to facilitate coordination among multiple care providers, to support interdisciplinary case management, and enables care providers and the patient to be together (Axford, Askill, & Jones, 2002; Chan, Woo, Hui, & Hjelm, 2001; Gelfand et al., 2003; Halamka, 2001; Vontetsianos, Giovas, Katsaras, Rigopoulou, et al 2005; Wilson, Marks, Collins, Warner, & Frick, 2004). Overall it would appear that the use of videoconferencing in chronic disease management appears to mirror the movement toward inter-professional clinical service delivery in these areas.

Supports multidisciplinary practice in homecare and long term care settings

Videoconferencing appears to be a promising application to support multi-disciplinary care coordination in homecare or long term care settings (Arnaert & Delesie, 2001; Chan, Woo, Hui, & Hjelm, 2001; Vontetsianos et al., 2005). In addition, videoconferencing enabled nurses and other care providers to help families manage care for their children or relatives who require ongoing care at home as a result of traumatic brain injury or chronic disease (Hauber and Jones 2002; Morgan, Grant, Craig, Sands, & Casey, 2005). In addition, videoconferencing holds promise in acute care settings, in advanced trauma life support in particular as it was found to help coordinate delivery amongst care (Rogers et al. (2001).

b. Promising Applications: Education Context

Building Familiarity Through Education; Extracting Learning Opportunities from Clinical Experiences

Extant videoconference educational activities are led primarily by academic or tertiary care institutions in the form of continuing medical education (CME) and are generally well accepted (Allen et al., 2003; Klein, Davis, & Hickey, 2005; Ricci et al., 2005). Most programs are aimed at physicians (specialist, general practitioners and medical student trainees) although there are an increasing number of programs for continuing nursing education, allied health professional and interprofessional education. Overall, the educational value is noted ahead of that of clinical applications in many videoconference systems (Watson, Glasser, &

Blignault., 2001; Cohn & Goodenough, 2002). It was also noted that the line between clinical and education services is often blurred (Health Canada, 2004c). This sentiment was supported by studies that found that videoconferencing for clinical applications often resulted in educational opportunities (Tachakra, Hollingdale, & Ucke, 2001; Bowater, 2001).

Enhancing Continuing Professional Development Opportunities

Continuing Professional Development in the practice environment

A promising videoconferencing application is for educational in rural areas to connect small numbers of physicians for interactive CME and overcome barriers related to distance and geography, thereby facilitating access to education that might otherwise not be available (Callas, Ricci, & Caputo, 2000; Ricci et al., 2005). However, rural physicians in particular, preferred face-to-face CME due to the greater degree of interaction (Davis & McCracken, 2002; Krupinski, Lopez, Lyman, Barker, & Weinstein, 2004). Videoconferencing supports learners in their practice environment (Lynch et al. 2004) and enables communities of practice (Smith, Batch, Lang, & Wootton, 2003).

Communities of Practice (e-communities of practice)

In most of the studies reviewed, learners were generally satisfied with their videoconference based education experiences (Gagliardi, Smith, Goel, & DePetrillo, 2003; Mea et al., 2003; Loewen, Seshia, Askin, Cronin, & Roberts, 2003) as long as the sessions were interactive, relatively free of technological difficulties and of high quality (Klein, Davis, & Hickey, 2005; Himpens, 2003b, 2003a; Stain et al., 2005). Videoconference based medical education holds promise as it was found to create communities of practice (Gagliardi et al., 2003) and facilitate the delivery of education at the point of care that was relevant to daily practice (Abrahamian, Schueller, Mauler, Prager, & Irsigler, 2002).

Health and Professional Contexts – Promising Educational Applications

Nursing Context – education without travel

The studies reviewed with respect to continuing nursing education suggested that videoconferencing is acceptable to nurses. Many of the studies reviewed suggested that the main benefit of nursing education via videoconference is to enable nurses to continue their education without having to travel or relocate (West, Adams, O’Sullivan, Hall-Barrow, & Hine, 2004).

Community Health Education – empowering patients

Evidence is limited to three studies but these studies do suggest that videoconferencing extends the boundaries for disease self management in chronic diseases like diabetes and asthma (need cites). The potential to empower patients in their own health care, who might not be otherwise able to access health education, holds much promise.

Psychiatric Education – potential to promote team building

The effectiveness of videoconferencing for continuing education in psychiatry and mental health is currently overlooked in the research literature. Many studies reported that

videoconferencing was used for educational purpose in mental health it has not been extensively evaluated. It does hold promise however. Telemedicine programs in British Columbia, Saskatchewan, the NWT, Yukon and Nunavut have reported that education services constitute their main telemental health focus (Health Canada, 2004c). Videoconferenced education in the mental health field was found to promote team building (Cornish et al., 2003; Mitchell et al., 2001), be comparable to face-to-face education, (Haythornthwaite, 2002; Rees & Gillam, 2001) and improve knowledge (Rees & Gillam, 2001).

Surgical Training –the virtual operating room

Evidence from five studies suggested that using videoconferencing to provide education and training to surgical residents is a promising application and will in fact stimulate important changes in surgical education (Mutter, Bouras and Marescaux 2005). The technology enables students to receive interactive lectures at their clinical practical site eliminating the need to travel to academic centres. Like other fields requiring a high degree of visual acuity, high video quality (and therefore bandwidth) is essential for this application. Obviously, as surgical trainees require ‘hands on’ practical training to ensure clinical competence, videoconference-based education is recommended to augment other training modalities, not fully replace it.

Emergency Medicine–‘just in time’ learning.

Videoconferencing has been demonstrated to facilitate ‘just in time’ learning for remote practitioners providing emergency care when certain cases exceed local capabilities. Through the process of generating diagnosis with an expert consultant remote clinicians were able to learn how to treat more complex cases. The corollary of this increased knowledge was an expanded role for remote practitioners and a subsequently decreased need for further consultations (Brebner et al., 2004).

VII. Aboriginal Context

According to a report by the First Nations and Inuit Health Branch (2002), First Nations and Inuit Communities are well suited to realize the benefits of information communication technologies like real-time interactive videoconferencing that deliver health care over distance. There are currently 6 telehealth networks across Canada providing services to First Nation and Inuit Communities, two of which are First Nation specific. As they have been in non-aboriginal communities, these programs have been beneficial in improving access to specialists, reducing travel and costs for patients to access care. However, there are a number of challenges related to infrastructure, organization and jurisdictional limitations which must be addressed in order to expand telehealth in remote Aboriginal communities.

From the evidence reviewed it would appear that successful telehealth programs in Aboriginal communities occur when programs are designed to meet specific needs identified by communities. This has been clearly demonstrated by the success of several telemental health programs for Aboriginal populations (Health Canada, 2004c). In addition, successful programs were found to start with small targeted programs to meet identified need and expand gradually (Reynolds, 2005).

Some of the most interesting findings regarding the use of telehealth (including videoconferencing) in Aboriginal communities in Canada were identified by the National First Nations Telehealth Research Project (First Nations and Inuit Health Branch, 2002). Five

Canadian First Nation and Inuit telehealth pilot projects ran from 1998-2001 and were evaluated in order to guide future telehealth development in Aboriginal communities. The key to successful telehealth implementation in Aboriginal communities was found to be dependent upon human factors. For example, its acceptance by patients, providers and families was dependent upon the commitment and capacity of individual people involved in the projects, and the presence of stable and committed staff throughout the implementation period. Others (Muttitt et al., 2004), suggested that successful implementation in Aboriginal communities will occur when there is full and seamless integration of telehealth as part of the healthcare system).

Other common misunderstandings about telehealth's potential in Aboriginal communities were also identified in this report (First Nations and Inuit Health Branch, 2002). For example, the net effect of telehealth is to generate care and therefore it generates costs. It should not be expected then to save costs, as it is often purported to do. Secondly, several reports including the Romanow report (2002), have proposed that telehealth represents a potential means of addressing some of the difficulties that many northern and First Nation communities have with respect to stable and adequate human resources. However, the First Nation pilot studies demonstrated that telehealth, like any other form of health care, is not immune to existing instabilities in First Nations health services delivery. Therefore, telehealth programs and services will need to address the broader situational factors that contribute to high degrees of staff turnover in these communities.

Finally, it has been proposed that an Aboriginal Health Infostructure be developed that is strategically interconnected to Health Canada Infoway, yet autonomous and distinct, and consistent with Aboriginal interests (Advisory Council of Health Infostructure, 1999). However, the Tactical Plan for a Pan-Canadian Health Infostructure released in 2000, and its subsequent update in 2001, was devoid of Aboriginal input according information posted on the National Aboriginal Health Organization website (National Aboriginal Health Organization, 2005). Consequently, in 2001, FNIHB invited Aboriginal leadership organizations to begin planning the Aboriginal Health Infostructure. Work of this committee made up of representatives from the Assembly of First Nations, Inuit Tapirit Kanatami, the Metis National Council, FNIHB and National Aboriginal Health Organization, is ongoing. In 2002 the F/P/T Advisory Committee on Health Infostructure was replaced with the F/P/T Advisory Committee on Information and Emerging Technologies (ACIET) and for the first time included an Aboriginal representative. A presentation of the draft AHI Blueprint and Tactical Plan was made at ACIET's first meeting. However, at the June 21-22, 2005 meeting, the Federal/Provincial/Territorial Conference of Deputy Ministers of Health, the Ministers agreed to make the Advisory Committee on Information and Emerging Technologies and all of its priorities dormant (Health Canada, 2005).

In conclusion, results of pilot studies and ongoing telehealth program suggested that telehealth can be successfully implemented in First Nations communities, bringing with it improved access to care, and facilitating community capacity to undertake major health initiatives. However, the greatest challenge facing further development of telehealth in Aboriginal communities in Canada is the need for a concerted approach to health infostructure development, one that emphasizes coordination, linkages and leveraging of investments and takes into consideration unique federal/provincial/Aboriginal jurisdictional issues (First Nations and Inuit Health Branch, 2002).

VIII. Patient Perspectives

Research suggests that high levels of patient satisfaction with videoconference based care delivery were demonstrated across the various health care fields examined. The audio and video quality of videoconferencing was demonstrated to be of sufficient quality to facilitate communication without eroding the relationship between the patient and provider (Guillen et al., 2002; Valero et al., 2000). The literature revealed that patients generally felt that they were able to establish a personal connection with their provider through videoconferencing (Bose, McClaren, Riley, & Mohammedali, 2001; Bratton & Cody, 2000; Hicks et al., 2003). Similarly, a number of studies involving psychiatric patients pointed to the potential of videoconferencing to promote a 'therapeutic alliance' between patient and practitioner (Bouchard et al., 2004; Day & Schneider, 2002).

A second pertinent theme that emerged from the literature was that patients valued videoconferencing because it often offers a more convenient and cost effective method of accessing care than traveling for face-to-face care. Videoconferencing has been demonstrated to reduce travel (Ohinmaa, Vuolio, Haukipuro, & Winblad, 2002; Wootton et al., 2000) and save costs associated with accessing care for patient populations, all while decreasing the time required to receive a diagnosis (Fortin et al., 2003). These effects are dramatically pronounced for individuals living greater distances from major care centers (Persaud et al., 2005). In some cases, patients who live far away from care centers stated that their alternative to videoconference based care was to not access care at all. This highlights the importance of providing access to services via videoconferencing in remote settings (Davis, Howard, & Brockway, 2001; Simpson, Doze, Urness, Hailey and Jacobs, 2001b). Additionally, videoconferencing enabled home bound patients and those in isolated communities to receive greater continuity of care, which would not have been otherwise possible (Hui & Woo, 2002; Nguyen et al., 2004; Young et al., 2004). This increased frequency of televisitation from a care provider was demonstrated to improve patient health and decrease subsequent hospitalizations (Chumblor et al., 2005).

Videoconferencing appears to positively impact the interactions of patients and health care providers. Patients in Psychiatry pilots have stated that videoconferencing encouraged a greater degree of 'turn taking' than is evident in conventional communications (due to the audio delay) (Deitsch, Frueh, & Santos, 2000; Kuulasmaa et al., 2004). Videoconferencing based communication empowered patients in their interactions with caregiver as well, as they had the ability to remove themselves from the communication at any point if they felt vulnerable (Grealish et al., 2005). Additionally, patients indicated that when accessing specialty services, having their GP present in the video-conference resulted in a more thorough and patient centered dialogue between them and their specialist than that of a face-to-face consultation (Nordal et al., 2001). Finally, video-conferencing provided patients with a greater degree of privacy and anonymity than face-to-face consultations as they were not required to be physically present in their physician's office (Mitchell et al., 2001; Shore & Manson, 2004)

Videoconferencing provides some additive benefits (above face-to-face care) for home bound populations as well. Several studies highlight the fact that videoconferencing served to reduce feelings of loneliness and isolation for home bound populations by connecting them with their caregivers (Arnaert & Delesie, 2001), family (Mickus & Luz, 2002) and similar others

(Ezumi, et al., 2003). The available evidence suggested that meeting the health needs of this ever growing demographic could best be achieved virtually.

Poor patient receptivity to the use of videoconferencing in health care provision was a salient theme in the reviewed literature. Some patients (almost exclusively elderly patients) were less receptive at the outset due to general unfamiliarity with the equipment and distrust that the equipment would adequately facilitate interaction with their care provider (Guillen et al., 2002).

However, the literature demonstrated that patients become more accepting of videoconferencing with increased exposure (Finklestein & Speedie, 2004).

IX. Policy Implications

The role of policy in telemedicine is vital to its sustainable development. When a patient is being treated by several health care providers via videoconferencing, his or her personal information becomes available to many people such as the physicians, nurses, technicians, etc. Policies and guidelines ensure that this information is not misused. Another role of policy relates to the situation created by telemedicine in which patients could be treated by physicians who are in a different state or province from the patient. This gives rise to questions about licensing, and whether that physician is licensed to practice in the state or province where the patient is located.

Von Tigerstrom (2000) examined how policy relates to telehealth in Canada. In videoconferencing, it is vital to ensure privacy and that participants' personal information is always protected. An appropriate legal regime protecting privacy of personal information is an important element in assuring public confidence in telehealth initiatives while at the same time avoiding undue restrictions or difficulties for those implementing these technologies. In Canada there are several sources of legal protection of personal information but there is increasing emphasis on legislation. Bill C-6, the *Personal Information Protection and Electronic Documents Act* was recently passed by the Canadian House of Commons. It is expected have a significant impact on the way personal information, including health information, is handled in the private sector. The successful development of telehealth depends partly on the establishment of an appropriate legal and policy framework, particularly in the area of patient privacy. The lack of adequate safeguards to protect the confidentiality of personal health information has been identified as one potential barrier to telehealth. An appropriate legal environment and technical and institutional security measures are important components in a strategy to ensure confidentiality and foster public confidence.

Privacy is protected by law in several different ways in Canada. Although there is no explicit right to privacy in the Canadian constitution, privacy rights have been recognized by the courts under specific sections of *the Canadian Charter of Rights and Freedoms*. Canadian courts have also recognized legal duties of confidentiality with respect to health information in certain contexts. Physicians and other health professionals are bound by ethical obligations which are monitored and enforced by professional regulatory bodies. For example, provincial and federal legislation also plays a role in protecting health information privacy. These legal and ethical constraints are effective in many circumstances, but their scope is limited. In the modern health-care system, a large number of people may have access to an individual's health information, and telehealth often increases this number. Besides the larger group of health professionals who may be granted access, there may be technical personnel and other

staff as well. The *Personal Information Protection and Electronic Documents Act* (2000) codifies the concept of informed consent as applied to personal health information. The participant should consent both to the treatment or the procedure, and to the individual health-care provider who will be treating him or her. This requirement deserves particular attention in the context of telehealth, where technology may make it possible to assemble a team of health-care providers, some of whom the patient has never met or even heard of.

Dunn (2004) noted that new legal issues are constantly arising as the use of information and communication technology in medicine increases in Canada. Cross-jurisdictional practice is the primary cause, with issues arising because of different regulatory environments. Licensing, the right to reimbursement, and privacy concerns all have the potential to hinder the expansion of telehealth. He states that three issues hinder the expansion of telehealth:

1. Licensure and the cross-jurisdictional regulation of practice and standards;
2. The right to reimbursement for services rendered; and
3. Patients' rights and attitudes with regard to privacy.

Dunn mentions that 50 per cent of American jurisdictions have addressed the issues of cross-border licensing. There is no consensus in Canada whether patient care takes place at the patient's location or the health care provider's location. In the absence of inter-jurisdictional agreement, the physical location of the patient at the time of the interaction is likely to remain a key factor in determining the applicability of local licensing.

Another example of this issue is highlighted in the U.S context. Silverman (2003) examined the barriers to telehealth and found that telemedicine and e-medicine have the potential to transform medical practice. However, while the benefits have long been known, many physicians and health systems have been reluctant to engage in such practices due to unresolved legal and ethical concerns. This research was a systematic examination of US and European statutes, regulations and civil, criminal and administrative decisions pertaining to telemedicine and e-medicine, as well as a review of the ethical, legal and medical literature pertaining to the practice of telemedicine and e-medicine in the US and Europe. The lack of generally agreed interstate and international standards of law and ethics means that telemedicine and e-medicine will continue to struggle to gain widespread support from providers, patients and regulatory bodies as an acceptable means of health service delivery.

Silverman (2003) writes that there are four areas presenting obstacles to the widespread delivery of health services through electronic means:

1. Establishment of a doctor-patient relationship, particularly online, and the need for agreement on what constitutes informed consent in an online relationship;
2. Medical malpractice, licensure and disciplinary concerns surrounding telemedicine and practice in cyberspace;
3. Standardization of practice and patient privacy in e-medicine (including doctor-patient email messages) and telemedicine; and
4. Reimbursement for telemedicine and Internet medicine exchanges.

With regard to malpractice suits, few, if any, civil lawsuits alleging substandard medical care during e-medicine or telemedicine interactions have arisen in the US. However, while the grounds for such a lawsuit remain somewhat speculative, the risks of a suit arising out of such interactions are very real. It is unclear whether physicians would be protected under malpractice insurance policies for allegations arising out of online or telemedicine care.

Brebner, Brebner and Ruddick-Bracken (2005) examined guidelines in the context of telemedicine utilization in Scotland. Implementation projects conducted were only partly

successful. Factors that contributed to failure included that the service was not needs-driven, and there was very little commitment to provide the service. Other factors contributing to failure were poor communication, lack of training, and unresolved technical difficulties. Projects were likely to fail when work practices were not updated to accommodate the changes associated with the introduction of telemedicine along with a lack of a suitable exit or transition strategy after research funding expired.

With regard to cost-effectiveness, the authors state that it is vital to determine the costs involved in establishing and maintaining a telemedicine service. A clear commitment to meet these costs is imperative. The costs include: hardware, software, line charges, maintenance, accommodation, administration and staff. It is also essential to provide sufficient staff training. The authors suggest conducting appropriate skills training for clinicians so that they become proficient in telemedicine. It is important that personnel have the opportunity to develop their skills with ongoing practice and training. Staff should be properly trained in how to operate the camera, audio and document cameras, and how to use the equipment effectively for consultation, administrative purposes and education.

Loane and Wootton (2002) conducted a review to establish the range and scope of current telemedicine guidelines and standards in Australia. The authors state that the aim of guidelines in health-care is to promote best practice and to improve the consistency and efficiency of health-care, based on scientific and clinical research. Guidelines are systematically developed statements to help practitioners and patients make decisions about appropriate health-care for specific clinical circumstances. Guidelines are a tool to aid decision making and have undergone extensive evaluation before implementation. As the interest in telemedicine techniques increases, guidelines describing best practice are becoming essential in order to provide appropriate and effective health-care. Yet do telemedicine guidelines exist?³ As telemedicine expands in the future, it is vital that policies and guidelines be developed along with the advances being made by telehealth. This will ensure that the system is not abused, and that the people who use telemedicine technology will be held accountable.

X. Financial Implications

Videoconferencing has proved to be a blessing for people who live in rural and remote communities, as it makes healthcare more easily available to them. Another benefit is that it is more economical than conventional face-to-face consultations. The evidence companion to this document evaluates several studies conducted in Canada and overseas, which indicate that videoconferencing is cost beneficial.

In a study conducted in Northern Ireland by Wootton et al. (2000), the authors discovered that videoconferencing is dramatically cheaper for patients, and becomes increasingly cost effective with greater distance, as it allows them to receive care within their own community, which reduces the travel and extensive time off work that would be associated with travelling great distances to receive face-to-face consultations. Persaud et al. (2005) conducted a study in Nova Scotia, and noted that when comparing telehealth to face-to-face treatment, shows that if cheaper equipment was purchased, and the travelling distances were

³ A formal Medline search was conducted to identify articles containing the term 'telemedicine guidelines' in the title. The Medline search produced 10 articles. So this is an area which will need to be developed in the future.

greater, tele dermatology would be a cost-effective alternative to conventional care. This illustrates the effect that equipment costs and travel distance can have on an economic analysis of telehealth applications.

In an Australian study, Smith, Youngberry et al. (2003) compared the costs incurred by families attending outpatient appointments at the Royal Children's Hospital (RCH) in Brisbane with those incurred by families who had a consultation via videoconference in their home region. In each category, 200 families were interviewed. The median time spent travelling for videoconferences was 30 minutes compared with 80 minutes for face-to-face appointments. Families interviewed in the outpatient department had travelled a median distance of 70 km, while those who had a videoconference at the local hospital had travelled only 20 km. Consequently, it cost these families much more to attend an appointment at the RCH than to attend a videoconference. More families who attended an outpatient appointment at the RCH had to take time off work to attend their appointment. Of the 200 families interviewed at the RCH, 83 family members reported that they had taken time off work or rearranged their schedule to attend the appointment. In comparison, 43 family members who attended an appointment via videoconference reported that they had taken some time off work. The average time spent away from work for families seen face-to-face was seven hours, compared with four hours for families seen via videoconference.

Ninety-six per cent of participating families (n=193) reported the following in terms of expense: One-hundred and fifty of the families had expenses related to parking; 156 had fuel expenses; and 122 reported costs related to meals purchased at the RCH. Only 21 families who had their appointment via local videoconference reported any additional costs. Specialist appointments via videoconference were a more convenient and cheaper option for families living in regional areas of Queensland than the conventional method of attending outpatient appointments at the specialist hospital in Brisbane. The results show that, in Queensland, outpatient appointments conducted via videoconference were less costly for families compared with the conventional method of attending outpatient appointments at the specialist hospital.

In a Canadian telepsychiatry study, Elford et al. (2001) conducted a cost analysis in Newfoundland and concluded that when analyzing costs for videoconferencing, several issues need to be balanced. Even though this study revealed that videoconferencing was slightly less expensive than travelling, one needs to take into account several other factors. For instance, if patient volumes increased then the average cost per patient for telepsychiatry would decrease. Costs would decrease because certain costs such as installation costs of workstations are fixed costs and the average estimated cost would not increase as patient numbers increase. Conversely, if patient numbers decrease, the average cost would increase per patient. Overall, the authors concluded that when policy makers want to know if telepsychiatry is a less expensive way of providing mental health services, the answer really depends on several variables. These variables include: infrastructure costs, operating costs, cost of travel and volume of patients. A balance needs to be reached by taking into consideration all these factors. The financial aspect of videoconferencing is a core feature of a successful telehealth system. This section has been discussed in more depth in the evidence companion.

XI. Conclusion

The overarching purpose of this literature review is to provide British Columbia's health policy makers, health administrators and health professionals with an evidence-based foundation for informed decision-making about videoconferencing for telehealth. This has been accomplished through the presentation of literal findings in the Evidence Companion with a synthesis outlined in the Primary Document. One must note that there is a vast amount of published and unpublished literature pertaining to videoconference-based telehealth applications. For the purposes of this literature review findings discussed are specifically based on the last five years of both published and grey English language literature. This review targeted the educational and clinical literature connected to the use of videoconferencing. Given these parameters there may be certain literature areas that were not uncovered. For example, in the field of radiology, most of the research connected to the use of videoconferencing happened prior to 2000 and therefore the literature prior to that has already drawn conclusions on the appropriateness of videoconferencing (as compared to store and forward technology). Alternatively, for other clinical specialty areas the use of videoconferencing is early in its development and therefore little published literature exists (e.g. pharmacy).

Another caveat the reader should be aware of is the publication bias that exists in peer reviewed literature. Of the reviewed literature, a bias exists in that for the most part only positive results and experiments have been reported (Pesämaa et al, 2004). Grey literature was used to compensate for this bias, however, information from grey literature (i.e., unpublished project reports, government websites, etc.) may also be politically biased to reflect the views of those funding the project. The final caveat to note is related to the cataloguing of published and grey literature. The combinations and permutations of how each database treats literature related to both videoconferencing and telehealth creates search confusions. To overcome this issue, searches were exhaustive in all aspects of known terms. However, there may still be terms which were not uncovered that would have led to other literature in this area. Each formal database catalogues literature according to its own parameters. In most cases, these may be similar enough to account for all the pertinent literature but one cannot assume that this search term variability could inevitably lead to overlooked articles. In the case of the grey literature the ability to search and find all relevant pieces of information is further exacerbated by the fact that no formal database exists for this type of information.

These caveats simply provide the reader with the contextual limitations of the current literature review. However, this comprehensive review is also able to outline some of the gaps discovered in the literature that lead to understanding 'what we still need to know?'

The first major gap that was identified in this literature review is connected to outcome data and reporting. For example, research on patient health outcomes has been lacking. Patient and provider satisfaction in most cases becomes the de facto measure when health outcomes are unable to be investigated. This is usually due to the short research timeframes and inability to control for other variables which may impact health outcomes. While health outcomes is a more difficult construct to research, studies on long term outcomes need to be conducted in order to evaluate the reliability and suitability of telemedicine in specific fields (Brodey et al, 2000; Leonard, 2004a). For instance, in the field of telepsychiatry, the majority of studies measured satisfaction levels and only a few studies examined therapeutic rapport

(Bouchard et al., 2004; Day & Schneider, 2002; Manning et al., 2000). It is important to address which patients show the greatest improvements over time and which interventions are associated with said improvement (Bouchard et al, 2004; Zaylor et al, 2001).

Another apparent gap in the research for clinical applications is investigations into why practitioners are reluctant to use videoconferencing. Reluctance issues and the concerns of practitioners needs to be further explored in order to successfully implement telemedicine into the routine clinical practice (Hockey et al, 2004). Two of the studies reviewed have also proposed that a novelty effect may have affected the acceptability and satisfaction levels of participants (Bouchard et al, 2004; Hildebrand et al, 2004; Nelson et al, 2003). Long term outcome data can also help determine if a novelty effect affects responses from participants. Implementing treatment before establishing the efficacy of videoconferencing through randomized controlled trials can have serious consequences. Researchers should therefore be rigorous in testing treatments prior to exposing patients to videoconference based interventions. (Nelson et al, 2003).

This lack of objective data is also present in the educational literature related to videoconferencing. In most cases, the effect of education has been measured through self-report. Despite these encouraging results from learner satisfaction studies, there is a paucity of data regarding the impact of videoconference based education on measurable knowledge change. More 'commitment to change' studies must be carried out in order to fully assess the impact this educational delivery modality has on learners. Comparisons between participants who accessed training face-to-face and those who accessed training via videoconferencing also needs to be conducted in order to determine whether or not training via videoconferencing is comparable to face-to-face training. Another notable gap in the evaluation of videoconference based education is the assessment of the quality of education. Presenter evaluations must be incorporated into the evaluation of an educational program in order to determine how presenter characteristics affect participant perception.

Related to the issue of outcome data is the methodologies that are employed to study both clinical and educational applications of telehealth. For example, Pesämaa et al (2004) concluded that well designed and properly controlled trials are required to evaluate the clinical value of videoconferencing. The frequent use of a case study design and the lack of controlled studies may mean that some of the possible negative aspects of videoconferencing may have been overlooked (Alessi, 2000; Frueh et al, 2004). Although preliminary findings suggest that videoconferencing is reliable and feasible there is a lack of randomized control trials in the literature on the videoconferencing (Alessi, 2000; Nelson, 2003; Pesämaa et al, 2004). In addition, the majority of studies often have used small sample sizes, conclusions in these studies therefore may not be generalizable to the general population (Dobscha et al, 2005; Hildebrand, et al, 2004; Morland et al, 2004; Poon et al, 2005; Simpson et al, 2005).

Another example, of how methodology affects research outcomes is related to the field of telehomecare where the goal is to objectively improve patient well being. However, the majority of the reviewed studies relied on patient and provider satisfaction ratings to determine the clinical efficacy of virtual interventions in the treatment of home-bound populations and nursing home residents. Larger studies are needed to demonstrate the impact of telehomecare on quality of care and cost-effectiveness (CSTH, 2000). The controversy in telehomecare appears to be which form of audiovisual communication is best suited to the services to be delivered. Various technologies have been researched including videophones, which operate over a 'plain old telephone system' (POTS) and videoconferencing, however

there were no studies identified that compared these systems. Future research should aim to elucidate the comparative cost effectiveness of videoconferencing and video-telephony application in order to determine which application is most appropriate for home care service delivery.

A final issue related to the question of methodology is the lack of evaluation frameworks to assess and evaluate telehealth initiatives. This is due in part to a project based approach in implementing videoconferencing applications rather than a coordinated effort (i.e., grassroots vs. high level policy implementation). Given this limitation, projects and their evaluations exist in isolation. The Health Telematics Unit at the University of Calgary is one example of a group trying to coordinate common evaluation principles to overcome this issue. Through their National Telehealth Outcome Indicators Project they are attempting to create a Canadian consensus approach to the identification and definition of outcome indicators for the evaluation of telehealth.

This gap in the research is also related to another broad issue of policy impact. Studies have brought to light (e.g., Moehr et al, 2005) the need for more research to focus on the jurisdictional issues related to videoconferencing as it applies to clinical practice. One of the clear advantages of using videoconferencing to provide care is its ability to span geographical distances. Of course, in terms of health care this is also one of its major obstacles. Future research needs to focus on how to overcome the jurisdictional barriers that are created when e-consultants are not part of the same practice context as patients and providers. This area of accountability has been overlooked in most project related applications of videoconferencing and is an important issue to be considered in the future.

A specific gap in research is directly related to researching the use of videoconferencing in the Aboriginal community context. Like in all other jurisdictions, research results have shown promise in increasing patient access to specialized services as well as reducing travel time for both patients and providers. While projects are being established in Aboriginal communities, there is still a lack of published research. As recently as December 5th, 2005, the KO Telehealth Network in Northwestern Ontario has established an Aboriginal Telehealth Research Institute. The hope is that these kinds of centres will become the incubation ground for new Aboriginal telehealth research.

Finally, coordination is a gap in the research spanning 2000-2005. As interest in telemedicine techniques increases, guidelines describing best practice are becoming essential in order to provide appropriate and effective health-care. For example, formal Medline search was conducted to identify articles containing the term 'telemedicine guidelines' in the title and search produced only ten articles. Guidelines describing best practice will need to be developed in the future. The field is growing and the need for coordinated efforts in understanding, implementing, sustaining and improving videoconferencing for educational and clinical purposes is upon us. Research needs to reflect this shifting landscape and be prepared to provide evidenced based outcomes in order to assess the effectiveness of policy decisions and their impact on future considerations.

