

**IDENTIFICATION OF BEST PRACTICES
FOR EVIDENCE-BASED TELEHEALTH
IN BRITISH COLUMBIA**

Evidence Companion

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INTRODUCTION TO THE EVIDENCE COMPANION

As indicated in the Primary Document, 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. Published literature pertaining to videoconference telehealth applications was identified via a systematic search of databases (Appendix A). 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. There are many specialty fields, but our search for videoconferencing applications covered just some of the fields. 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, and 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 In addition, grey literature including policy documents, unpublished reports and conference proceedings were included.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, were “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.

CLINICAL CONTEXT

I. Introduction

This chapter is the “**Evidence Companion**” for the clinical telehealth applications of telehealth component of this literature review report. For each component of the report, the evidence companion is a comprehensive repository of findings for each area of the literature investigated. This is intended to be used in reference to its respective component in the **Primary Document**. The Primary Document provides a synthesized report of findings across the bodies of evidence reviewed. This clinical applications component contains an intact report of findings for each clinical context investigated – a first level of synthesis that provides in-depth information for each clinical context.

This chapter is organized according to the following clinical contexts: General Practice; Specialist Services; Psychiatry; Nursing; Allied Health Professions; Interprofessional Contexts and Emergency Medicine Services. In addition, there is a special section dedicated to Language Interpretation. Where applicable, findings for a particular clinical context are presented in pertinent categories. For example, the Psychiatry context covers the following: general therapy; child psychiatry; geriatric psychiatry; prison system services; treatment of eating disorders; and post traumatic stress disorder. For a complete listing of subsections, please refer to the table of

contents on the first page of this document. Clinical context sections each include an introduction, a presentation of findings, as well as summary/synthesis of findings in terms of impact factor or implications.

II. General Practitioners

This section deals with the use of videoconferencing for general practice clinical service delivery. These few studies highlight the role of videoconferencing to bridge geographic distance and support general practitioners in remote or isolated areas who may be the sole care provider with limited support of additional health care providers. Typically, general practitioners use videoconferences to consult with specialists, to access continuing medical education (which will be discussed in subsequent section) but less often, as a means of providing services to their patients except for patients with specific demographic characteristics.

Bowater (2001) described his use of a telemedicine program as a rural practitioner working alone in a Western Australia mining community over a two year period. A real-time video link to specialist offices in Perth was achieved using standard commercial equipment connected by ISDN at 128 kbit/s. Ninety teleconsultations were carried out over the two year period, about 1/3 of which were ophthalmology consults to a specialist in Perth. In over 75% of the teleconsultations, patient transfers to Perth were avoided. The videoconference consultations also enabled the author to improve his professional skills. The author added that enthusiasm on both ends of the connection was required to make the process work.

Gustke, Balch Rogers and West (2000) collected demographic and descriptive variables about providers, patients and consulting physicians who used real-time interactive teleconference clinical consultations (ITCCs) in rural areas and compared those to patients and physicians receiving face-to-face services delivery at the Brody School of Medicine, East Carolina University. Evaluation forms were completed after every consultation from rural practitioners requesting consultations (n=76), consulting physicians (n=40) and patients (n=495). There were no significant differences in age or sex between referring practitioners and practitioners in the region. There were no age or sex differences in physicians who provided face-to-face services versus those referring patients for ITCCs. Of those patients and providers who took part in ITCCs, the majority of the referrals (65.2%) were made to obtain a second opinion and 15 % were made to establish a diagnosis. The most frequent consultations were in dermatology (33%), allergy (21%) and cardiology (18%). However, with respect to patients, there were highly significant differences between ITCC patients and patients who received face-to-face services at the university. ICTT patients were more likely to be minorities, under 10 or over 59 years of age, female and either without insurance or Medicaid. Referring practitioners reported that few of the patients' needs could have been met in their offices (only 5.2% would have been treated by the practitioner making the referral). The authors concluded that ITCCs enable access to health care for patients whose age and economic situation might otherwise restrict access.

Watson, Gasser, Blignault and Collins (2001) described a telehealth program using videoconferencing to facilitate the delivery of health and other services to 21 mostly rural communities in northern Queensland Australia. A total of 197 hours of videoconferencing was

recorded at 10 of the remotes sites over 12 months. Highest usage was for educational purposes. Clinical activity only accounted for 10% of total usage. Of the clinical consultations, most occurred in three communities where general practitioners (GPs) were located. Pediatrics, mental health, surgical and general medicine used videoconferencing the most. Highest usage occurred in communities with the largest population and highest level of staffing. Other factors related to high usage included, low staff turnover and the presence of a local champion. They note that especially in rural and remote communities where staff turnover is high, training and support needs to be continuous.

Robinson (2002) conducted qualitative interviews with eight GPs in rural Australia and found that videoconferencing was not considered a valuable tool for assisting in patient care. Only two participants felt that it was useful for certain aspects of support with patient consultations and continuing education. They felt that the telephone was more immediate and convenient and can achieve the same result. In addition, the GPs viewed videoconferencing as an intrusion of a large centre into the care provided by rural doctors.

In the primary research examined, there were no studies where GPs used videoconferencing to communicate directly with patients and no Canadian studies that examined the use of videoconferencing by GPs as a clinical service delivery tool. General practitioners reported that connecting with a specialist for patient care improved their clinical skills (Bowater, 2001), provided them with opportunities for continuing education (Robinson, 2002; Bowater, 2001) and most importantly ensured that their patients had access to care they required (Grutske, Rogers & West, 2000). In addition, the research suggests that characteristics of patients who use videoconferencing may be different from those who receive care face-to-face. According to Grutske et al. (2000) videoconferencing enables access to health care for patients whose age and economic situation might otherwise restrict access.

The number of general practitioners included in the studies examined was small. For example, one study discussed the experiences of a single GP (Bowater, 2001). Robinson (2002), reported on qualitative interviews with 8 GPs, 6 of whom felt that a telephone was superior, and another study based its findings on 197 hours of videoconferencing experience. There was only one study with a substantial sample size of both patient (n = 495) and physician participants (n=76) (Gustke et al., 2000) which found that videoconferencing facilitated access to health care for patients. None of the studies reviewed assessed the effect of videoconferencing on health patient outcomes. Videoconferencing was primarily used by GPs to consult with specialists as will be discussed further in the section devoted to specialist consultations. The impact of these studies suggests that videoconferencing for clinical service delivery by GPs does not appear to be a promising application.

III. Specialists

This section reviews the use of videoconferencing by specialists from several disciplines including Neurology, Dermatology, Radiology, Orthopaedics, Rheumatology, Surgery (pre and post surgical consults), Cardiology, Paediatrics, Pathology, Renal and Genetics. The research findings are presented in order of disciplines with most published studies to those with fewest published studies. While we recognize that Psychiatry is a specialty field, the body of literature

regarding the use of videoconferencing is so large, these findings will be discussed in their own section immediately following. In general, the studies reviewed discuss the use of videoconference to connect specialists to patients and their families, or other physicians, usually general practitioners in order to provide clinical services such as diagnosis and or follow up consultation.

a. Neurology

Neurology is a latecomer in the field of telemedicine and most of the publications on teleneurology have appeared in the last five years (Patterson, 2005). Wade, Wolfe & Pestian (2004) developed and compared two web-based interventions for pediatric traumatic brain injury in Ohio. Two girls and four boys with moderate to severe brain injuries and their families participated in the study. Weekly videoconferences with the therapist were conducted with NetMeeting (high resolution) or ViaVideo (lower resolution) applications. Families were randomly assigned to the NetMeeting (cost - \$400 USD) or ViaVideo (cost - \$80 USD) group. The authors sought to determine whether higher resolution video images would substantially change the family's experience with the intervention. Results suggested that younger children and those with attention difficulties found the smaller video image provided by NetMeeting to be inadequate to sustain their attention. Additionally, families using NetMeeting also commented on the poor audio quality and nearly constant audio feedback and reverberation. Despite this, 63% of participants stated that they preferred meeting online to face-to-face. Parents reported that they gained an increased understanding of traumatic brain injuries. Moreover, the information gave parents a sense of closure and helped them feel less alone. Overall results indicated that a majority of participants improved on one or more target behaviours. Parents also reported strong therapeutic alliance (i.e. the relationship between the physician and patient).

Chua, Craig, Wootton, & Patterson (2001b) conducted a randomized controlled trial which compared videoconferencing to face-to-face consultation for new neurological outpatient referrals in the UK. This study randomized a total of 141 patients into the two conditions (65 face-to-face and 76 telemedicine). A cost comparison was also analyzed from this study and will be discussed in the section on financial implications. Results demonstrated that the diagnostic categories were similar between the two groups. More patients in the telemedicine group however, required a subsequent neurological evaluation than those in the face-to-face condition. Additionally, patients were significantly more concerned about issues related to privacy in the telemedicine group. Overall, patients were satisfied with both types of consultations.

In a subsequent study, Chua, Craig, Esmonde, Wootton & Patterson (2002) compared four cohorts of neurological patients to determine differences in the management of such patients in everyday practice in the UK. A cohort of 150 outpatients was obtained from three district general hospitals and were seen face-to-face by three neurologists. Furthermore, data from two previous studies by the authors were reanalyzed. Data from the randomized control study described above of 141 outpatients was incorporated in this study (Chua et al., 2001b). Results indicated that there were no differences in mean age and sex distribution of all four cohorts. In addition there were no significant differences in investigation rate or review numbers between the telemedicine group from the randomized control study and the patients seen face-to-face by neurologists in district clinics. However, comparing those seen face-to-face at the district clinics to the face-to-face group of the randomized control study, the face-to-face group from the randomized control

study had significantly fewer investigations but similar number of reviews. Moreover, the cohort seen face-to-face by general practitioners had significantly more investigations and reviews than those seen face-to-face at the district clinics and the telemedicine group in the randomized study. In this study, the telemedicine cohort did not differ in investigation numbers from the cohort of patients seen face-to-face by other neurologists in district clinics. The authors concluded that it is likely that the difference in the number of investigations found in the randomized control study (Chua et al., 2001b) were likely due to chance. The authors found that all of the cohorts seen by a neurologist, including the telemedicine one, generated significantly fewer investigations than the cohort seen by general practitioners.

Craig et al. (2005) studied the effect of early neurological consultation using a videoconferencing on the care of patients with neurological symptoms admitted to hospitals without neurologists on site. Outcome measures were: 1) the length of hospital stay, 2) change in diagnosis, 3) mortality at three months, 4) inpatient investigation, 5) transfer rate and 6) use of healthcare resources within three months of admission. A total of 292 patients from the UK were recruited from two rural hospitals. From one site 111 patients were seen by a visiting neurologist face-to-face and 53 patients were seen by a neurologist via videoconferencing. From the other site 128 patients were seen face-to-face by a neurologist. Results indicated that patients who had teleconsultations were significantly younger than those who did not. Hospital stay was only dependent on age. There was significantly shorter stay in younger patients. Length of hospital stay was significantly shorter in the group of patients who had access to early neurological consultation via videoconferencing. Moreover none of the patients in the videoconferencing group had their diagnosis changed at follow-up. In addition to that there was no difference in overall mortality or the use of other hospital and community based resources between groups.

Rasmusson and Hartshorn (2005) compared epileptic patients in a traditional ambulatory clinic and a telemedicine clinic. Data from both clinics were collected for a three month period. Outcome measures were also collected and these included the number of seizures, hospitalizations, and emergency room visits. Data on the medication compliance was also collected for all patients. Seventy-two patients were seen face-to-face and 83 patients were seen via telemedicine. No significant differences were found on any of the outcome measures.

Preliminary evidence indicated that teleneurology is comparable to face-to-face consultations (Chua et al., 2002; Craig et al., 2005; Rasmusson & Hartshorn, 2005). What is interesting is that a majority of the studies above compared the health outcomes between face-to-face consultations and teleneurology. Although it has been claimed that neurology has been a latecomer in the field of telemedicine it would seem they have studied outcome measures beyond just patient perspectives. Another important factor to note is that results from the study by Chua et al. (2001b) have also been reanalyzed in a subsequent study by the authors. Moreover, with the exception of the study by Wade et al. (2004) all of the studies above used large sample sizes in their studies. It would seem that from reviewing the studies above, despite teleneurology being a latecomer, large-sampled research and retesting of results have been conducted. Research in the field of teleneurology seems to be well conducted.

A subfield of neurology focusing on stroke epitomizes the need for quick diagnosis and rapid response as patients suffering from stroke who are not treated both quickly and appropriately can

potentially suffer long term neurological damage. In many cases of stroke, health care providers (ideally stroke neurologists) are required to determine whether patients are suitable candidates to receive tissue plasminogen activator (tPA) a synthesized enzyme used to dissolve clots blocking coronary arteries in heart attack and cranial arteries in certain cases of stroke. The challenge surrounding administration of tPA is that its inappropriate use can adversely affect the patient. Videoconferencing serves to bridge care providers with stroke experts to determine the appropriateness of tPA administration.

Schwamm et al. (2004) examined the viability of videoconferencing to facilitate acute stroke management and determine patients' eligibility for treatment with tPA. The study took place in Boston and involved establishing a videoconferencing connection between emergency physicians and a stroke neurologist. Over a 27 month period, 24 hour videoconferencing consultation was made available to emergency physicians at an island-based hospital. The data was reviewed from 24 stroke consultations, in which six patients were determined to be candidates for tPA treatment. The consultations resulted in a more timely administration of tPA and did not result in any protocol violations during the study. Physicians involved in the study believed that the videoconferencing link improved care in 95% of the 24 cases. The authors concluded that virtually connecting emergency medical service providers in rural areas with stroke neurologists may facilitate enhanced tPA delivery, resulting in subsequent improvements to the health outcomes of these underserved populations.

In a similar initiative in Germany, Handschu et al. (2003) conducted a comparison of face-to-face and videoconference based evaluation of stroke patients admitted to emergency hospital facilities. The authors used a telemedicine system to provide real-time audio-visual data to stroke neurologists in an effort to determine the appropriateness of tPA administration. Before or after the virtual examination, a second, face-to-face examination was performed at bedside by different stroke neurologist who was not involved in the virtual examination process and was therefore unaware of its result. In the pilot, 41 patients were examined by both a live and virtual practitioner. Inter-rater agreement between the live and virtual stroke neurologists was good to excellent (on the National Institutes of Stroke Scale Score) on all items related to stroke severity assessment and recommended treatment. The authors concluded that virtual delivery of this service is comparable to bedside.

Few studies have been conducted regarding the use of videoconferencing in stroke neurology; however, these studies have focused on patient health outcomes and inter rater reliability measures to determine its effectiveness. Results from these studies demonstrate the potential of videoconferencing to rapidly deliver information in acute care situations. Stroke management requires rapid but well informed clinical decision making in order to minimize stroke related complications and subsequent neurological damage. The existing body of literature illustrates that videoconferencing based consultation has the potential to maximize appropriate decision making while minimizing the response time which is so critical in determining patient outcomes. However, more research in this area is needed in order to generate reliable information on the utility of videoconferencing in stroke neurology.

b. Dermatology

The existing body of literature suggests that videoconference based dermatology holds great potential for altering the current service delivery and equalizing delivery to remote areas by making consultation more affordable and accessible for patient populations. Additionally, the high levels of diagnostic accuracy achieved with videoconference based teledermatology indicate that it represents a clinically acceptable substitute for face-to-face care in the majority of cases.

Wootton et al. (2000) compared teledermatology with outpatient dermatology in terms of clinical outcomes, patient re-attendance and cost benefits (cost details discussed in a subsequent section). Two-hundred and four patients in Ireland were selected and randomized into either a “teledermatology” group (videoconsultation at local health care center with GP present) or a traditional face-to-face consultation. No major differences were found between the two groups with respect to clinical outcomes as 46% of patients in the teledermatology group required a subsequent hospitalization compared to 45% in the face-to-face group. Patient re-attendance data demonstrated that patients seen by videoconference made fewer trips to their general practitioner compared with patients seen conventionally.

In a subsequent study (Loane et al., 2000) the clinical effectiveness of real-time teledermatology and that of store and forward dermatology were compared. The authors found that the patients who were diagnosed and treated via videoconference required a similar number of subsequent hospitalizations than those in the face-to-face condition (see above study). However, subsequent hospitalizations were requested for 69% of patients who were seen by store and forward teledermatology. The authors argue that although store and forward teledermatology is relatively inexpensive, it offers an insufficient degree of clinical information and does not reduce the need for subsequent hospitalization.

In a Norwegian study, Nordal, Moseng, Kvammen and Lochen (2001) compared the diagnosis made by clinicians in videoconference based dermatology with those made in face-to-face dermatology to assess the relative clinical accuracy of the two modes of service delivery. The 121 patients in the study first underwent a teledermatology consultation and then a face-to-face consultation. The diagnostic agreement of the dermatologists in the two conditions was assessed at 72% total agreement, 14% partial agreement and 13% discordance. In no case did either dermatologist fail to make proper diagnosis of a serious condition. Participants in the study were equally satisfied with both conditions, with the exception of “feelings of contact” with the dermatologist, which surprisingly, was rated as superior in the videoconference condition. This effect, the authors hypothesized, may be attributable to the presence of the general practitioner in the examination. Dermatologists in the study deemed videoconference based consultation as suitable for 80% of the patients in the study. The remaining unsuitable patients suffered from conditions which required close inspection and palpation in order to achieve diagnosis (e.g., scars, or conditions in areas covered by hair). The authors concluded that in cases where virtual patient evaluation is appropriate, videoconferencing represents a clinically suitable alternative to face-to-face care provision.

Eedy and Wootton (2001) reviewed the available literature regarding the potential of teledermatology with both videoconferencing and store and forward applications being considered and compared, to impact the delivery of dermatological services. They asserted that

real-time, videoconference based dermatology allowed greater clinical information to be obtained which limited subsequent patient consultations. Additional benefits of real-time teledermatology included its ability to facilitate three way conversations between the specialist, patient and general practitioner as well as the educational value for the GP of being involved in the consultation. The challenges associated with videoconferencing as cited by Eedy and Wootton (2001) included its poor cost effectiveness over short distances and difficulty in coordinating the patient, GP and specialist to be present at the same time. This is in contrast to store and forward technologies which enable practitioners to access images at any time that is convenient for them. The authors concluded that store and forward technologies will most likely be used for basic service provision while real-time videoconferencing will be employed in case conference and educational contexts.

Within the field of teledermatology a large portion of the studies conducted have been randomized controlled trials with substantial participant populations. We can therefore conclude that the results of videoconferencing in this field are highly reliable. Studies conducted in the teledermatology field have also focused on the cost effectiveness of delivering videoconference based services to remote populations. Perhaps this cost effectiveness data offers insight into the financial viability of providing such services in a variety of clinical areas.

Videoconferencing based dermatology represents a clinically viable alternative to face-to-face care provision. Nordal et al. (2001) assessed the diagnostic agreement of remote (videoconferencing) and face-to-face dermatologists at 86%. In the study by Loane et al. (2000), 46% of patients in the teledermatology condition, compared to 45% in the face-to-face condition were required to attend subsequent hospital appointments, which illustrated the comparative clinical utility of the two delivery modes. Eedy and Wootton's (2001) review of the literature concluded that "50% of dermatology could be safely and adequately managed via videoconferencing" (p. 669).

Despite its established accuracy, there are certain situations in which teledermatology is less desirable than face-to-face consultation, particularly when evaluating conditions that require the caregiver to make contact with the patient in order to make an accurate diagnosis. Nordal et al. (2001) found teledermatology to be inadequate in the examination of areas covered by hair, or in scabies examinations. Similarly, Nguyen et al. (2004) in their evaluation of videoconferencing use within a telemedicine burn unit determined that videoconferencing did not enable clinicians to determine scar thickness and firmness. The existing body of literature indicates that while teledermatology holds great diagnostic potential, it must be used in appropriate circumstances.

Hicks et al. (2003) in their study of patient satisfaction with teledermatological services calculated that 151 of the patients in their study would have been required to travel an average of 71 miles one way in order to reach a dermatologist for a face-to-face consultation. This represents a substantial investment in time and energy for the patient. Videoconferencing holds the potential to increase rural and isolated populations' access to dermatological services, by offering savings in both time and money. The Stuart Pegg (Australia) and Regions (USA) Burn Centres are successful examples of teledermatological services reaching patients in rural areas. Patients living in America and Australia respectively were able to consult experts at these burn centers on a regular basis. Testimonials from parents in both studies indicated that parents felt

they would not have been able to achieve regular treatment for their children otherwise (Nguyen et al., 2004; Smith, Youngberry, Mill, Kimble, & Wootton, 2004). Teledermatology programs dramatically reduce the travel costs of patients by allowing them to access care within their own communities.

In the field of teledermatology there are two dominant technologies (videoconferencing and store and forward) which are used to deliver services to remote populations. Videoconferencing offers a superior degree of diagnostic accuracy (Loane et al., 2000) and provides clinicians with better diagnostic information with which to evaluate patients. Additionally, videoconferencing allows the specialist, GP and patient to simultaneously interact (Eedy & Wootton, 2001), which according to patients improves the quality of the communication (Hicks et al., 2003).

Store and forward technologies are cheaper and require less technological resources to operate than videoconferencing based technologies. Perhaps the greatest benefit associated with store and forward technologies is their convenience of use. Because store and forward technology involves the transfer of stored (as opposed to live) images, it enables users to access the images at a time which is most convenient for them as opposed to videoconferencing which requires all of the participants to synchronize their schedules. While videoconferencing is most useful for case conferences involving several participants and in educational contexts, store and forward technologies are of considerable use for more basic service provision (Eedy & Wootton, 2001).

c. Radiology

A shortage of radiologists has created a move to use telemedicine to meet the rising demands (Myers, 2005). In teleradiology, the transmission of digital radiographs can be prerecorded or real-time. In real-time, it is required that an expert be available to give an opinion as the image is taken and transmitted (Craig & Patterson, 2005). Another term for prerecorded is store-forward, an application that is also used in teledermatology.

Kaidu et al. (2004) evaluated a teleradiology system in Japan from a practitioner's perspective. Five diagnostic radiologists from three hospitals completed a questionnaire that rated 32 features of the teleradiology system. The desirability of each feature and the degree of completion (improvements needed) of each feature was rated. Using a formula an overall performance was determined by the authors. This questionnaire was completed at baseline and then 17 months later. The average performance score at baseline was 1.38 and after improvements were made to the system the performance improved to a mean score of 2.86. It was later discussed by the authors that the teleradiology system enabled a prompt consultation with specialists, improved the quality of patient care and enabled emergency diagnosis of life-threatening diseases. In addition to that, discussions via the teleradiology system allowed for the selection of appropriate therapies for the patient.

O'Neil, Allen and Brockway (2000) developed an off-the-shelf system to transfer DICOM ultrasound images from a small rural hospital in Alberta to an urban radiology clinic in Calgary. A RAD tinybridge was added to both sites in order to translate the RS449 high-speed data transfer protocol of the satellite videoconferencing system to a TCP/IP and DICOM protocols (industry standard for transferal of radiologic image) commonly used by ultrasound machines. It

was indicated that image transfer took less than 30s per image and the radiologist could then review the case and release the patient or switch to real-time videoconferencing to instruct the rural ultrasound technician to obtain additional images of the patient.

Chan et al. (2002) compared the quality of real-time fetal ultrasound images transmitted using ISDN and IP networks in Queensland, Australia. In a randomized trial, four obstetric ultrasound specialists viewed standard recordings of various combinations of bandwidths (128, 384 or 768 kbit/s) on two different networks (ISDN or IP). Specialists were blinded to the bandwidth and method of transmission. A total of 12 evaluations were performed and specialists used a seven-point scoring sheet for the clarity of visualization of each of the 30 fetal anatomical landmarks used. Ratings ranged from a score of 1 = uninterpretable image to a score of 7 = an image quality which was the same as the original video. At the start of the evaluation, the specialists reviewed the original video-recording to set the '7' standard. Interobserver variability was also measured and analysis of the data showed no significant interobserver variations. The most significant variable affecting the mean score was bandwidth used. The mean scores for transmission by ISDN was 3.6 at 128 kbit/s, which was significantly worse than the mean score of 4.9 at 384 kbit/s, which was also in turn significantly worse than the mean score of 5.9 at 768 kbit/s. The mean score for IP transmission was about 0.5 points lower than that using the ISDN across all the different bandwidths but these differences were not significant.

In a study conducted in the UK, Hussain, Deshpande, Shridhar, Saini and Kay (2004) compared hard-copy images to transmitted images of ultrasounds. Real-time videoconferencing was linked between a GP and a university department of radiology. All ultrasounds were performed by the GP under the supervision of the university staff. Prior to the transmission of the ultrasounds, the captured still images were printed on thermal paper from the ultrasound machine's printer. A total of 15 telemedicine sessions were conducted of 50 patients who presented with lower urinary tract symptoms. Of these patients a random subset of 15 patients were used for data analysis. Each patient had paired images of seven procedures. A total of 105 transmitted still images and 105 hard-copy images were then placed side by side for comparison and graded on assigned criteria to evaluate the associated image. Images were graded on a five-point Likert scale from 1 = very poor to 5 = excellent. Results indicated that only 92 of these paired images were classified to be sufficient for diagnosis. The mean technical quality score given to the transmitted images was 3.7 and was significantly greater than the mean score of 3.0 for the hard-copy images.

Tachakra and Doherty (2002) evaluated the accuracy of length and angle measurements on radiographs in-person compared to radiographs measured via videoconferencing. A videoconferencing link was established between the Central Middlesex Hospital to support the emergency nurse practitioners (ENP) at a minor injuries unit in the UK. A total of 125 radiographs were measured. Four lengths were measured in the first group of 25 radiographs of the cervical spine and the degree of backward angulation of the distal fragment was measured on the second group of 100 wrist radiographs. These radiographs were measured three times, once by the ENP, and twice by the accident and emergency consultant (once via videoconferencing and once in-person). The ENP marked the digital image with lines showing where the measurements were to be made and the accident and emergency consultant confirmed these markings via videoconferencing. The ENP then measured the lengths and angles of the radiographs without disclosing her findings. The consultant used the videoconferencing camera

to read the scales on the measuring device being held by the ENP against the X-ray film. Finally, on the consultant's next visit to the minor injury unit, the consultant measured the radiographs again. This was called the 'gold standard'. Four different methods were used to measure the length and three methods were used to measure the angle. Results from this study found that in comparison to the gold standard, the transparent ruler was best for measuring length for both participants (ENP five errors within 1mm; consultant two errors within 1 mm) and the protractor with pen marker was the best for both practitioners (eight errors within 1°; 10 errors within 2° for both). No statistical analyses were reported in the study.

It has been found that "teleradiology is the branch of telemedicine which has been integrated best into the fabric of clinical practice" (Craig & Patterson, 2005, p. 6). However, teleradiology often uses store-forward consultations because the diagnostic question often does not require direct audio and video interaction or a virtual physical examination (Lopez, Avery, Krupinski, Lazarus & Weinstein, 2005). This point was clearly illustrated by Lopez et al. (2005) who surveyed the use of telemedicine within the Arizona Telemedicine Program (ATP). Since the inception of the ATP, there have been 97,722 telemedicine events of which 85,728 teleconsultations were for teleradiology. All 85,728 teleconsultations were store-forward and none were real-time.

In three of the studies described above, videoconferencing was used for the transmission of ultrasounds (Chan et al., 2002; Hussain et al., 2004; O'Neil et al., 2000) and three studies used videoconferencing for the supervision of other practitioners (Hussain et al., 2004; O'Neil et al., 2000; Tachakra & Doherty, 2002).

Ultrasound images can occupy a bandwidth of about 70-100 Mbit/s. It has been therefore noted that efficient compression and operability over high-speed telecommunication lines are basic requirements of a practical teleultrasound system (Yoo et al., 2004). Indeed Chan et al. (2002) found that the performance was significantly rated better with increasing bandwidth size.

Preliminary results indicated that transmitted still images had better diagnostic and technical quality than the corresponding thermal paper images (Hussain et al., 2004). Preliminary results also indicated that teleradiology can quite safely measure the length and angle of radiographs (Tachakra & Doherty, 2002).

Descriptions of the methodology in the studies by Chan et al. (2002) and Hussain et al. (2004) have certain limitations. Although the study by Chan et al. (2002) was a randomized controlled trial, the sample size was very small, only a total of 12 evaluations were included in this study. Hussain et al. (2004) reported that a total 15 teleconsultations were conducted; involving 50 patients. The number of patients involved exceeded the number of consultations performed. In addition to that, only a subset of patients was selected for analysis.

d. Orthopaedics

Baruffaldi, Gualdrini and Toni (2002) compared the use of asynchronous (video-messages and still images) and real-time teleconsulting to obtain second opinions in the field of orthopaedics. Three remote sites were connected to a large orthopedic hospital in Bologna Italy. Similar telemedicine equipment was used in both the hub and remotes sites. Orthopaedic specialists'

opinions about the service were obtained via questionnaires and physicians at remote sites were interviewed via videoconference at the end of the study. Over the 20 month study period, 65 teleconsultations were carried out, 51 asynchronous (78%) and 14 videoconferences (22%). Clinical complexity of the case and the organization requirements were found to be the main factors affecting choice of consulting procedure. Videoconferencing was preferred in more demanding cases but this was hindered by its considerable organizational requirements (e.g., difficulty of simultaneous presence of the specialist, physician and patient) Asynchronous methods was preferred in the majority of cases as it could easily be integrated in to clinical practice, however there were some concerns about the diagnostic quality of the information transmitted. In addition the lack of direct communication with patients was the most frequently criticized aspect of the asynchronous consulting. Clinician confidence in diagnosis was lower when using the asynchronous consultation service than the videoconference service.

Haukipuro, Ohinmaa, Winblad, Linden and Vuolio (2000) conducted a study in Finland to investigate the use of videoconferencing in the examination of orthopaedic outpatients. During an 18 month study period, orthopaedic patients were randomly divided into two groups. One group of patients had conventional face-to-face specialist consultations (n = 69). The other group had videoconferencing sessions with a specialist at a remote location (n = 76). The article does not mention how many specialists and GPs participated in the study. The GP was present with the patient in the videoconferencing session. The specialists rated the voice quality lower than the GPs and the patients. The voice problems may have been because during the consultations, the patient and GP had only one microphone on the table. The volume and quality of the voice decreased whenever the GP or patient moved during the consultation. The problem would be reduced if the GP had a portable microphone. No serious technical problems were encountered in the telemedicine examinations. Voice and image disturbances slightly impeded the examination by the specialists in 40% of the cases. The study demonstrated that videoconferencing can be used for the remote examination of orthopedic patients whenever no demanding imaging technology is needed. Additionally, 80% of the specialists involved in the study assessed the suitability of videoconferencing as good or very good.

Ohinmaa, Vuolio, Haukipuro and Winblad (2002) compared conventional orthopedic outpatient visits and videoconferencing based visits. The participants included patients at a university hospital in Finland (videoconferencing group), and other patients who were accessing specialists in their own town, without needing to travel to the university hospital. The study sample of 145 orthopaedic patients was divided into a telemedicine group (n = 69) and conventional outpatient group (n = 76.) About half the patients had joint arthrosis. About half were first-time attendees and about half were follow-up patients. The study demonstrated that if the reliability of the videoconferencing equipment is not good, (if connections are lost, unable to be made, or if there is poor picture or audio quality), this will necessitate additional consultations, because decisions cannot be made with incomplete information about the patient. The study indicated that with regard to orthopaedic care, videoconferencing is a cost-effective alternative to conventional consultations.

Winblad, Vuolio, Haukipuro and Ohinmaa (2003) conducted a study in Finland to determine whether surgical outpatient orthopaedic consultations via videoconferencing and traditional outpatient clinic visits differently impact the implementation of a patient management plan

during a one year follow-up. First-admission and follow-up orthopaedic patients were randomly allocated to an outpatient visit at the Oulu University Hospital or to videoconferencing at a health centre. In this one year study, 145 orthopaedic patients met the inclusion criteria: 84 referred to a specialist for their first visit, and 61 of them for a follow-up. The study does not mention how many specialists participated. During the course of a one year follow-up, the treatment process for orthopedic patients usually consists of an examination, drawing up a management plan, treatment, and follow-up. The study demonstrated that if the management plan had been followed equally often in both groups, videoconferencing could be considered as clinically valid as a hospital outpatient consultation for orthopedic patients.

Lemaire, Smith, Nielen and Fawcett (2004) conducted a study in Canada to determine whether application sharing and desktop videoconferencing using the internet constituted a viable method for remotely configuring a microprocessor-controlled lower-extremity prosthesis. Fifteen patients with trans-femoral amputations had the settings for their prosthesis scrambled before a specialist at another site remotely configured the device. All clients had been successfully fitted with an Otto Bock C-leg system and were at least able to walk. The specialist clinician used application sharing to examine walking, and climbing up and down stairs. The article does not mention how many specialists participated in this study. Fourteen out of 15 sessions were considered successful. (One trial involved technical problems with the knee unit that were unrelated to the telemedicine trial.) In three cases communications stalled – this problem was solved by merely restarting the computer. Suggestions from the patients included improvements in sound quality, and having a wireless connection from the c-leg to the computer. This study confirmed that a lower-extremity microprocessor-controlled prosthesis can be remotely configured using desktop videoconferencing and application sharing. Additionally, the remote clinicians and clients were comfortable interacting with a specialist over the videoconferencing connection.

In summary, the results of four orthopaedic studies suggested that patients responded well and that videoconferencing was a feasible way of delivering orthopedic services to patients in remote locations. Patients who had previously tried videoconferencing consultations were more willing to have their next visit by videoconferencing than the conventional patients. This indicates a general fear of the unfamiliar (videoconferencing) until they try it out and discover that it is promising. There was a great deal of patient satisfaction with videoconferencing. Many participants noted that videoconferencing was more convenient, saved time and money, and cut down the need to travel. Technical problems were encountered in some of the studies, but these can be ironed out gradually, as the applications are used more frequently. These studies show that videoconferencing is a valid alternative to outpatient clinic visits for orthopedic specialist consultations. One study explored the specialists' perspective and found that videoconferencing was preferred to asynchronous methods in more demanding cases. However, the considerable organizational requirements (i.e. simultaneous presence of the specialist, physician and patient) of videoconferencing tampered this preference overall (Baruffaldi et al., 2002).

e. Rheumatology

Jong and Kraishi (2004) evaluated three modes of providing rheumatology consults to three communities in Newfoundland and Labrador. The control community received eight weekly

clinic visits by a rheumatologist, the second community received consulting services of the same rheumatologist through email as needed, and the third received a monthly one hour rheumatology videoconference clinic where one long case and two short cases were discussed. Six physicians used the videoconference application, two used the email mode and two used visiting clinics. Physicians responded positively to all modes however, the videoconferencing mode was most positively received based on the results of a satisfaction questionnaire. Physicians reported that they liked videoconferencing because it provided immediate feedback, facilitated learning, improved access and eliminated travel. Technical difficulties and time required to prepare for case presentation, voice and picture delay and inability to archive the consult were cited as challenges. Under the current medical funding model the rheumatologists could not be paid for the consults, therefore limiting the sustainability of this project.

Graham et al. (2000) investigated prospectively the diagnostic accuracy, specialist satisfaction and patient-specialist rapport of a low cost audio-visual link between two consulting rooms in the department of rheumatology at Musgrave Park Hospital in Belfast, U.K. During a four month study period, 20 patients were seen by the rheumatologist via video-phone link for a provisional diagnosis. All patients were then seen face-to-face by the consultant, where a final diagnosis was made by an independent consultant rheumatologist. Results indicated however that only 40% of diagnoses were made correctly over the phone and rapport over the video-phone was universally poor and technical problems were unacceptably high. Important clinical signs including joint swelling could not be clearly seen in more than 85% of cases. The authors concluded that as opposed to using ISDN lines where videoconferencing has been demonstrated as effective as face-to-face consultation, the low-cost audio-visual technology was inadequate as a diagnostic and therapeutic tool for rheumatology.

The studies reviewed suggested that videoconferencing was an effective service delivery mode for rheumatologists providing consultations to patients and their GPs, provided that the videoconference was delivered using high bandwidth connections such as ISDN. Videoconferencing in Rheumatology, like Orthopaedics, requires a high degree of visual acuity to ensure clinical signs such as swelling and therefore requires excellent video quality.

f. Surgery

Hands, Jones, Clarke, Mahaffey and Bangs (2004) conducted a feasibility study of telemedicine as an alternative to conventional outpatient appointments for 22 patients referred to a vascular clinic for a pre-surgical consult in the United Kingdom. The authors noted that their patient population is typically elderly and socially isolated which makes traveling difficult. Each videoconference session involved the patient, practice nurse and vascular consultant. The authors found that all standard assessment information if sent prior to the consult with a form and an accompanying a digital photo and followed by a videoconference consultation with the support of a practice nurse enabled them to satisfactorily assess patients with vascular symptoms at a distance. Overall 27 conventional outpatient appointments were replaced by a videoconference teleconsultation.

Aarnio, Rudenberg, Ellonen and Jaatinen (2000) conducted a prospective study of user satisfaction with teleconsultations for surgery. The study group consisted of 50 patients who

required surgical consultation and involved the patient, the GP and Surgeon. The GP carried out the physical exam according to the surgeons instructions. The videoconference systems used 3 ISDN lines providing 384 kbit/s bandwidth to connect the Satakunta Central Hospital in Pori, Finland and two health centres in the cities of Kanaanpaa and Huittineen located 55 and 60 km from Pori respectively. A document camera was also used to capture images of radiographs and paper documents. Questionnaires were used to collect data from patient and physicians after every consult. The consulting surgeons felt that videoconferencing worked well or very well in 48 out of 50 cases, GPs in the health centres felt the consultation was useful in 49 cases, and overall patient satisfaction was very good or good in 45 cases. Both GPs and Specialists felt that the decisions made during the teleconsultation were as reliable as those made at an outpatient appointment.

Rodas, Mora, Tamariz, Cone and Merrell (2005) studied the use of low-bandwidth telemedicine for pre and postoperative evaluation of patients treated by a mobile surgery service in remote Ecuador. Between February 2002 and July 2003, 144 patients were studied preoperatively and 50 post-operatively. Diagnosis and management plans made by a surgeon via telemedicine (real-time video and store and forward) were compared with those made independently by a second surgeon who saw the patient face-to-face. Real-time videoconferences were attempted in 75 of the cases and of those 55 videoconsultations were not useful because of restricted bandwidth or dropped connections. Therefore only 20 satisfactory preoperative real-time connections that enabled good-quality, simultaneous audiovisual transmission occurred. No technical problems occurred in the store and forward condition. Agreement on diagnosis and management between the videoconferencing and face-to-face conditions was 77% in preoperative evaluation and 97% in postoperative evaluations. The authors discussed that without real-time communication between the two sites, it was difficult to request additional information and wasted time for both doctor and patient. However, the authors still concluded that telemedicine (presumably store and forward) may reduce time required on site for preoperative planning and may provide reliable postoperative surveillance, improving efficiency of mobile surgery services.

The studies reviewed found that videoconferencing could be effectively used to provide pre and post surgical evaluations and consultations. Both patient and physician satisfaction with videoconferencing was high and specialists felt that decisions about the need for surgical treatment were as reliable as those made at face-to-face appointment. Patient populations were either elderly and socially isolated or residing in remote areas thereby having difficulties accessing specialty services. Once again, the need for high bandwidth was noted (without it, the majority of videoconsultations in one study were not useful). The advantage of videoconference over store and forward was the ability to request additional information in real-time.

g. Cardiology

Tsilimigake et al. (2001) described a telemedicine system linking a tertiary centre in Athens to a general hospital on the Greek Island of Crete. The aim of the program was to improve patient care by providing better access to a tertiary centre and avoidance of patient travel. During the 18 month study period 39 consultations were held for 93 children, 33 sessions were to confirm a diagnosis, 2 sessions for management issues and 4 for educational purposes. However, real-time transmissions were only used for 17 patients and the remaining were pre-recorded

echocardiograms. In 47% of cases patients were managed locally after the teleconsultation, 3% were emergency transported to Athens and the remaining 50% were scheduled for further evaluation and treatment at the tertiary centre. The authors concluded that echocardiographic transmission from remote sites to specialized hospital is diagnostically accurate and cost-effective. The authors did not identify why only 17 teleconsultations were real-time. Perhaps, real-time consultation was only warranted in these cases whereas specialist interpretation of pre-recorded videotapes was sufficient for the remainder of cases.

In a similar study in Queensland Australia, Justo et al. (2004) also found that using videoconferencing at 384 kbit/s for the transmission of echocardiograms is useful in the assessment of children with suspected disease. They conducted a retrospective review of patient and management outcomes on cardiac teleconsultations performed at two regional hospitals. A detailed review of 72 out of a total 106 echo studies found that 16% had been urgent and conducted on same day as referral. Following the videoconference, 90% of patients were managed locally. Eight percent had significant cardiac lesions that were handled by elective transfer at the appropriate time. Only one child required urgent transfer for treatment.

A Canadian study by Sicotte, Lehoux, Van Doesburg, Cardinal and Leblanc (2004) examined the cost-effectiveness of a pediatric telecardiology service after five years of operation. Interactive telecardiology consultations were held between a tertiary care centre in Montreal and an acute care hospital located 640 km away. A retrospective study was performed of 78 infants who had received paediatric cardiology teleconsultation and the cost effectiveness of telecardiology was compared with that of conventional care. While teleconsultation proved to be effective and reliable means of enhancing access to tertiary services, a cost analysis did not demonstrate overall cost savings. A full discussion of the cost analysis from this study will be discussed in a subsequent section of this report.

In the Cardiology studies reviewed, videoconferencing was used for real-time transmission of echocardiograms. Interestingly, all three studies pertained to paediatric cardiology assessments. Videoconferencing was used to improve patient access to this specialty service and reduced the need for patients (children and their families) to travel. The studies suggested that both real-time and store and forward can be used to transfer echocardiograms, however the advantage of videoconferencing is its use in urgent situations in order to determine if a patient needs to be transferred for treatment. One study of a Canadian telecardiology program (Sicotte et al., 2004) that had operated for 5 years to successfully enhance access to tertiary services, did not however demonstrate overall cost savings upon a cost analysis.

h. Paediatrics

Smith, Batch, Lang and Wootton (2003) reviewed a Queensland based program which utilized videoconferencing to deliver specialist paediatric services. Children with diabetes traditionally traveled to paediatric regional diabetes clinics or tertiary centres. Each trip required considerable time, travel and inconvenience for patient and family. Specialist outreach clinics were also provided by the Royal Children's Hospital where specialists would travel to regional and remote hospitals. The purpose of this project was to reduce travel required by patients and their families while ensuring they had fair access to specialist health services. The authors conducted a

retrospective review of their videoconference experiences and used telepaediatric activity records including videoconference usage data to analyze the type and frequency of activities. A total of 160 patient consultations and 10 education sessions were facilitated via videoconference during the 28 month study period. Three applications emerged: routine specialist clinics via videoconferencing, ad hoc patient consultations, and the delivery of education to staff and patients. Videoconferencing was used to obtain a brief history of the diabetic patients and to examine injection sites. Relevant test results and blood sugar readings recorded by patients and families were reviewed via a videoconference document camera. Overall, the study demonstrated that combining on-site outreach and videoconferencing clinics enabled specialists to maintain and often increase their contact with regional sites, reducing travel and time away from Brisbane. Videoconferencing also forced efficient use of time and facilitated local case management.

Similarly, Marcin et al. (2004) reported the results of 130 telemedicine consultations for 55 children with special health care needs from a rural community in California. Following the results of a pre-telemedicine medical-needs survey (which identified several barriers in access to subspecialty care) a telemedicine program was initiated to provide consultative services to children with special health care needs living in rural, medically underserved communities. The variety of illnesses that affected the participants warranted different paediatric subspecialty consultations including paediatric endocrinology (n = 99), psychiatry (n = 17), gastroenterology (n = 6), hematology-oncology (n = 4), nephrology (n=3) and infectious disease (n = 1). They found that paediatric subspecialty consultations via videoconference were feasible and highly satisfactory to both parents and the rural health care providers. All of the parent/guardians (130 surveys from 55 individual parents/guardians) rated their satisfaction with telemedicine care as either excellent or very good, as did all but two of the rural providers (81 surveys from 3 physicians and 2 physician assistants). Technical difficulties were reported in 38 consultations (29.2%). In 22 encounters (16.9%) either the subspecialist or a community health care provider complained of “pixelation” of the image, and audio problems occurred in 10 (7.7%) encounters. The authors concluded that telemedicine should be considered as a means of facilitating care, and that relative to customary delivery of health care, is more accessible, family-centered and coordinated among patients and their providers in rural, medically underserved communities.

While only two studies were reviewed in the area of Paediatrics, both studies found videoconferencing to be an effective means of delivery services and reducing time, travel and inconvenience for children with special health care needs and their families who resided some distance from tertiary centres. In addition, the findings suggested that specialists were highly satisfied with videoconferencing as it increased their contact with regional sites yet reduce their travel, yet increased overall efficiency and coordination of patient care at the local level.

i. Pathology

Hutarew, Dandachi, Strasserm, Prokop and Dietze (2003) examined the accuracy of a dynamic, videoconference based telepathology system used in pathological examinations in St John’s Hospital of the Salzburg State Clinics in Austria. The system viewed real-time video streams from both gross examination and the microscope. In two, three-month studies, all intraoperative frozen sections were examined by one pathologist via telepathology system. Lab technicians sampled tissues at gross examination as instructed by a pathologist via videoconference. The

specimens were then prepared as histological slides and placed under a robotic microscope for the pathologist to make a diagnosis. The same pathologist also made a diagnosis from traditional routine sections. The sample included 342 cases and the results indicated that the telepathology and traditional frozen section diagnoses agreed in 99.4% of cases, but telepathology took two to four times longer for gross and histological examination and up to 10 times longer for histological examination only. They concluded that good diagnostic results can be obtained with telepathology when staff are properly trained and have a profound knowledge of the system used. The authors stated that robotic microscopes are the best choice for intraoperative diagnosis, educational systems, quality assessment and scientific research and that the advantages of telepathology lie in documentation, second opinions and education. The authors concluded that telepathology is not a replacement for light microscopy but rather a complementary technique.

Hitchcock and Hitchcock (2005) used a dynamic, videoconference based telepathology system to assess 315 excisional biopsies and 209 fine needle aspirates of breast lesions submitted by surgeons 20 km from the Ohio State University Medical Centre. The results of gross and microscopic telepathology diagnoses were compared with final microscopic diagnoses and found to be as effective as conventional methods. For frozen sections, the microscopic telepathology diagnoses had a diagnostic accuracy of 95.3%, for malignant tumors, the positive predictive value was 100% and the negative predictive value was 94%. For the fine needle aspirate cases, telepathology diagnosis of agreed with conventional cytology in 163 of 206 cases. The authors noted that the technology was incorporated into the department's normal workflow which contributed to the overall success of the project.

The studies reviewed suggested that videoconference technology can be used to provide accurate pathological diagnosis, however, like in other fields, success is dependent upon the integration of the technology into the normal patterns of work. At best, telepathology can be considered a complementary technique with strengths in documentation, second opinions and education.

j. Renal Care

Rumpsfeld, Arild, Noruma and Breivik (2005) described the use of a videoconferencing system to link a university department and two remote dialysis centres together in the provision of haemodialysis services in Norway. During an eight month study period, 225 videoconferences were performed for daily visits and regular rounds. The study identified several factors required for successful communication. These included a bandwidth of 768 kbit/s and intensive testing of the system before it was brought into daily practice to minimize frustration of clinicians. Nurses and patients (n = 8) were satisfied with the videoconferencing system despite technical difficulties in 30% of the sessions. Nurses, patients, and nephrologists did not report any inconvenience concerning the reduction in nephrologists' rounds.

From the one study reviewed, it appears that videoconferencing can be used successfully to link remote dialysis centres to a university department in the provision of haemodialysis services. Findings from this study suggest that intensive testing of the system minimizes frustration once brought into daily practice.

k. Genetics

Gattas, MacMillan, Meinecke, Loane and Wootton (2001) reported on the results of a study where patients were randomly allocated to either a telegenetic or a conventional face-to-face (control) clinic in Queensland, Australia that provides genetic counseling. Genetic counseling is, generally described as an exchange of information between a health professional with specialist knowledge of genetics and a health consumer that can be complex, often emotionally charged and highly confidential. One clinical genetics service for the state of Brisbane is located in Brisbane with regular clinic services provided to nine hospitals throughout the region. The existing Queensland Health Telemedicine network was used to extend the visiting clinic services and deliver the same services via videoconference. The telegenetic consultation was done via videoconferencing using ISDN lines at 384 kbits/s. Patients evaluated the session via telephone questionnaire four weeks after the event. Physician (Geneticists $n = 16$) and counselor ($n=16$) data collection took place immediately after each appointment. Patients were selected for inclusion in the study if they did not need a physical examination as part of the consultation. Forty-two patients were invited to participate and 79% ($n=33$) returned a consent form agreeing to do so. While the sample sizes were too small for statistical analysis there were no obvious differences between patients in the telegenetics or face-to-face group when asked their level of agreement on a 5-point scale (5 = strongly agree) that communication was easy, they were able to maintain eye contact, the room was comfortable and they were satisfied with the clinic format. Both patients and care providers assessed the telegenetic consultations very favourably.

One study reviewed suggested that videoconferencing was well received by patients and care providers and in selected consultations videoconferencing appears to fulfill a useful role in clinical genetics.

A large number of specialty fields have used videoconferencing with reasonable levels of success including, Neurology, Dermatology, Rheumatology, Orthopaedics, Cardiology, Surgery, Paediatrics, Pathology, Radiology, Renal, Oncology and Genetics. Many technical issues have been resolved since the inception of many telemedicine applications contributing to better acceptance where videoconferencing has been used more often. In the studies reviewed in this section, videoconferencing was used to provide consultative services to general practitioners and to provide clinical services to patients. Several studies explored the effectiveness of videoconferencing technology in providing accurate diagnoses and second opinions (Graham et al., 2000; Hitchcock & Hitchcock, 2005; Justo et al., 2004; Baruffaldi et al., 2002) as compared to face-to-face or traditional means of diagnosis. In specialties where visual cues are essential, high bandwidths are required to ensure acceptable video quality (Graham et al., 2000; Baruffaldi et al., 2002). In addition, training and support needs to be continuous especially in rural/remote areas where staff turnover is high (Watson et al., 2001). Videoconferencing facilitated access to services otherwise not available and reduced patients need to travel and incur out of pocket expenses (Fortin, Gagnon, Cloutier & Labbé, 2003; Smith, Batch et al., 2003, Brown-Connolly, 2002, Marcin et al., 2004). In addition, videoconferencing was found to reduce specialist's time away from urban centres and facilitate local case management (Smith, Batch, et al., 2003). In the area of Radiology, videoconferencing was used to address shortages of specialists (Myers, 2005).

There were considerably more studies that described the use of videoconferencing by specialists than by GPs. Typically, in the studies of specialist's use, sample sizes were larger and more

teleconsultations were conducted over a longer duration of time. A challenge noted in several of the studies was that specialists did not receive remuneration for videoconference service delivery (Fortin et al., 2003). Often specialists agreed to participate because of the pilot nature of the study but, without resolution of this issue, the sustainability of many of the programs and services was limited.

Havranek (2005) discussed the role of technology (including videoconferencing) in the management of chronic disease. Havranek noted the increasing use of telecommunication tools to help manage chronic disease and the willingness of patients to use technology. However, the author argued that a confounder in many of the studies is that the greatest gains in patient health often occurred when patients had regular contact with well trained health care providers. Havranek concluded that new technologies should be viewed as useful adjuncts and not as the centre pieces of redesigned health care systems.

IV. Psychiatry

For over 40 years, psychiatrists have provided assessment and treatment via videoconferencing (Bishop, O'Reilly, Maddox, & Hutchinson, 2002; Zaylor, Whitten, & Kingsley, 2000). It has been noted that psychiatry was one of the first health disciplines to use videoconferencing in clinical practice (Alessi, 2000).

A survey of Canadian telepsychiatry programs identified a total of 14 of such programs nationally (Urness, Hailey, Delday, Callanan, & Orlik, 2004). Three telepsychiatry programs were identified in Ontario and they included: Ontario/North, Ontario/University of Toronto, and Ontario/Outreach. British Columbia, Yukon, Alberta, Ontario/North and New Brunswick programs provided adult, child and adolescent, and geriatric services. Ontario/University of Toronto and Prince Edward Island offered child psychiatry only, and child and adolescent services were dominant in Newfoundland. Results from the 14 surveys indicated that the average number of consultations per program per year was 238. These programs provided 107 telepsychiatry consultations per million people. Based on the population data of children 14 and younger, the rate for children's telepsychiatry services was found to be higher, at 194 per million. In comparison to some telepsychiatry programs, similar patterns were also found in the United States.

A review of the literature found several themes within the field of telepsychiatry. The following research has been grouped into several categories according to the population under study: child and adolescent psychiatry, geriatric psychiatry, clients with Post-traumatic Stress Disorder, clients with eating disorders, and telepsychiatry for the inmate population. A section on the research that compares face-to-face consultation and videoconferencing consultation is also included at the end of this chapter.

a. General

The overall effectiveness of telepsychiatry needs to be examined in order to assess whether or not it is an effective alternative to face-to-face consultations. Several studies have been conducted to assess whether or not telepsychiatry was comparable to face-to-face therapy.

Ruskin et al. (2004) in a large scale randomized control trial compared treatment outcomes of 119 veterans (105 male and 14 female) located in the state of Maryland with depressive disorders treated face-to-face to those treated remotely by videoconferencing. The authors also examined patients' rates of adherence to and satisfaction with treatment. Treatment consisted of eight-sessions with a psychiatrist conducted over a six-month period. Eight psychiatrists participated in both treatment groups. Results showed that there were no significant differences for treatment outcomes, patient dropout rate and no differences in the percentage of patients' adherence to appointments and compliance with medication treatment between groups. There was evidence of significant improvements in participants' depression in both groups. Remotely delivered treatment was comparable to in-person treatment in terms of symptom improvement. Patients were satisfied in both conditions and there were no significant differences found. The psychiatrists however reported more satisfaction when patients were seen face-to-face. Despite the psychiatrists reduced satisfaction with the videoconferencing condition, the results of the study demonstrated the clinical potential for treating patients with depressive disorder via videoconferencing.

Day and Schneider (2002) compared the health outcomes of patients who received psychotherapy face-to-face, via videoconferencing, and via audio. The study aimed to discover if the levels of working alliance, the emotional bond between client and therapist were influenced by the delivery mode and whether patient outcomes in the intervention groups varied with those of a no-treatment, wait-list control group. A community sample (n=80) was collected from the state of Illinois and randomly assigned to the three different modes of delivery. In addition to that, 20 participants were first assigned to a 4- or 5- week wait-list to serve as outcome control participants, after which they joined their randomly appointed group for therapy. A total of 27 clients completed the face-to-face condition, 26 completed the video condition and 27 completed the audio condition. All 16 therapists worked in all three modes. Statistically significant differences were found between modes of delivery. Participation scores such as clients' activity level, initiative, trust, spontaneity were rated by the clinicians. It was found that clients participated less in the face-to-face mode than either of the technologically directed modes. Results indicated that the three treatment groups had more similarities amongst groups than differences. Preliminary evaluations from this study indicated that two-way audio, video, and face-to-face treatment delivery modes all can be used to provide similarly effective psychotherapy treatment.

Manning, Goetz and Street (2000) evaluated the effect of signal delay on participant-perceived rapport in a quasi-psychotherapy stress evaluation. Forty-eight participants from Texas were randomly assigned to four conditions: face-to-face counseling, videoconferenced session with 0 milliseconds (ms), 300 ms or 1000 ms delay. A total of 16 participants were in each counseling conditions with counseling being provided by three male counselors. Results from this study showed that males and females responded differently in their perceived rapport. Rapport scores

were significantly lower in the face-to-face condition compared to the zero and 300 ms delay videoconference conditions for females. No significant differences were found for males.

Menon et al. (2001) evaluated a low cost, portable videophone in the assessment of depressive symptoms and cognitive function in veterans who were admitted to the acute medical unit of the Veterans Affairs Medical Center in Maryland. Twenty-four patients were observed in the study, half of whom attended one consultation in-person and one remote consultation whereas the other half had two in-person consultations. Results revealed that remote assessment of depression and cognitive status was comparable to in-person assessment.

In a Canadian study, Bouchard et al. (2004) compared the effectiveness of cognitive-behavioural therapy (CBT) delivered face-to-face to that of therapy delivered via videoconference for patients with panic disorder with agoraphobia. Patients were assessed after intake, at pre-treatment, post-treatment, and at 6-month follow up. A total of 21 adults, 11 at the remote site (Maniwaki, Ontario) and 10 at the local site (Gatineau, Ontario) were recruited. It was found that cognitive behavioural therapy conducted via videoconferencing was as effective as face-to-face therapy. Statistically significant reduction in all panic disorder with agoraphobia symptoms were observed by the researchers including significant improvements in panic symptoms, panic-related characteristics, agoraphobic avoidance, general anxiety, depressive affect, and general functioning. Additionally, of the patients receiving therapy via videoconferencing 81% were panic-free at post-treatment and 91% at the 6-month follow-up. Results from this study also showed a large effect size on some measures that favored telepsychotherapy this study. Therapeutic alliance, a similar concept to the working alliance described in Day and Schneider (2002) was reported to be very high after the first session. A comparison between the post-treatment therapeutic alliance scores revealed no differences between groups which further illustrate the viability of using videoconferencing to facilitate therapy.

All of the studies reviewed above found that telepsychiatry was comparable to face-to-face consultations (Bouchard et al., 2004; Day & Schneider, 2002; Manning et al., 2000; Menon et al., 2001; Ruskin et al., 2004). Randomized controlled studies were conducted in three studies reviewed (Day & Schneider, 2002; Manning et al., 2000; Ruskin et al., 2004).

Ruskin et al. (2004) conducted a large scale randomized controlled trials and found no significant differences between telepsychiatry and face-to-face consultations. There is a lack of large scale randomized controlled trials in the field of telepsychiatry, this study is therefore a step towards validating and testing the reliability of telepsychiatry. Day & Schneider (2002) found that participants who were in the face-to-face group participated significantly less than in the videoconferencing and audio conditions. The authors proposed that participants may have tried harder to communicate when technology was involved. Manning et al. (2000) examined the effect of signal delay on rapport. This study is rather unique because a review of the literature found only one study that explored this interaction. Compared to the rapport scores of participants in the face-to-face group, females reported higher rapport in the videoconferenced sessions. This also an interesting finding and further exploration with larger samples needs to be completed. However, the convenience sampling of university students may have biased the results. The authors also suggested that it was possible that the females were uncomfortable in the face-to-face settings because of the presence of an unfamiliar male counselor.

Videoconferencing thus provided distance between the females and the male counselor and that is perhaps why rapport was reported higher in those conditions.

Menon et al. (2001) found that remote assessment was comparable to face-to-face assessment however, statistical analyses were not reported and the sample size used was small. A small sample size was also used in the Bouchard et al. (2004) study. What is interesting is that Bouchard et al. (2004) found that telepsychiatry had a large effect on panic disorder patients with agoraphobia symptoms. These results may be attributed to the unique psychological characteristics of this sample. Several psychological disorders such as agoraphobia cause extreme discomfort with human contact (Bouchard et al., 2004; Day & Schneider, 2002). Favourable results in the telepsychiatry condition may therefore be a result of this. However, results from this study need to be interpreted with caution because the sample was not randomized thus introducing a sampling bias.

b. Child Psychiatry

In a survey of telepsychiatry services in Canada, Urness et al. (2004) noted that the rate for of psychiatric consultation for children under the age of 14 was higher than the average rate of teleconsultations for the general population. In addition to that, of the 14 telepsychiatry programs in Canada, two provided services to children only and one program serves adolescents predominately. It is therefore not surprising to find a sufficient amount of research in the area of child telepsychiatry.

Pesämaa et al. (2004) conducted a systematic review of the literature regarding the use of videoconferencing in child and adolescent telepsychiatry. The review included 27 articles covering the period of 1966-2003. The authors found that videoconferencing seemed to increase the accessibility of services and served an educational function. However, the drawbacks that were frequently mentioned included: problems with non-verbal communication and the audiovisual quality of the videoconference. When analyzing the effects of videoconferencing, it was also noted that there was a lack of structured instruments in child and adolescent telepsychiatry (Alessi, 2000; Pesämaa et al., 2004). According to staff feedback, videoconferencing helped them feel less professionally isolated and increased knowledge of child psychiatry in primary health care. It was also pointed out that networking enabled staff to make better use of supportive services in healthcare. Although users in the reviewed literature were mostly very satisfied with the use of videoconferencing, some of them still preferred face-to-face meetings to videoconferences.

Elford et al. (2000) conducted a study in Newfoundland which compared psychiatric assessments performed face-to-face and psychiatric assessments conducted via videoconferencing. Twenty-three children aged 4-16 years participated in two psychiatric assessments, one of each method. The order of assessment method was randomized and two different psychiatrists interviewed each child. Questionnaires were used to record the diagnosis, treatment recommendations and the satisfaction of patients, parents and psychiatrists.

Twenty-three patients (18 males and 5 females) completed both assessments and a total of five child psychiatrists were involved in this study. In the post-project questionnaire, all child

psychiatrists stated that videoconferencing was an acceptable alternative to face-to-face assessment. However, there was still a preference to conduct psychiatric assessments face-to-face. Responses indicated that psychiatrists preferred face-to-face assessments because they went better, that they were able to communicate better with the patient, and that the patient and parent were better able to understand them. The researchers also measured the clinical accuracy of the videoconferencing intervention. An independent child psychiatrist was used to verify the reliability of diagnosis between the two assessments. It was concluded that in 96% of cases, the diagnosis and treatment recommendations made using videoconferencing were clinically the same as those made in face-to-face sessions. The authors concluded that videoconferencing represents a viable alternative to face-to-face assessment in for the delivery of mental health services.

Nelson, Barnard and Cain (2003) conducted an eight week cognitive-behavioural therapy intervention in Kansas for childhood depression in order to determine the potential of videoconferencing. Children in this study were randomized to either face-to-face or videoconferencing treatment in order to compare the relative efficacy of each treatment condition. Twenty-eight (20 boys and eight girls) participated for a total of 100 videoconferencing sessions and 104 face-to-face sessions. There were 14 children per condition. Success in the intervention was defined by a measurable decrease in depressive symptoms at similar rates in both groups. Participants completed the Children's Depression Inventory (CDI) and the Schedule for Affective Disorders and Schizophrenia (K-SADS-P) at pre- and post-treatment. Results indicated that cognitive-behavioural therapy was effective across both conditions and at post-test, 23 children no longer met the DSM-IV criteria for depression. The two groups did not differ significantly in gender, age, ethnicity, socio-economic status, or initial depression total score. Additionally, statistical analysis indicated that there was a faster rate of decline in the depression total score for the videoconference group. Treatment was effective in both conditions with an 82% remission rate. It was also concluded by the authors that children tend to adapt to the videoconference setup quickly due to their experience with technology in other settings.

Elford, White, St John, Maddigan, & Ghandi (2001), in a subsequent study examined user satisfaction with the aforementioned telepsychiatry service in Newfoundland. The expressed rationale for the project was to connect patients in Cornerbrook with child psychiatrists in St Johns thereby reducing the distance that parents had to travel in order to gain access to specialty services. The objective of this study was to evaluate both patient and provider satisfaction, perform a cost analysis and encourage other uses of the videoconferencing system. Participants in this study included 11 children (aged 5-12), 19 adolescents, 30 parents and five child psychiatrists. Overall the results indicated that psychiatrists were either satisfied or very satisfied with the telepsychiatry interview. The majority of responses also indicated that they felt the telepsychiatric interview was just as good as a face-to-face interview. One psychiatrist even felt that videoconferencing was better than face-to-face because the child had Tourette's syndrome and the psychiatrist was able to zoom in and see the tics on the child's face without making the child feel uncomfortable. While this study also included patient satisfaction and cost analysis, these will be discussed in subsequent sections.

Kopel, Nunn and Dossetor (2001) evaluated patient and provider satisfaction with a psychological telemedicine outreach service located in New South Wales. Over a 12-month period, questionnaires regarding user satisfaction were completed by 100 rural mental health workers, as well as 82 patients and their families/care givers. Additionally, surveys regarding satisfaction with the technological aspects of the intervention were completed by 136 child psychiatrists, 101 rural mental health workers and 79 patients. Rural clinicians rated the quality of services as excellent or good as well as being mostly satisfied or very satisfied with the amount of help they had received. Telemedicine consultations were rated favorably by rural clinicians compared to face-to-face consultations. Both sound and video quality was rated good or excellent by rural clinicians. When evaluating satisfaction with the technology, the majority of psychiatrists felt that the ease of using the equipment was fair to excellent. Moreover, almost all stated that the equipment did not make them feel anxious. However, unlike the rural clinicians, urban clinicians rated the sound and video quality poor. Despite these findings, clinicians still rated the videoconferencing system to be adequate or almost as good as face-to-face consultation. The feedback from the rural practitioners demonstrated the viability of delivering telepsychiatric services via videoconferencing. This study also included patient feedback which will be discussed in an upcoming section.

During a 24-month study Grealish, Hunter, Glaze and Potter (2005) examined both patient and provider satisfaction with a telepsychiatric service for children and adolescents. Three sites were linked to an inpatient service in Edinburgh, Scotland. Interestingly, the authors did not provide data on how many patients and providers participated. Satisfaction was measured from the client's, their caregivers and the child and adolescent mental health services perspective with a focus on empowerment and enablement. Initially, clinicians were apprehensive and hesitant about using videoconferencing for their clinical consultation. However, it only took one session, supported by technical training to reduce their anxieties. Clinicians were very satisfied with teleconsultations because of the increased collaboration between sites and facilitated peer reviews. In addition, the videoconferencing link increased the efficiency of communication between all parties involved and feedback from the clinicians was more rapid because they did not have to go into lengthy discussions updating other clinicians about treatment and progress. Unfortunately, the staff members who gave feedback in this study did not continue to use the equipment regularly. It was therefore hard to capture a thorough account of the effects of telemedicine on clinical practice because of the limited usage of the videoconferencing system. Moreover, continual funding for videoconferencing equipment was made available for only two of the four sites. The staff in this study remained unwilling to use telemedicine routinely despite regular workshops, ongoing training and the finding that adolescents and their families enjoyed the equipment. The authors concluded that widespread integration of telemedicine within the child and adolescent mental health services is likely to be difficult because of the resistance to telemedicine from staff members and because managers may be unwilling to reallocate funding away from staffing for telemedicine.

Videoconferencing has also been used by other child and adolescent mental health service workers. The following two Australian studies evaluated multidisciplinary teams of remote and rural child and mental health service workers.

A study by Hockey, Yellowlees and Murphy (2004) evaluated an Australian child psychiatry service that was piloted for six months. The goal of the service was to provide child and youth staff with access to child and youth experts located in Brisbane. This service was offered to all professionals at the Child and Youth Mental Health Service (CYMHS) in the northern and central zones of Queensland. At the end of the pilot, a total of 28 videoconferences were performed, comprising of nine for administrative purposes, two for educational purposes and 17 clinical applications. In order to identify the barriers to using the service, a questionnaire was administered to referring and non-referring CYMHS teams. A total of 17 CYMHS workers (eight psychologists, six team leaders and three social workers) completed the questionnaire. Overall responses indicated that CYMHS workers felt the telepsychiatry service was useful and it reduced the sense of the isolation experienced by remote and rural workers. Additionally, most of the CYMHS workers agreed that the “guiding principles of the service were consistent with the culture” of the CYMHS (p. 50).

Gelber (2001) surveyed Australian child and adolescent mental health workers (CAMHS) regarding their experiences with videoconference based telepsychiatry. A total of 25 CAMHS completed the survey. The survey explored six key areas which included: usage; level of comfort with technology; purpose of use; effect of telepsychiatry on professional practice and on clients; advantages and disadvantages of telepsychiatry; and suggested improvements. Results indicated that 60% of participants had used the technology on over 30 occasions and 24% had used it on 20-29 occasions. Level of comfort increased with continued use. Ninety-two per cent of respondents reported that they had used the videoconferencing unit for clinical applications or supervision purposes and 36% of CAMHS stated that it was used for teaching purposes. When asked about the effects of telepsychiatry on professional practice, workers recognized that it increased knowledge and skill, strengthened relationships with colleagues, and decreased the sense of isolation. Savings in time and cost were named as advantages of telepsychiatry. Technical difficulties were cited most frequently (76% of respondents) as disadvantages. Additionally, respondents were concerned about time delay and poor picture quality. The loss of emotional cues when using technology was also a significant concern amongst respondents in the sense that interactions were viewed as impersonal.

The current review yielded seven studies and two literature reviews that examined clinical research on child and adolescent telepsychiatry. Inter-rater reliability, comparison between face-to-face and videoconferencing treatment, participant satisfaction and surveys on multi-disciplinary teams of child and mental health workers were explored in the above studies. Whereas other fields have explored mainly participant satisfaction, it seems that a variety of aspects in child and adolescent telepsychiatry have been examined in the studies above.

Elford et al. (2000) concluded from their randomized controlled trial that 96% of the diagnoses and treatment recommendations were similar in both the videoconference and face-to-face sessions. The study design was well controlled, both the client and the clinician were randomly assigned to each assessment and each client was assessed by two child psychiatrists. In addition to that, an independent rater who was blinded by the treatment conditions was used to assess inter-rater reliability. However, the value of this study was impaired because this study did not use structured instruments (Pesämaa et al., 2004).

Another randomized controlled trial by Nelson et al. (2003) examined cognitive behavioural therapy for children with depression found no significant differences between the groups that received therapy through videoconferencing to the group with face-to-face therapy sessions. A faster rate of symptom decline was found in the videoconferencing group. In addition to that, this study used two standardized tests. Although both randomized controlled studies found positive results, Elford et al. (2000) and Nelson et al. (2003) used relatively small sample sizes (n=23 and n=28; respectively). These small sample sizes may limit generalizability.

Clinician satisfaction was examined in three of the studies above (Elford et al., 2001; Grealish et al., 2005; Kopel et al., 2001). All of these studies found that a majority of clinicians were very satisfied with the telepsychiatry services; however most had a preference for face-to-face consultations. In the study by Elford et al. (2001) only five clinicians were surveyed and in the study by Grealish et al. (2005) sample sizes were not reported. Large sample sizes were used in the study by Kopel et al. (2001) however a major problem with studies that examine satisfaction is that there is a lack of structured instruments that examine satisfaction in telepsychiatry. Oftentimes researchers created or adapted satisfaction questionnaires because of this lack of standardized instruments.

Videoconferencing for multidisciplinary teams of child and adolescent mental health found that the telepsychiatry services reduced the sense of isolation of remote and rural workers (Gelber, 2001; Grealish et al., 2005; Hockey et al., 2004). In the study by Grealish et al. (2005) the authors failed to report the sample size of the participants and only qualitative data were collected from this study. The authors failed to report sample size and failed to report statistical analysis yet are bold enough to claim that they believe that widespread integration of videoconferencing is difficult to achieve because of clinician resistance to this delivery mode and the unwillingness of managers to reallocate funding. Although this view is rather unique, the authors did not provide sufficient evidence in this study to claim such a belief.

c. Geriatric Psychiatry

Oftentimes traveling to receive mental health services may not be feasible for the elderly population because of their limited mobility and limited access to transportation. Thus, telepsychiatry may be beneficial to the elderly population because it reduces the need to travel (Tang, Chui Woo, Hjelm & Hui 2001). The articles discussed have examined the use of videoconferencing with geriatric populations.

Hildebrand, Chow, Williams, Nelson and Wass (2004) examined the feasibility of administering neuropsychological tests to older adults via videoconferencing. The study's aim was to determine whether videoconference based cognitive testing was an accurate measure of: memory and learning, letter fluency, expressive word knowledge, reasoning, verbal attention, and visual-spatial processing. Twenty-nine participants were recruited in central Alberta. All participants were 60 years of age or older and without neurological or psychological disturbances. Participants were tested both face-to-face and via videoconferencing and by the same psychologist. Two clinical psychologists were the examiners in this study. Scores for expressive word knowledge were similar in the two conditions, however large differences were found in visual-spatial processing tasks. The authors found a small order-of-administration effect. Those

who had the videoconferencing session first exhibited a wider range of mean scores on six of the nine measures whereas those who had the face-to-face session first had a small range of mean scores. In other words, mean scores were less varied between conditions if participants were interviewed face-to-face first. It was suggested by the authors that these results may be due to the novelty of the medium and to the small sample size. However these findings seem to undermine the reliability of videoconferencing in facilitating assessments. The authors concluded that the cognitive capabilities of the potential patient need to be assessed in order to determine their appropriateness for examination via videoconferencing.

Tang et al. (2001) conducted a pilot study which utilized a videoconferencing system to connect a regional hospital with a care center in Hong Kong. The study examined the feasibility, acceptability, costs, benefits and limitations of telepsychiatry. Demographic and clinical data were collected during each teleconsultation and included: age, sex, psychiatric diagnosis, waiting time, and time spent on each consultation. The opinions of the authors (also the clinician in this study), nursing staff and patients were obtained. This system provided 149 psychiatric assessments to 45 residents of the care home over 11 months. It was found that 96% of patients required regular follow-ups. Sixty-seven percent were diagnosed with dementia and 16% suffered from depression. The average response time for a new case evaluation and urgent consultations were 12.4 and 3.8 days respectively with the videoconferencing system. On the other hand, the average waiting time for new cases in the face-to-face psychogeriatric outpatient clinics was 8-12 weeks in Hong Kong. In this respect the teleconsultation system was found to expedite caregiver response to patient needs. Telepsychiatry was found to be feasible in a care home setting and was acceptable to the psychiatrist, staff and patients. Although the psychiatrist found no difficulties with videoconferencing, the patients and nursing staff had less favourable feedback. The staff found the videoconferencing difficult to use. However, staff also did agree that teleconsultation provided more health care support and saved their time spent on outpatient clinics and emergency room visits.

Poon, Hui, Dai, Kwok and Woo (2005) compared the feasibility, acceptability, and clinical outcomes of a videoconference based cognitive intervention program for older patients with mild cognitive impairment and mild dementia. Twelve sessions of assessment and cognitive intervention were conducted via videoconferencing or face-to-face interactions. A total of 22 participants were randomized into either the videoconferencing or face-to-face group. Cognitive assessments were measured at baseline and after completion of the program. Assessment tools were distributed to participants and staff and included: Cantonese version of Mini-Mental State Examination (C-MMSE), Hierarchic Dementia Scale (HDS) and a user satisfaction questionnaire towards videoconferencing. Results demonstrated that at baseline, no significant differences were found between the two groups in either their clinical and demographic characteristics or the scores of neuropsychological tests. Following intervention, both groups improved significantly and for the HDS, both groups improved in the areas of attention and memory, calculation, and language. However, the face-to-face group attained significant improvement in spatial construction whereas the videoconference group did not. Overall, the two groups did not differ significantly in neuropsychological outcomes which led the authors to conclude that videoconferencing was a feasible and effective means in providing cognitive assessments and intervention to older adults with mild cognitive impairments.

Telepsychiatry can improve the accessibility of mental health services to the geriatric population (Tang et al., 2001). Consultations conducted via videoconferencing were faster than the average wait time in the psychogeriatric clinics in Hong Kong (Tang et al., 2001). Results indicated that videoconferencing was comparable and an acceptable method of assessing cognitive functioning of older adults (Hildebrand et al., 2004; Poon et al., 2005). Only one of these studies randomized the participants into treatment conditions (Poon et al., 2005). Results from this study found that overall the patients in the face-to-face group and videoconferencing group did not differ significantly in neuropsychological outcomes.

An order of assessment effect was found in one study, agreement between scores were stronger for those who were assessed in the face-to-face first as opposed to those who were assessed via videoconferencing first (Hildebrand et al., 2004). Perhaps clinicians felt less confident with assessing patients via a novel medium such as videoconferencing and therefore rated patients on a wider range if the consultation was done via videoconferencing first. Further research needs to be conducted in this area to explore this finding. In addition to that, a more controlled study design needs to be incorporated.

Small sample sizes were also found in studies concerning the use of videoconferencing with the geriatric population (Hildebrand et al., 2004; Poon et al., 2005; Tang et al., 2001) with the total number of participants being 96. What needs to be noted is that at times, responses to questionnaires or interviews may be difficult to obtain from the geriatric population due to cognitive impairment, deafness, or language impairment (Tang et al., 2001). Thus it is difficult to conclude if telemedicine is considered acceptable to these patients. It has also been noted that the studies above did not explore the practitioner's perspective in depth. However this questionnaire only sought to establish the extent of which staff agreed with four statements.

d. Post Traumatic Stress Disorder

Many veterans with post traumatic stress disorder (PTSD) live in remote areas with low population densities because they often use self-isolation to reduce stimulation and arousal (Morland, Pierce & Wong, 2004). PTSD is also highly prevalent among indigenous populations in isolated areas, such as tribal reservations and the Pacific Islands (The National Center of Post Traumatic Stress Disorder, 2005). The distance between the provider and the patient can be a barrier when effective treatment must be provided regularly and sustained over long periods (Deitsch, Frueh & Santos, 2000). Telemedicine appears to be a promising solution to this problem (Morland et al., 2004).

Deitsch et al. (2000) examined a group therapy session conducted via videoconferencing. This session involved four male veterans with PTSD who had been meeting every week in South Carolina for seven years with variable attendance. It was reported that there were frequent occasions in which group members wanted to attend a meeting but could not do so because of lack of transport. For the telepsychiatry session, patients met at their usual site with two of the three mental health providers in case there were any difficulties between sites. The third mental health provider traveled to a site 200km away from the patients. According to the remote mental health provider, there was an audio delay when someone at each site spoke at the same time. This was mildly distracting but everyone seemed to adapt to this because in face-to-face group

sessions, patients are encouraged to take turns speaking and listening. A review of the literature by the authors found that there were no previous reports of videoconferencing being used to conduct group psychotherapy (Frueh, Deitsch & Santos, 2000). Results from this case study suggest that group therapy for PTSD can be conducted via videoconferencing. The authors concluded that videoconferencing can facilitate more frequent attendance and thus increase the sense of cohesion and support that group therapy patients experience by reducing the barrier of distance.

Dobscha, Corson, Solodsky and Gerrity (2005) studied the effects of using videoconferencing on participant enrollment, the administration of questionnaires, study retention, and satisfaction. The authors recruited 400 patients from the Portland Veterans Affairs Primary Care Clinics for a randomized trial of care management intervention for depression. There were 31 patients in the videoconferencing group and 369 in the face-to-face group. Results demonstrated that there were no significant differences in mean depression scores, posttraumatic stress disorder scores, age or gender between patients interviewed by videoconferencing versus those interviewed in-person. Results also indicated that enrollment and consent of psychiatric research participants can be accomplished using videoconferencing. Of the 31 veterans who participated in the videoconferencing condition only 20 returned the satisfaction questionnaire. Patients who completed these interviews were generally satisfied with their experience and were not frequently lost in follow-up.

Morland et al. (2004) conducted an eight-week pilot study in Hawaii to investigate the feasibility of using videoconferencing to provide coping skills training to veterans with post traumatic stress disorder living in remote areas. Twenty male veterans (11 Asian Pacific Islanders, seven Caucasians, two African Americans) agreed to participate in the study. Three participants however, withdrew from the study before randomization. Seventeen patients were randomly assigned to a face-to-face or videoconferencing coping skills group. At the end of the study, the two groups were compared on levels of attrition and compliance, patient satisfaction, clinician satisfaction, and patients' retention of information. There were nine patients in the videoconferencing condition and eight in the face-to-face condition. Results indicated that 89% of patients remained in the videoconferencing group whereas only 50% of patients remained in the face-to-face condition. Patients in the face-to-face group attended an average of 4.9 sessions and patients in the videoconferencing group attended 6.3 sessions. However, this difference was not significant. Additionally, homework compliance was also reported as slightly lower in the face-to-face group. However, statistical analyses were not reported by the authors. Patient satisfaction was similar in both groups, no significant differences were found. Likewise, there were no significant differences found in the clinician's satisfaction ratings for the two groups. Information retention was also measured at week four and week eight. At week four, both groups had similar scores for information retention but by week eight the face-to-face group retained more information although these differences were not significant. The findings from this study demonstrated the feasibility of using videoconferencing to provide psycho-educational group services to veteran patients with PTSD living in remote locations.

Overall these studies have show how telemedicine has also been used in the management of patients with PTSD (Deitsch et al., 2000; Dobscha et al., 2005; Morland et al., 2004). The technology was used to conduct group therapy, to administer questionnaires, obtain consent, and

to provide information on coping skills to veterans. Videoconferencing was found to be comparable to face-to-face assessment, there were no significant differences in mean scores for depression or PTSD scores between conditions (Dobscha et al., 2005). In addition to that, information retention on coping skills did not differ significantly between veterans who received education in-person and veterans who received education via videoconferencing (Morland et al., 2004).

Results from the studies with veterans with PTSD should be interpreted with caution because with the exception of Dobscha et al. (2005), small sample sizes were used in two of the three studies reviewed here. A total of 421 veterans were involved in the studies above, of which 400 of these veterans were from Dobscha et al.'s (2005) study. Only 44 veterans were participants in the videoconferencing conditions. It is therefore possible that significant differences were not found due to small samples sizes.

While the study by Dobscha et al.'s (2005) had 400 participants, only 31 veterans participated in the videoconferencing condition. This uneven distribution of participants may skew results. In addition to that, veterans were given a choice to be interviewed in-person or via videoconferencing. All of the veterans who used videoconferencing chose to be in that condition and therefore results on the satisfaction questionnaire may be bias.

e. Eating Disorders

Cognitive behavioural therapy has been delivered via videoconferencing to patients with eating disorders. Simpson (2003) examined a multidisciplinary approach to the treatment of eating disorders via videoconferencing. Patients were offered between 12 and 20 sessions of cognitive behavioural therapy and when necessary, between six and eight nutritional education sessions. Daily food diaries were measured before and after therapy to determine the change in eating pathology. Twelve patients were enrolled in this study, consisting of five patients with bulimia nervosa, one with anorexia nervosa and six with eating disorders not otherwise specified. When this study was published, a number of patients were still undergoing treatment; however, preliminary results showed that the majority of patients experienced symptomatic improvements. There was also a reduction in compensatory behaviors such as self-induced vomiting, dietary restrictions and over-exercising. Additionally, eight patients were totally symptom free at the end of the treatment. Furthermore, all patients showed some positive changes in their eating behaviour. Early results from this pilot study indicated that video-therapy is a suitable means for multidisciplinary team management of patients with eating disorders.

Simpson, Bell, Knox and Mitchell (2005) examined the clinical utility of cognitive behavioural therapy delivered via videoconferencing to six patients with bulimic disorders. A baseline measurement of bulimic symptoms was recorded for each participant prior to treatment. This measure was compared with data at post treatment as well as one month post intervention to determine the clinical impact of the program. Weekly therapy sessions were conducted between local community hospital sites and the eating disorders clinic in Aberdeen, Scotland. During the last four weeks of treatment, three of the six participants no longer met the diagnostic criteria for having an eating disorder. Two of those three also continued their progress a month following treatment. However, two participants continued to binge, vomit and restrict dietary intake

throughout treatment and post-treatment. The authors concluded by saying that the current sample was too small to draw any general conclusions, however initial findings suggest that video therapy leads to improvement in bulimic symptoms for some clients.

Preliminary findings suggested that cognitive behavioural therapy conducted via videoconferencing produced symptomatic improvements for patients with eating disorders. However, neither of these studies compared video-therapy with face-to-face therapy. In addition to that sample sizes were very small (i.e. both studies only investigated 18 patients total).

f. Treatment in the Prison System

The following articles pertain to the delivery of telepsychiatry services to inmate populations. Leonard (2004a) reviewed the available literature and argued that serious mental health problems are common amongst prisoners. These mental health needs often remain unmet because access to specialized health care is often restricted in remote prisons: “In countries such as Australia and the USA where geographical isolation can create problems of accessibility, telepsychiatry services have been developed to reduce inequalities in service provision to remote areas” (p. 461). Leonard concluded that Videoconferencing offers opportunities to help reduce the level of health care inequality experienced by prisoners.

Zaylor et al. (2000) piloted a telepsychiatry service for prison inmates in Kansas. Over the duration of this study, a total of 264 telepsychiatry consultations were performed, consisting of 70 initial evaluations and 194 follow-up visits. Eighty-nine percent of consultations were for the male inmates and 11% were for the female inmates. Responses from interviews with six jail personnel were overwhelmingly positive. Prison staff outlined the following advantages of telepsychiatry. It provides quicker access than traditional care, lowers security risk, frees up staff to perform other roles, helps inmates with problems immediately, reduces the jail’s liability and gets patients off of costly suicide watch more quickly. With telepsychiatry, transportation and extra personnel to guard inmates for face-to-face consultation was no longer needed. Moreover, before the telepsychiatry service was made available, inmates needing treatment were kept on suicide watch until a mental health professional could evaluate them. The disadvantage of telepsychiatry, according to the prison staff, was that it resulted in many more inmates being put on psychotropic medication.

An important lesson learned from this study was that the initial needs of the jail were underestimated; the demand for the telepsychiatry service was actually five times greater than that projected. In a subsequent study, Zaylor, Nelson and Cook (2001) examined the clinical outcomes of patients enrolled in the Kansas prison telepsychiatry program. A total of 45 inmates (41 males and 4 females) completed the Symptom Rating Checklist-90-Revised (SCL-90-R) three times over the period of the study, once before the inception of the study and twice during treatment. The SCL-90-R is a 90-item self-report symptom inventory in which each item is rated on a five-point scale of distress. The psychiatrist, on the other hand, completed the Clinical Global Impression Scale-Severity Index (CGI) after each teleconsultation. The CGI is a clinician-rated scale that rates the patient’s level of distress. The authors found that inmates reported lower scores on the SCL-90-R over time, indicating less distress after having received telepsychiatric services. Psychiatrists also noted that patients’ improvement on the CGI also

coincided with the lower scores on the SCL-90-R. This pilot demonstrated that the delivery of psychiatric services to prison populations via videoconference was clinically viable.

Leonard (2004b) evaluated a videoconference based telepsychiatry service at a UK prison. A random sample of 81 prisoners was assessed by both a psychiatrist over videoconference and a face-to-face health care professional simultaneously. The Comprehensive Psychopathology Rating Scale (CPRS) was used to assess the prisoner's psychopathology. Both practitioners rated the inmates on the CPRS and inter-rater reliability was analyzed. After the initial assessment, 20 inmates also took part in a semi-structured interview to elicit their views about the acceptability of and their satisfaction with the service. The results suggested that videoconferencing can provide reliable assessment of a wide range of psychiatric signs and symptoms. This method of health care delivery was found to be both feasible and acceptable in a prison setting. Additionally, the author discovered the importance of obtaining the support of key individuals in a prison setting (namely the warden) in order to ensure the success of any pilot of this nature.

The researchers who studied the use of videoconferencing in a jail setting agreed that prisons often lack mental health services due to limited resources and limited accessibility. Telepsychiatry has been suggested as a method of increasing accessibility of these services in prisons (Brodey, Claypoole, Motto & Arias, 2000; Leonard, 2004a; Leonard 2004b; Zaylor et al., 2001; Zaylor et al., 2000). Further, the reliability of a psychiatrist assessment was tested in the study by Leonard (2004b). The author found that remote assessments were reliable and feasible. Another study even showed that psychological distress of inmates decreased over time with the introduction of a telepsychiatry service (Zaylor et al., 2001).

Results indicated that jail personnel are generally supportive of the telepsychiatry service (Leonard, 2004b; Zaylor et al., 2000). Jail personnel thought that telepsychiatry helped reduce the extra burden of transporting inmates to seek treatment in-person. Telepsychiatry therefore reduced the costs associated with in person treatment because there was no need to have extra personnel to guard prisoners during transport which also carries the risk of escape (Zaylor et al., 2001; Zaylor et al., 2000). In addition to that, suicide watch time can also be reduced because response time tends to be faster when a psychiatrist can evaluate an inmate remotely as opposed to in-person (Zaylor et al., 2000).

A review of the literature found only three articles that examined clinical uses of telepsychiatry in the prison population. Results from these studies were based on moderate sample sizes with the total number of 126 inmates participating. Results from this study, based on qualitative data, suggest that telepsychiatry was well accepted by six jail personnel (Zaylor et al., 2000). In addition to that, the study by Zaylor et al. (2001) showed that the introduction of telepsychiatry reduced distress for prisoners. While Leonard (2004b) concluded that videoconferencing can provide reliable assessment of a wide range of psychiatric signs and symptoms, none of the statistical results were reported.

V. Nursing

A small number of studies in the literature describe situations in which nurses deliver care in isolation of other health professionals (the great exception to this rule being home care which is discussed in a subsequent section). Most typically, nurses involved in videoconferencing initiatives are involved in multidisciplinary care provision, or providing services to home bound populations and their families. Additionally, a large body of the literature regarding nurses and videoconferencing is devoted to continuing nursing education. Therefore, the following analysis is limited to the role of videoconferencing in aiding nurses in remote or isolated areas providing care without the physical support of additional health care providers. The reviewed literature suggests that videoconferencing facilitates consultancy between isolated nurses and other health care providers, which expands the nurse's role and results in improved health care for patient populations.

Foster and Whitworth (2005) evaluated the utility of a videoconferencing system in Florida which established an audiovisual link between community nurses (n=4) performing child abuse examinations and a specialist clinician (n= 1) at a medical hub site. Often, child abuse examinations require families to travel great distances in order to obtain the appropriate medical consultation. The authors felt that a telemedicine link could maintain care within the community and designed a pilot study to explore this potential. For cases of suspected sexual abuse the patient and nurse at the remote site were connected via videoconference to an expert at a hub medical center to assist the nurse perform an evidentiary examination. It was found that the link allowed for rapid evaluation, response to community needs as well as an expanded role for nurses. On the basis of interviews, the authors concluded that the presence of the videoconferencing equipment did not interfere with the nurse patient relationship or hinder the examination process in any way. Additionally, it was found that the coordinated effort of community nurses and hub experts "expedited child safety decisions and resulted in more successful court actions (against offenders) (p. 128).

Heckner and Giard (2005) conducted a pilot study to test the effectiveness of using videoconferencing to facilitate the supervision of nurse practitioners (n=8). Recently graduated nurse practitioners in the USA are required to be supervised for a period of 24 months by a licensed doctor before they can prescribe psychiatric drugs to patients. The authors compared traditional on site supervision to supervision via videoconferencing. Four nurses in a virtual supervision group, working in three locations in Maine communicated via videoconference with a Psychiatrist in Boston whereas four nurses in a face-to-face condition were supervised on site. Feedback from both doctors and nurses in the videoconferencing cohort indicated that videoconferencing allowed for a supervisory experience similar to face-to-face. This application of videoconferencing was deemed to be of the most utility to rural nurse practitioners, working in isolation yet still requiring supervision for the probationary period.

Rosina, Starling, Nunn, Dossetor and Bridgland (2002) described the Australian based child and adolescent psychological telemedicine outreach service (CAPTOS), designed to connect rural nurses caring for children with psychological issues with clinical consultancy from urban centers. Although the number of children and nurses involved in the project were not disclosed, the authors established that the CAPTOS network facilitated clinical nurse consultancy in 27

ward areas in Australia which care for young people with mental health issues. The authors asserted that young people in Australia, particularly those in rural areas often encounter challenges in accessing care. The CAPTOS project allowed children who require hospitalization due to their psychological issues to access care in a non-psychiatric environment close to home which is “better than either a position on a waiting list or a bed a long way from family, cultural support and community services which are critical to recovery” (p. 49). Additionally, the authors felt that videoconferencing allowed caregivers to achieve immediate intervention which reduced “the risk of self harm, substance abuse, adult psychopathology and criminal behavior” (p. 48). Another major benefit of the consultancy link was that it ensured that the working environment for participating nurses was safe. Many of the nurses in the program were practicing outside the boundaries of their education and training in providing services to mentally ill populations without on site support from experts. The CAPTOS videoconferencing link ensured that while children were provided with immediate access to best care, nurses’ rights to a safe work environment were also upheld. The authors concluded that CAPTOS is a model for provision of mental health services to rural populations.

Tachakra, Dutton, et al., (2000) examined the change in teleconsultation usage (based on 300 total consultations) that occurred over time at a London based minor accident unit run by emergency nurse practitioners (the number of nurses that participated in the project was unspecified). A videoconferencing service was established to allow the nurse practitioners to obtain medical advice from staff at a major hospital six kilometers away. It was found that over time the nature of the teleconsultations changed, with the nurses using the service less frequently for cases that had become familiar such as soft tissue injuries, wound management and radiograph interpretation. This was partly attributed to the experience gained by the nurse practitioners over time. By gaining experience and clinical knowledge through previous teleconsultations, the nurse practitioners were less dependent on the service to when making specific diagnoses. This increase in skill contributed to the expansion of the nurse practitioners role in providing emergency treatment. This explained an increase in emergency cases that were sent to the clinic (which resulted in a subsequent increase in teleconsultations, however the magnitude of the increase was unspecified) as the consultant run clinics were curtailed as the nurse practitioner run clinics were capable of handling more complex cases . The authors concluded that the videoconferencing link was an excellent educational tool that enhanced the nurse practitioners ability to manage simple cases without support while also providing them with a more advanced skill set when providing care in more complex situations.

Nurses in remote areas often require support in delivering care to populations with complex health needs. The existing body of literature suggests that one promising application of videoconferencing technology is its ability to connect nurses in remote communities with physicians in urban centers who can provide support, supervision and clinical consultation. This consultation allows for an expanded role for nurses (Tachakra, Dutton, et al., 2000; Rosina et al., 2002; Foster & Whitworth 2005) as well as an improvement in the quality of care delivered to patients seeking care in remote areas. Additionally, it appears that telemedicine allows nurses to gain increased and skills over time and with increased exposure to complex clinical situations (Tachakra, Hollingdale & Ucke, 2001).

Foster and Whitworth (2005) established that creating a link between nurses performing child abuse examinations in remote areas and physicians in “hub centers” facilitated consultation and supervision (and ultimately quick diagnosis) without interfering with the nurse-patient relationship. Rosina et al. (2002) generated similar conclusions in their evaluation of an Australia based child and adolescent psychological outreach service which connects nurses in remote communities with expert consultants in urban centers, thus enabling nurses to deliver care in a context that due to diagnostic challenges would typically warrant patient transfer. Heckner and Giard (2005) established that videoconferencing can assist physicians in the remote supervision of nurse practitioners who are engaged in a 24 month probationary period (after which they can prescribe medications independently) which required them to report to expert clinicians once a week. The reviewed literature demonstrates the potential of videoconferencing to allow rural/isolated nurses to expand their services through consultation. Limitations of the reviewed studies included a small sample of participating nurses and an unspecified number of participating patients. Additionally, three of the four studies relied exclusively on qualitative data to draw conclusions regarding the efficacy of the videoconferencing intervention. Larger, more rigorous studies need to be conducted in the future in order to draw general conclusions concerning the impact of connecting nurses with other health care providers via videoconference.

VI. Telehomecare

The existing body of literature demonstrates that audio-visual technologies which connect home bound patients or residents of nursing homes with caregivers (health care professionals, family) contribute greatly to patient management and well being. Two principle technologies are discussed in the literature, which include: Standard ISDN based videoconferencing technology which is typically utilized in multidisciplinary team based care contexts. The second, video-telephony, typically operates over a ‘plain old telephone system’ and appears to be used to connect home bound patients with nurses or family members for one on one dialogue. Presentation and discussion of the reviewed literature will adhere to the following format. Studies in which videoconferencing was used to deliver services to institutionalized patient populations will be reviewed first; Videoconferencing in home care contexts second; and cases in which video-telephony was utilized to deliver care to home bound populations third.

a. Videoconferencing in Nursing Homes

The following studies from the reviewed literature demonstrated the utility of videoconferencing in delivering care to patients residing in retirement home facilities. Studies in which videoconferencing facilitated one on one care between the institutionalized patient and a caregiver (either a doctor or nurse) are presented first, followed by studies in which videoconferencing facilitated multidisciplinary case management, and incorporated the expertise of various practitioners.

Laflamme et al. (2005) conducted an Indiana based pilot designed to assess the role of videoconferencing in facilitating clinician decision making in their interactions with nursing home residents. Specifically, the authors aimed to determine whether videoconferencing could compensate for the limited availability of clinicians in dealing with residents with limited

mobility. Over an eight month period, 68 video encounters were recorded with 35 patients. The authors paired virtual and bedside examinations in order to gauge the utility of videoconferencing. Face-to-face examination of residents (n=35) by an offsite clinician immediately followed the videoconferencing session by the same clinician to compare the two interventions. Results showed that for 63% of the encounters clinicians (n=3) stated that the videoconferencing intervention was appropriate and in 71% of cases stated that it facilitated assessment. In only 3% of the videoconference assessments did the virtual clinician find it necessary to seek a focused, face-to-face examination that videoconferencing could not provide. There were challenges however in engaging the patients via the technology as residents were only alert in 50% (n=17) of the cases which made diagnosis challenging for the virtual clinicians. The authors concluded that although face-to-face interaction is most desirable, as it allows the clinician to properly engage the patient, videoconferencing may exist as a viable alternative which could prove especially useful in cases where the clinician is not available on site.

In a study conducted in Iowa, Wakefield, Buresh, Flanigan and Kienzie (2004) assessed provider and resident satisfaction with specialist consultations provided to residents of long term care center via videoconferencing. Throughout the course of the study nurses (n=30) brought patients (n=62) into a telemedical room where they were evaluated remotely by doctors (n=12) at another facility. Surveys administered to the various study participants revealed that physicians rating of the videoconference intervention were good to excellent for “usefulness in developing a diagnosis, developing a treatment plan, quality of transmission and satisfaction with the consult format” (p.791). Ninety-two percent of the residents in the program felt that telemedicine made it easier to obtain medical care and a staggering 100% of the nurses felt participating in the telemedicine clinics was a good use of their time. Despite the overwhelmingly positive patient/provider response to the telemedical intervention, the authors did encounter some challenges with the integration of videoconferencing technology into their workflow. They highlight the challenges associated with requiring staff to take on new roles in the workplace, which required additional training and a shift of human resources from the primary site to remote site in order to account for the shift in workload. The authors concluded that, challenges aside, videoconferencing between clinicians and caregivers in long term care offers several advantages including avoidance of travel and increased continuity of care.

Weiner et al. (2003) conducted a clinical trial of unscheduled, nighttime videoconferencing in a nursing home in order to assess its strengths and weaknesses as a mode of spontaneous care delivery compared to a telephone (which is traditionally used on demand). The study took place in a 240 bed Indiana based nursing home facility over a twelve month period. When acute medical events took place in the evening hours (which corresponds to a period of limited medical supervision) a triage computer system sent a page to participating physicians (n=6) indicating the appropriateness of using videoconferencing to respond to the situation. Of a total of 394 pages that doctors were sent throughout the study period, videoconferencing was utilized in 15 of these and found to be particularly appropriate in dealing with cases involving changes in mental status, unusual lab values and falls. However, in some cases there was failure to perform videoconferencing evaluation. The authors outlined that this failure to complete the evaluations was due to a lack of preparation, occurrence of emergencies during time periods when physicians were unable to access their video stations, and unavailability of technical support workers who were able to remedy technical issues late at night. The study demonstrated that using

videoconferencing technology on an on demand basis, late in the evening presents potential users with challenges not typically encountered on occasions where equipment use is scheduled and technical support is available

Chan, Woo, Hui and Hjelm (2001) examined the feasibility of providing multidisciplinary nursing services to the 198 occupants of a Hong Kong nursing home via videoconferencing. Over twelve months, a variety of health care providers including doctors, nurses and physiotherapists were involved in the delivery of patient education programs regarding the use of a metered dose inhaler, wound management consultation and a falls prevention program. The authors concluded that 89% of the aforementioned services could be accomplished via videoconsultation compared to 11% which required on-site visits. In addition, the videoconferencing intervention was considered acceptable to both nursing home residents (96% of nursing home respondents had favorable opinions) and staff (detailed staff results are described below). This study demonstrated that videoconferencing can be used to deliver a large portion of geriatric outreach services for nursing home residents, reduce costs, and increase convenience for both health care providers and consumers.

In a subsequent evaluation, Hui and Woo (2002) examined health professional perspectives on the feasibility of videoconferencing to provide services to geriatric facilities. After every consultation (n=1001), the specialists evaluated whether videoconferencing served as an adequate replacement for conventional face-to-face consultation. Across the various specialties, which included Geriatricians, Psychogeriatricians, Dermatologists, Nurses, Physiotherapists, Occupational therapists and Podiatrists, videoconference based service provision was rated as adequate in 84% of the consultations. Additionally, it was determined that the establishment of a videoconferencing link in the nursing home enabled the community geriatric assessment team to serve more patients and see them more regularly. Videoconferencing was found to be deficient in consultations which required the specialist to make physical contact with the patient (chest auscultation, wound palpation), however, overall the authors concluded that it was feasible to use videoconferencing to deliver specialist care to nursing home patients and resulted in increased productivity (more visits) and cost savings.

The reviewed literature demonstrates that videoconferencing greatly aided in the management of institutionalized patient populations. Firstly, videoconferencing allowed for multidisciplinary care, integrating the expertise of the entire patient management team at once, which resulted in increased continuity of care and cost savings (Chan et al., 2001; Hui & Woo, 2002). This modality of care provision was acceptable to both patients and providers as it did not negatively impact communication between patients and caregivers (Wakefield et al., 2004). In summary, videoconferencing was demonstrated to be an effective advocate in the management of institutionalized patients.

Challenges surrounding the delivery of 'virtual' care to institutionalized populations included the establishment of 'on demand' consultations due to human resource limitations (Weiner et al., 2003), and difficulties in properly engaging elderly, often demented patients in communication (LaFlamme et al., 2005).

b. Videoconferencing for Home Bound Patients:

The following studies from the reviewed literature demonstrated the utility of videoconferencing in delivering care to home bound patients. Studies in which videoconferencing facilitated one on one care between the home bound patient and a caregiver (either a doctor or nurse) are presented first, followed by studies in which videoconferencing facilitated multidisciplinary case management, and incorporated the expertise of multiple caregivers.

Young et al. (2004) compared three models of telehomecare across Canada (St Johns, Toronto and Calgary) in order to determine whether there was a generalisable core model of telehomecare that could be applied universally. Semi-structured interviews and focus groups were conducted with hospital administrators, health care providers and patient families (roughly 100 participants total across the three sites) and content analysis was applied in order to determine the degree of overlap between the services provided at the three sites. The authors determined that the core model would utilize videoconferencing technology to bridge the gap between clinicians and recently discharged, home bound patients in order to streamline the transition from hospital to home environments and establish a “hospital without walls” for telehomecare

In a study conducted at the University of Alberta, Miyazaki, Stuart, Liu, Tell and Stewart (2003) examined the use of ISDN videophones by nurses (n=15) and home bound palliative care clients (n=4). The usability of the phones was assessed in terms of user friendliness and the perceived effect that they had on care. Interviews were conducted with three clients and eight staff at the end of the intervention in an effort to understand the users’ experiences. Responses in exit interviews to questions surrounding the utility of the phone were quite positive. Patients’ and nurses responded affirmatively to the following questions; “will you miss the videophone, was it advantageous to see who you were talking to, did the videophone affect the care received or given, would you use the videophone again, and would you recommend the phone to somebody else?” (p. 74) The only item which garnered a negative response from the group was would you buy a videophone? (p. 74). The authors concluded that based on patient and provider data, videophones can facilitate the provision of support to clients with a terminal illness in their own homes.

In a Florida based study, Hauber and Jones (2002) investigated the use of videoconferencing in supporting families caring for individuals in prolonged states of reduced consciousness. In a controlled trial, family caregivers in an experimental group (n=6) were provided with videoconferencing equipment which enabled them to connect with a nurse weekly for support. The stated objectives of the experimental condition were to reinforce aspects of patient care, give the family emotional support and monitor the patient for changes in neurological status. Caregivers in a control group (n=4) were provided with no support except for access to a telephone line that the families could call for support and advice. Data from the study revealed that patients in the videoconferencing group returned more often for rehabilitation than those in the telephone group and that videoconferencing families felt that 58% of their needs were being met compared to 50% in the control group (based on a completed family needs questionnaire). The authors suggested that videoconferencing allowed caregivers to establish an audiovisual link with nurses who can educate the family on topics related to traumatic brain injury care as well as supervise various procedures (wound dressing, insertion of trachostomy) which would typically take place in a health care facility. The authors concluded that videoconferencing may serve to

support the transition from care facility to home for patients with traumatic brain injury by reducing the number of perceived family needs.

Rosen (2005) profiled the experience of Linda McCrae, a Sacramento based video nurse, who delivered care 100 to chronically ill patients via videoconferencing. Rosen asserted that the immediacy of videoconferencing offers significant advantages over traditional health care delivery. This was typified by one of McCrae's patients, Elwin who experienced emergency breathing problems and was able to liaise with Linda right away where an in person visit would have been impossible. Rosen stated that Linda's company Kaiser Permanente is currently quantifying the benefits of home tele-health through formalized trials, and preliminary results indicated that videoconferencing technology allowed nurses to make more than twice as many visits compared to face-to-face visits over the course of a working day. The most profound benefit associated with the videoconferencing technology according to McCrae was that it reduced the isolation that home bound patients often feel by allowing them to communicate with health care providers, family or similar others. The article discussed challenges associated with the program, namely that it was difficult to properly engage patients who are immobile or too mentally confused to operate the equipment. McCrae asserted her belief that videoconferencing technologies may not be suitable for this segment of the population.

Finklestein and Speedie (2004) examined patient and provider satisfaction with the delivery of videoconference based telehomecare service. The authors employed a low cost videoconferencing system which operated over a 'plain old telephone system' (POTS) in order to determine the utility of said system in the delivery of home care. Congestive heart failure, chronic obstructive pulmonary disease and chronic wound patients were randomized into control (standard home healthcare,) and intervention (face-to-face care plus additive interaction with nurse via videoconferencing) .A total of 567 virtual visits to 53 Participants were conducted. Nurses (n=11) rated the videoconference visits to be as useful as actual home visits in 90.7% of the cases. Patient perception of the videoconferencing intervention improved over the course of the study which led the authors to conclude that "Participants develop a more positive perception of videoconference based telehomecare after experiencing it" (p. 125). The authors concluded that home monitoring can be achieved over a plain old telephone system (POTS) and that a system of this nature may be of exceptional utility to rural populations.

Guillén et al. (2002) assessed user (both patient and health care provider) satisfaction with a broadband based home telecare system. Two different types of videoconferencing systems were developed and set up in the homes of 135 home bound patients across five locations in Spain, Ireland, Greece and Germany. Questionnaires were distributed to evaluate the users' perception of the usability of the system, the perceived quality of communication and the effect of the services on the patient's lives. The questionnaires were completed by a total of 135 patients, 88 patient caregivers and 13 medical staff (which health care professionals were interviewed was unspecified). The questionnaires revealed significant differences in 'perceived usability of the system' amongst the patients. Those who had experience with technology typically rated the system as 'good to excellent', whereas those with less experience rated the usability as lower. The authors found however that all participants who initially feared the technology came to embrace it with exposure. Both patients and caregivers scored the quality of the communication as 'satisfactory'. Further, this finding was consistent throughout the locations in Europe. Medical

staff indicated that the telecare service was of benefit to the participating patients. Across the participating sites it was demonstrated that the intervention improved independence, increased spare time and had a positive impact on the patient's lives. The only anomaly was the Frankfurt site at which health care professionals provided support to elderly patients in an effort to reduce loneliness and isolation. Home bound patients in this cohort did not feel that the intervention improved their independence or increased their spare time. Amongst participating health care professionals there was a consensus that telecare should never fully replace more traditional, hands on care delivery, however they trusted their ability to make assessments over the telecare system and felt that telemedicine represents an acceptable alternative when face-to-face care is not available.

In a Florida based study, Chumbler et al. (2005) examined the clinical effect that intervention frequency has on the health of home bound diabetic patients. Two groups of veterans with diabetes were enrolled in home telehealth programs. One group (n=197) received "intensive" weekly virtual visits from a nurse, and the other (n=100) was monitored daily by videoconference but "less intensively" (p. 151). Over the course of the twelve month study, hospital service utilization amongst the two groups was observed and compared. A decrease in hospitalizations and bed days of care was observed in the daily group, whereas use of these services doubled in the weekly monitoring group. The authors hypothesized that the differences between the two groups may have been attributable to the fact that the daily intervention program supported insulin management much more proficiently than the weekly program. One notable limitation of the study was that the daily monitoring group had substantially lower body mass index and diastolic blood pressure at the outset of the study than the weekly monitoring group. Nevertheless, the authors arrived at the conclusion that frequency of monitoring is related to subsequent service utilization in home bound, diabetic patients.

Guest, Rittey and O'Brien (2005) reviewed the impact of a three year pilot study in the U.K. where a videoconference link was established in the homes of three families with neurologically impaired children. The link enabled parents to communicate with various members of an interdisciplinary team (nurses, physiotherapists, neurologists) without having to transport children who were seriously ill, and often 'movement sensitive'. Early outcomes of the pilot indicated that the families felt reassured by the presence of the technology and noted that it saved them several "disruptive and potentially dangerous trips to the ER" (p. 22). Consultants involved in the project stated that the images were of sufficient quality to facilitate diagnosis and to make changes in treatment. The authors concluded that the establishment of a telemedical link between the families and their care providers increased their independence and made their lives "more bearable" (p. 22).

In a study conducted in Belfast, Morgan, Grant, Craig, Sands and Casey (2005) compared the utility of videoconference based home monitoring of children with complex congenital heart disease with telephone based monitoring. Children in the study were selected based on the presence of a severe, life-threatening heart condition which required one on one support post discharge from hospital. A randomized controlled trial was carried out comparing home videoconferencing (n=14) with regular telephone contact (n=9) and with ad hoc telephone support traditionally provided (n=13). Preliminary results suggested that videoconferencing provided significant benefits to families of seriously ill children over and above telephone

support. The authors state that although their study is not complete, they have determined that the videoconference link reduces parental anxiety about returning home with their children. Additionally, the videoconferencing link provided information to doctors that enabled urgent admission to hospital

Vontetsianos et al. (2005) evaluated a telemedicine-assisted home support program for patients in Athens, Greece with advanced chronic obstructive pulmonary disease. The patients (n=18) included in the study were well motivated to improve their condition and had been hospitalized at least four times over the past four years. In this study, a nurse visited the home bound patients with a medical kit (including a spirometer, blood pressure monitor, ECG recorder etc) and liaised with specialists at a local hospital via videoconferencing in order to assist the nurse and patient in the management of the patients' condition. An analysis of patient health outcomes nine months after the inception of the project revealed a substantial decrease in hospitalizations (from 37 to 6), a reduction in the number of days spent in the hospital (from 315 to 64) and a reduction in the number of both emergency and scheduled visits to the patient (from 156 to 86) . The intervention also served to improve patients' disease knowledge on a number of topics and therefore improved self management. The authors concluded that the establishment of a videoconference link between home bound patients and hospital based specialists empowered patients to minimize symptoms and "increase autonomy in everyday living" (p. 88).

Wilson et al. (2004) conducted a randomized controlled trial aimed at comparing the utility of both videoconferencing and telephone technologies in facilitating multidisciplinary case conferencing. One-hundred patients receiving acute home based care in New South Wales Australia were randomized to one of two conditions. One group enabled a multidisciplinary team of caregivers (nurse, occupational therapists, social workers, etc) to engage in a videoconference communication, while in the other condition, the team communicated over the telephone. The effectiveness of the two interventions were measured by the number of conferences required per patient, average length of each conference, length of treatment, degree of team involvement, level of communication, the sophistication of the management plan and staff satisfaction. Audio-visual case conferencing resulted in a reduction in the number of case conferences required to manage the patient (1.9 compared to 3.3) and a shorter length of treatment (6.0 days compared to 10.2). Additionally, the videoconferencing group demonstrated mildly increased multidisciplinary involvement in the patients' case management (at 26% compared to 18% in the videoconferencing group). The above findings were statistically significant. Although the use of videoconferencing did not improve the cost effectiveness of multidisciplinary case management (as compared to the telephone group) the vast majority of participating health care providers indicated that videoconferencing was superior to telephone for articulating a management plan

Valero, Arredondo, del Nogal, Rodriguez and Frias (2000) examined the impact of implementing broadband based, high quality audio/video telemedicine units into the homes of 15 chronically ill, homebound patients in Spain. The 15 patients each engaged in three brief videoconferences with specialists and nurses, and rated their satisfaction (via questionnaire) with several aspects of the experience including the quality of the images, ability to hear the nurse/specialist, level of comfort with a videoconference home visit and the need for further follow up at a hospital to solve their problem. Patient response to all of the questionnaire items was positive, indicating the

feasibility, from a patient perspective, of using videoconferencing in the delivery of medical consultations to home bound, chronically ill patients.

The reviewed studies demonstrated the effectiveness of videoconferencing in delivering care to home bound patients. Firstly, videoconferencing supported the patients' transition from a hospital environment to a home based care environment without interrupting the caregiving process (Hauber et al., 2002; Young et al., 2004). Videoconferencing also benefited family members of home bound patients by providing them with opportunities for education which assisted them in care provision (Hauber et al., 2002) and by reducing their feelings of anxiety with the knowledge that medical expertise was only a call away (Guest et al., 2005). Videoconferencing was demonstrated to impact the health of home bound populations as well by reducing the time that patients were required to spend in a hospital setting. This was achieved largely through improved multidisciplinary case management, improved patient 'self management' (Vontetsianos et al., 2005; Wilson et al., 2004) and enhanced continuity of patient care (Chumbler et al., 2005).

c. Video-Telephony Based Home Care

Video-telephony is a unique modality which was frequently used in the reviewed literature to connect home bound patients with their caregivers and families. Video-telephony is a broad term which encompasses several technologies (videophones, television based video-telephony) which connect home bound patients with their caregivers in a one-on-one, face-to-face fashion. This is in contrast to videoconferencing technologies which most typically allow more than one person to be present at the site connected. Like videoconferencing, video-telephony has been demonstrated to positively impact the physical and emotional well being of home bound patient populations by connecting them with caregivers. Unlike traditional videoconferencing modalities however, video-telephony operated at a lower cost and with greater ease than videoconferencing using a 'plain old telephone system' as opposed to an ISDN connection. The following section is a discussion of the impact of video-telephony based technologies in home care contexts.

Arneart and Delesie (2001) reviewed previous studies on the role of video-telephony in the provision of care to elderly populations. The authors made the case that many elderly people prefer home care to residential care and that the nursing field needs to adapt its service delivery in response to this demographic trend. Video-telephony is proposed as a vehicle to connect service providers (in this case nurses) with elderly populations in a cost effective yet clinically efficacious way. The authors described the benefits of video-telephony as established in previous studies. These included; savings in cost and time, improvement in patient compliance to therapy, reduced admissions to nursing homes, increased continuity of care and an improvement in feelings of community integration.

In a study conducted at Michigan State University, Mickus and Luz (2002) examined the feasibility of using videophones to reduce social isolation experienced by nursing home residents. They provided 20 individuals (ten pairs of family members) with lost cost videophones. The data revealed that introducing videophones into the nursing home did not impact the *frequency* of communication between nursing home residents and their families (17 of the 20 Participants reported this) however, 60% of the sample indicated that *quality* of their visits

were enhanced by the videophones. This effect was especially pronounced amongst Participants who were separated by geographical distance and unable to make face-to-face contact without the video-phone. The authors concluded that there is high potential for social interaction and improved emotional well being via videophone use when both the nursing home residents and family members are capable of using the equipment, tolerant of technical difficulties and responsive to the additive benefits (virtual face-to-face contact) the technology offers over telephone communication.

Savenstedt, Brulin and Sandman (2003) conducted a study in Sweden with family members of demented patients who were given videophones for communicating with their husband/wife/parent once a day. Five spouses and two children were provided with low broadband videophones and interviewed after three months in order to gauge their perceptions of the intervention. Qualitative data analysis of interviews with the patients' spouse/family member revealed the following: the visual link established by the videophone reduced travel and improved convenience, facilitated their involvement in the caring process, allowed them to interpret their relatives well being and confirmed their relationship. The authors attributed the aforementioned benefits to the visual aspect of the videophone communication. In addition, the authors found that videophone interaction was short and characterized by increased patient alertness and therefore superior to that achieved during face-to-face visits in the hospital. One of the significant challenges was the need for nurses to assist those patients unable to operate the videophones independently. This proved frustrating for the spouse/family members as it interfered with natural communication. Overall, the authors concluded that videophones have the potential to be useful tools for improving communication between family members and elderly, institutionalized relatives.

Ezumi et al. (2003) described the effect of a videophone network on peer support amongst Japanese elderly people living at home. The authors selected 28 elderly participants from an adult day care service for participation in the study. The study compared two groups of subjects, one who had been provided with 2-way synchronous videophone (n=14) and one without videophones (n=14) to determine the impact of peer support on social independence and social cognition. The authors found that the videophone users established communication networks amongst themselves and that at least half the users perceived an improvement in functional independence as a result of videophone use. These findings were not demonstrated in the control group which the authors concluded illustrated the power of video-telephony in network building and development of peer support amongst elderly patients.

Hebert, Jansen, Brant, Hailey and van der Pol (2004) conducted a three year randomized controlled trial aimed at assessing the use of videophones in the provision of palliative home care services. The project was implemented in 11 home care offices that served rural citizens in Alberta and the authors looked at videophones effect on symptom management, quality of life, and cost. Study participants included sixteen palliative care nurses and 320 palliative care clients across four health regions in Alberta. Preliminary findings suggested that both patients and nurses were enthusiastic about using the videophones and found them to be user friendly. Additionally, the authors suggest that videophones were of great utility to the home care field as they operate over ordinary telephone lines (as opposed to videoconferencing which requires high

broadband ISDN connections) and are easy for both health care providers and consumers to operate.

Guilfoyle, Perry, Lord, Mathews and Wootton (2002) aimed at examining the feasibility of videophones in care delivery from nurses to patients in rural Australia. Home bound Patients (n=10) and nurses were equipped with low cost, commercially available videophones and a hands free speaker. Miniature video cameras were attached to the side of the phone to allow the nurses to gain a close up view of the patients. The duration of the study was six months and during this time 84% of the patients' calls (43 total calls were made) to nurses were video-phone calls (as opposed to simple telephone calls) and in 53% of the calls the close up camera was used. Both the nurses and patients rated the equipment as satisfactory to good (as rated on a 5 point Likert scale) although on some occasions, nurses indicated that they were unable to get a satisfactory view of the patients wound site. Eighty percent of the patients in the study stated that the videophone visit was less desirable than a visit from an actual nurse, however ninety percent stated that the videophone allowed the nurse to provide them with extra support, that they may not have received otherwise. Additionally, patients in the study stated that although they appreciated the ability to connect with their caregiver, they would not be prepared to pay for the unit themselves. The authors concluded that videophones may represent a low cost option for the delivery of health care to rural populations.

A large body of the pilots/studies which describe the delivery of virtual nursing care to home bound patients and residents of long term care facilities utilize videophones of some type. Videophones may represent a viable alternative to more advanced videoconferencing technologies as they are easier to operate and consume less technological resources (run over a standard telephone line as opposed ISDN) than videoconferencing systems, while at the same time offering some similar benefits to patient populations (Arneart and Delesie, 2001). The suitability of videophones to facilitate diagnosis has been called into question in the literature. In a pilot study aimed at examining the feasibility of utilizing low cost videophones to provide community health care in Australia (Guilfoyle et al., 2002) several nurses commented that the visual component was not sufficiently clear to aid in diagnosis. Nurses in a study by Miyazaki et al. (2003) indicated that the color quality of the videophones was too poor to facilitate diagnosis.

There is a paucity of literature which directly examines health outcomes of patients receiving care from health professionals via video-phone, and further an absence of studies which directly compare these two modes of delivery across all relevant dimensions (cost-effectiveness, clinical efficacy). Hebert et al. (2004) are currently conducting a three year study aimed at assessing the utility of videophones as patient care tools in palliative care contexts. The authors are examining their effect on symptom management and quality of life as well as cost and readiness factors. More studies of this nature which endeavor to quantify the utility and cost effectiveness of these devices are required in order for an audience of health care providers and consumers to be in a position to make an informed decision concerning the suitability using video-phones to deliver care.

In conclusion, the existing literature in the telehomecare field reveals that synchronous, audio-visual technologies are of substantial utility to health professionals providing virtual care to home bound patients and residents of nursing homes. Several pieces of literature highlight the

fact that in the field of home care, the patients are coping with mobility challenges (Guest et al. 2005; Herbert et al., 2004; Valero et al. 2000) which makes videoconferencing an ideal modality for the delivery of virtual care as it minimizes travel for these individuals. Secondly, utilizing videoconference based technologies allows health professionals to visit patients more frequently, which improves the continuity of patient care (Arnaert and Delesie, 2001, Hauber et al. 2002). Chumbler et al. (2005) in study in which nurse practitioners provided virtual care to diabetic home bound patients found that increasing the frequency of videoconference based patient visitation results in improved patient health and decreased hospitalizations. A segment of the literature on the role of videoconferencing applications in home care contexts focuses on its ability to facilitate multidisciplinary care to these populations, integrating the efforts and diagnostic expertise of the entire home care team as opposed to simply connecting a nurse and patient one on one. The aforementioned studies describe situations where integrated, team based communication occurred and the videoconference link facilitated diagnosis and team based patient management (Chan et al., 2001; Vontetsianos et al., 2005; Wilson et al., 2004). Arguably, sufficient technological resources in the form of ISDN lines and broadband networks are required to support this process. This contrasts with nursing based telehomecare in which a typical encounter consists of a one on one visit between the patient and nurse. In the majority of cases in the literature, this type of intervention was achieved via video-telephone which operates over the “plain old telephone system” and is less expensive than videoconferencing for both health care providers and consumers (Arneart and Delesie, 2001).

A segment of home bound patients require ongoing monitoring and care from family members. Videoconferencing enables nurses to communicate with these family members and both equip them with the knowledge and support they need to adequately manage their ill relative’s health care needs as well as supervise various procedures related to the caring process (Hauber et al., 2002). Videoconferencing also enables families caring for children suffering from chronic illness to manage illness within the home environment. The knowledge that expert consultation is easily accessible aids in minimizing the anxiety that parents cope with as caregivers (Morgan et al., 2005). Arguably, the principal benefits that patients derive from a 24 hour audio visual link with their caregiver are emotional. In many cases, home bound patients are isolated from society and therefore unable to participate in active social relationships which are essential to the maintenance of emotional well being (Mickus et al. 2002). A large portion of the literature pertaining to virtual nursing illustrates that establishing open lines of communication between care- givers and home bound patients (or nursing home residents) positively impacts their emotional state by reducing their feelings of isolation and loneliness (Arnaert et al., 2001; Mickus et al., 2002; Miyazaki et al., 2003; Savenstedt et al., 2003).

There is a lack of data regarding the clinical accuracy and effectiveness of videoconference/video-telephony based home care. The variable which is most commonly used to demonstrate the accuracy of this type of intervention is decrease in hospitalizations. The majority of the reviewed studies rely 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. Additionally several of the above studies employed small patient sample sizes which impact the generalizability of the findings in this field. Future research should aim to elucidate the comparative cost effectiveness and clinical utility of videoconferencing and video-

telephony applications in order to determine which application is most appropriate for home care service delivery.

VII. Allied Health Professionals

Under the heading of Allied Health Professionals, we conducted a search of the literature in the areas of telerehabilitation, pharmacy, social work and speech pathology. Videoconferencing has been accepted with enthusiasm by the providers and patients, as they recognize that it benefits those who are located in rural and remote locations.

a. Telerehabilitation

Lemaire, Bourdrias, and Greene (2001) used low-bandwidth, internet-based videoconferencing to provide physical rehabilitation consultation services for eight community hospitals in Ontario. Over 21 months, 47 physical rehabilitation consultations were completed for communication disorders, foot care, gait problems, orthotics, prosthetics, arm weakness and wheelchair prescription. This program aimed to bridge the gap between a client's home and a central rehabilitation centre. The equipment included a data communications unit that plugged into a television set, a telephone line and a video-camera. The communication device transmitted simultaneous audio and video pictures over the ordinary telephone network at 33 kbps per second. A home care nurse or technician could adjust the equipment according to the rehabilitation specialist's needs. Clinician questionnaires were completed by 47 individuals. Almost 80% of remote clinicians considered teleconsultations to be easy, or easier, than in-person sessions. Fifty-five percent of specialists and 80% of remote clinicians were as confident in the outcome as they would have been after an in-person consultation. Ninety percent of the clients felt as comfortable or more comfortable with the teleconsultation as with a conventional appointment. Challenges identified included video picture delay (of up to 10 seconds), and blurred images. The authors purported that using a telemedicine system helped reduce the feelings of isolation often common in rural healthcare settings by providing access to specialized expertise and continuing education as well as reducing travel. This study supported the use of low-bandwidth, Internet-based videoconferencing for many remote physical rehabilitation consultations.

Russell, Jull and Wootton (2003) conducted a study in Australia to evaluate the reliability and validity of assessing knee range of motion via the Internet. The authors developed a low-cost telemedicine application for the delivery of physiotherapy intervention to the home. One tool incorporated into this application is an Internet-based goniometre (IBG). A goniometre is a tool which measures joint angle and range of motion to determine the presence or absence of dysfunction. Historically, the most common tool used to perform goniometry is the standard universal goniometre (UG). The aims of this study were to examine the intra- and inter-rater reliability of the new IBG for the physical outcome measure of knee angle; and to determine the criterion validity of the IBG by comparison with the UG. Two therapists evaluated knee angle on a single participant via two methods of assessment: the Internet and the traditional method (face-to-face). The authors concluded that a low-speed Internet connection can be utilized as a medium over which reliable and valid goniometric measurements can be performed. This study

demonstrated that the intra- and inter-rater reliability of the IBG is comparable to that of the UG. Unlike the UG, the high inter-rater reliability of the IBG indicates that the measurement of participants can be completed by more than one therapist. Furthermore, the low cost and ease of use of this tool makes it suitable for the field of Internet-based clinical practice.

Russell, Buttrum, Wootton and Jull (2004) conducted a study in Australia to determine the effectiveness of delivering physiotherapy services to patients via videoconferencing. After a total knee replacement, good rehabilitation is essential for good outcomes. However, as a result of a lack of health care professionals and resources in rural and remote areas, patients often forego outpatient rehabilitation, which results in sub-optimal outcomes, and shortened longevity of the knee prosthesis. The article did not mention how many physiotherapists participated in the study, noting only that 31 patients participated. The participants received a six week rehabilitation program consisting of one 45 minute treatment session per week. The videoconferencing method was well received by both the physiotherapists and the patients. The service was easy to use and integrated well into clinical practice. Participants were found to achieve treatment outcomes that were comparable to those achieved with traditional, face-to-face treatment. Only 29% of the participants had ever used a computer, with an average self-rated confidence in their ability being 0.8 out of 10. Despite that, this videoconferencing method ensured that participants could operate the software with little training, regardless of their previous experience with a computer. User-friendly technology is one of the seven core principles required for a successful telemedicine system. The study demonstrated the potential for delivering physiotherapy services via videoconferencing.

Maeno, Fujita and Iwatsuki (2004) conducted a study to determine whether the delivery of rehabilitation services was feasible in remote places in Japan. The purpose of this study was to investigate the possibility of instructing people, like family members, to assist patients with activities of daily living using a videoconferencing system. The subjects were five first year students at Aomori University of Health and Welfare. A videoconferencing system was installed in two rooms at the university to simulate a connection between a home and an institution. The subjects first saw a video-tape of several general procedures for assisting a patient in sitting up, standing up from a bed, standing up from sitting with legs stretched, and walking with a cane. Then they assisted a simulated patient who had suffered from a stroke, while receiving instructions via videoconferencing from a physiotherapist in another room. Student's performance on assisting with four activities was scored on a five-point scale (higher scores indicating better performance). The average score in the first session was 35 points out of 45. Students were given a chance to ask questions and resolve difficulties before a second trial. The average score on the second trial was 39 points. The authors noted that a more thorough explanation would be required when guiding members of a patient's family. The instruction in assistance techniques given in video-recordings needed to be improved and complemented by verbal guidance. Nonetheless, the present study showed that the delivery of rehabilitation services is feasible in remote places.

Jin, Ishikawa, Sengoku and Ohyanagi (2000) conducted a study to assist a physiotherapist located in the remote area of Hokkaido, the northernmost province in Japan. Almost all towns and villages in the rural areas of Hokkaido suffer shortages of health-care professionals, particularly physiotherapists, occupational and speech therapists. As a result of these shortages, a

therapist's role is often expanded, contributing to higher stress and departures from the rural communities. A telehealth project between a medical university and the village of Betsukai provided regular videoconferencing support to an isolated physiotherapist in Betsukai. The authors reported that the videoconferencing helped the physiotherapist gain confidence in her work, access continuing education and avoid burnout thereby ensuring the patients received the regular treatment they needed. The authors planned to explore the use of videoconferencing for case studies of physiotherapy patients, case conferences, interactive training of rehabilitation therapists, and open lectures to residents in rural communities in future research.

Liu and Miyazaki (2000) established a telerehabilitation system to link staff at the University of Alberta with clinicians and students located in a rural community approximately 180 km east of Edmonton. From February 1996 to March 1999, the Faculty of Rehabilitation Medicine conducted 254 telehealth sessions. Of these connections, only 11 were unsuccessful owing to technical or telecommunication problems. Therefore, 96% were successfully conducted. The outcome measures of this study were that telerehabilitation enabled the clinical supervision of students in rural placements, more support for clinicians, increased access to graduate education, increased access to continuing education, access to specialized rehabilitation services, and access to clinical consultations. The study concluded by stating that telerehabilitation presents opportunities for researchers to examine and develop new outcome measures.

Hughes, Hudgins, Hooper and Wallace (2003) conducted a study in New Brunswick whereby videoconferencing was used to view pieces of rehabilitation equipment, determine its usefulness, enable remote troubleshooting, and remote assessment of clients with disabilities. Thirty-two videoconference sessions were conducted during the study period. In 31 of the 32 sessions, a connection was successfully established between the sites. Sixty participant questionnaires were returned (a 94% response rate.) Questions asked included: the ease of the connection process, clarity of the audio and video equipment, comfort in using the system, problems experienced during set-up, problems experienced during the session, and whether the objectives of the session were met. Videoconferencing was used to view rehabilitative equipment. Therapists established connections with personnel from the New Brunswick Easter Seals March of Dimes office to view rehabilitative devices before shipment, to ensure they would be suitable for the intended client. Device viewing applications allowed remote viewers to make decisions about the suitability of the equipment before shipment. This resulted in quicker delivery of the appropriate devices for the client in need, reduced shipping costs, and reduced labour costs. The remote troubleshooting application improved therapist competencies with specialized devices and provided clients with timely access to solutions without the need to travel. The videoconferencing application also allowed non-verbal persons with severe disabilities to participate in conversations pertaining to their health and care plan using whatever means of communication they had (e.g., letter boards, computer-based voice output communication aids or physical expressions and gestures). Videoconferencing equipment stability/reliability issues and security and confidentiality issues that need to be addressed before adoption of the system can be more widespread.

Engbers, Bloo, Kleissen, Spoelstra and Vollenbroek-Hutten (2003) conducted a study in the Netherlands to determine whether a relatively low-cost, PC-based teleconsultation system could be used for inter-institutional communication with children who have complex movement and

postural disorders. Four paediatric physiotherapists in three different institutions participated. The article does not mention how many cases were conducted in total. Both videoconferencing and email were tested. (Emails were sent with video clips as attachments.) Videoconferencing was unsuccessful, as the low-bandwidth analogue lines, used by the majority of the therapists, made the quality of the real-time video-images very poor. The study demonstrated that for postural and movement disorders that vary according to the environment such as home, school and clinic setting, the relevant information cannot be captured by a single test result or picture and that low-bandwidth videoconferencing did not offer any advantages over email. Emails with attached video recordings were successful and the therapists used this method to consult each other in about 20 cases. This study found that asynchronous communication seemed to have an advantage over low-bandwidth videoconferencing (synchronous communication) since it enabled the therapists to work independently of the other therapists and their time schedules. A major challenge identified was that therapists were required to solve technical problems with the videoconferencing, rather than dealing with the clinical problems presented

Lai, Woo, Hui and Chan (2004) conducted a study in Hong Kong to examine the feasibility of using videoconferencing for community-based stroke rehabilitation. One physiotherapist participated, and the sample comprised of 21 stroke patients living at home. The participants were involved in an eight-week intervention program at a community centre for seniors that included educational talks, exercise and psychosocial support, delivered by a physiotherapist via a videoconference link. The results indicated that videoconferencing can be used to extend post-acute care into a non-clinical setting. Extending rehabilitation beyond the hospital and into the community or the home, enabled providers to continue to monitor patients' progress, identify areas in need of improvement before complications set in, and decrease long-term disability and costs.

Savard, Borstad, Tkachuck, Lauderdale and Conroy (2003) described two clinical programs that utilized videoconferencing to provide rehabilitation specialist consultations to individuals living in remote areas. One program, the Minnesota Telerehabilitation Initiative (MTI), serves patients and clinicians in rural Minnesota. The other program, the Pacific Rim Initiative (PRI), serves patients and clinicians on the island of American Samoa. Both service areas have a lack of rehabilitation clinicians. High speed videoconferencing that allowed for real-time audio and video interaction was used to connect the patient, the local caregivers and specialists from the remote facility. A total of 117 telerehabilitation encounters were completed across both projects. All consultations resulted in changes to the plan of care. Clinicians who participated in the projects consistently rated the clinical effectiveness of teleconsultations as good or excellent. The authors concluded that the care of individuals with neurologic issues can be augmented and supported via specialty consultation using telehealth technology. They emphasized that telehealth technologies used for specialist consultations have the potential to elevate the standard of care for individuals receiving rehabilitation services.

In the field of telerehabilitation, videoconferencing has generally been accepted enthusiastically by both patients and therapists. The delivery of rehabilitation services has proved to be feasible in remote places. Remote clinicians consider teleconsultations to be as easy as in-person sessions. Many clients reported feeling as comfortable with the teleconsultation as with a conventional appointment. The participants were found to achieve treatment outcomes that were

comparable to those achieved with traditional, face-to-face treatment. These articles demonstrate the potential for delivering physiotherapy services via videoconferencing. The many benefits of videoconferencing include: decreased travel time; better clinical support in local communities; improved access to specialized services; indirect educational benefits for remote clinicians who participate in teleconsultations; and reduced feelings of isolation for rural clinicians.

In the study conducted by Engbers et al. (2003) however, videoconferencing was unsuccessful, as the low-bandwidth analogue lines, used by the majority of the therapists, made the quality of the real-time video-images very poor. However, email with attached video recordings was successful and the therapists used the system to consult each other in about 20 cases. This particular study found that asynchronous communication seemed to have an advantage over videoconferencing (synchronous communication) since it enabled the therapists to work independently of the other therapists and their time schedules.

In physiotherapy, a necessary condition for a successful consultation is generally where the physiotherapist can see the patient moving around and demonstrating his or her postural disorders. These images seem difficult to capture on video camera, but in spite of this limitation, videoconferencing has proved to be a success in telerehabilitation. Another limitation seen in these studies is that very few authors report how many clinicians and patients participated in the studies, and how many cases were conducted. So it is difficult to analyze the success of these studies, when there is a lack of reported numbers.

b. Pharmacy

Nissen and Tett (2003) examined the feasibility of providing telepharmacy services in remote areas of Australia. Rural and remote community pharmacies service large areas of rural Queensland, and because of the distances involved, often do not meet the patients for whom they provide medication. The objective of this study was to improve the quality of pharmaceutical services provided in rural and remote areas, by allowing community pharmacists to have real-time contact with dispensing doctors, aboriginal health workers, and patients via video-phone. Video-phones were placed in the offices of the aboriginal medical services in Yapatjarra and Doomadgee, and linked to the community pharmacy and hospital pharmacy, respectively, which supplied medication to them under the Australian government's Pharmaceutical Benefits Scheme. The article does not mention how many doctors, pharmacists and aboriginal health workers participated in this study. There were numerous technical and logistical difficulties experienced during this project (e.g., set-up issues, difficulty in achieving a video-phone connection). All the project participants stated that they were disappointed and frustrated by the technical problems encountered during the project, and stated that these issues needed to be resolved to make video-telephony a feasible form of communication in the future. The telepharmacy project and video-phones served to increase communication and liaison between pharmacists and other health professionals.

Clifton, Byer, Heaton, Haberman, and Gill (2003) devised a telepharmacy program to address issues related to access to prescription drugs and pharmacists for low income populations in Washington State, USA, where some geographically isolated communities cannot financially support a pharmacy or recruit pharmacists. The program implemented remote dispensing and

counseling via a two-way interactive videoconferencing system. It was conducted at the Community Health Association of Spokane (CHAS). The collaboration involved CHAS, another federal community health centre, Northeast Washington Health Plan, a small clinic serving Native Americans (Native Health of Spokane), and the Washington State University College of Pharmacy. The telepharmacy program was conducted between one base pharmacy and five remote clinics. The base pharmacy had two full-time pharmacists and one pharmacy technician. The study does not state how many patients participated, but did report that over 75% of patients seen at the remote sites were satisfied with their videoconference interactions with the pharmacist. Of the patients seen at the remote site, 55.6% agreed or strongly agreed that they were satisfied with the time required to obtain medications and counseling. 46% agreed or strongly agreed that they would not have been able to have their prescriptions filled easily without this program. This study concluded that remote dispensing of medications by pharmacists is a viable solution to the complex problems of access to prescription medications and pharmacists by low-income individuals located in rural and remote areas.

Bynum, Hopkins, Thomas, Copeland and Irwin (2001) examined the effect of telepharmacy counseling on metered-dose inhaler (MDI) technique and patient satisfaction for adolescents with asthma in rural Arkansas, using interactive real-time compressed videoconferencing. Twenty percent of the adolescents who participated had never been shown the appropriate use of an MDI. Participants were randomly assigned to either a telepharmacy counseling group (n = 15) or a control group (n = 21). Both groups participated in pre-test, post-test, and two to four week follow-up assessments for MDI technique and patient satisfaction via interactive compressed video. The control group did not receive face-to-face instructions about the techniques, but rather, it was provided via written instructions on an inhaler package insert. Results indicated that from pre-test to follow-up, the telepharmacy counseling group showed more improvement in MDI technique than participants in the control group. The study findings demonstrated that patient education provided by pharmacists via interactive compressed video was superior to education provided via written instructions on an inhaler package insert. Interactive compressed video is an effective medium for teaching and improving MDI technique in this rural, adolescent, predominantly African-American population.

The purpose of a study by Leversha, Pendergast, Humphreys, Colley and Bommer (2002) was to develop guidelines for use by pharmacists who own and operate pharmacy depots using videoconferencing in Victoria, Australia. A pharmacy depot is a place where pharmacy medicines are stored in bulk, until they are delivered to pharmacies. Real-time videoconferencing was used to facilitate an adequate supply of medicines between a pharmacy and a pharmacy depot in a rural area and deliver counseling to depot customers. The authors did not provide data on how many pharmacies and pharmacy depots were included. A community survey was carried out before and after the trial. The development of guidelines, and their testing, ensures that pharmacists who own and operate depots which use videoconferencing facilities have clear standards, and rural consumers receive a more comprehensive pharmacy service. Pharmacy depot owners needed to indicate how orders for medicines/prescriptions are to be received at the depot and transmitted to the pharmacist; how orders/prescriptions are to be collected from the depot and conveyed to the pharmacy; how medicines supplied to the depot are to be packaged; how the packaged medicines are to be stored at the depot pending delivery; and how the pharmacist intends to counsel the patient who obtains medicine from the depot. As a result of

this study, the Pharmacy Board of Victoria prepared an amendment to its guidelines to ensure that pharmacy practice is carried out in accordance with Pharmacy legislation. The Board required an acceptable description of the operation of the audiovisual system; security of the depot; stock control, audit system and records of supply; sales procedure; and list of products and maximum quantity to be kept in stock. This enables consumers to receive pharmacy medicines without the delay which occurred when they had to be sent from the parent pharmacy.

In the field of pharmacy, videoconferencing has been accepted with enthusiasm in rural and remote areas. The pharmacy studies indicate that videoconferencing would improve the quality of pharmaceutical services provided in rural and remote areas, by allowing community pharmacists to have real-time contact with dispensing doctors and patients. Pharmacists who participated in these studies stated that video-phones offered potential benefit over conventional telephones, as they could provide a face-to-face link, allowing better interaction in areas where distance limited personal contact.

Other studies have shown that remote dispensing of medications by pharmacists is a viable solution to the complex problems of access to prescription medications and pharmacists by low-income individuals located in rural and remote areas. In addition, patient education provided by pharmacists via videoconferencing was superior to education provided via written instructions to patients. In the Australian study conducted by Nissen and Tett (2003) however, technical difficulties hampered the videoconferencing sessions, leading to frustration among the participants. These issues need to be ironed out, so that videoconferencing can be a feasible method of delivering pharmacy services in remote areas.

The analysis of the benefits of videoconferencing in the field of pharmacy is limited by the number of studies that have been conducted. We found just four articles that deal with videoconferencing in the context of pharmacy. So it is difficult to draw any grand conclusions based on such a limited number of studies. Another limitation seen in these studies is that very few authors report how many clinicians and patients participated in the studies, and how many cases were conducted. So it is difficult to analyze the success of these studies, when there is a lack of reported numbers.

c. Social Work

In the area of Social Work, there were no Canadian studies published. McCarty and Clancy (2002) examined the use of modern communications technologies such as e-mail and videoconferencing in the field of social work in the U.S, with emphasis on the legal, ethical, and relationship issues raised. They reported that the potential for telehealth is tremendous, and that nearly anything a social worker does face-to-face could theoretically be done through videoconferencing. They noted however that there is some debate regarding how technology affects the nature of the professional-patient relationship, that telemedicine has potential for cost savings but, that the lack of third party reimbursement for teleconferenced therapy, or chat room counseling greatly impedes its potential.

Burton, Stanley and Ireson (2002), conducted a study in the U.S to evaluate the use of videoconferencing as an educational and consultative tool for physicians and mental health staff

providing services for child victims of sexual abuse in rural Kentucky. During the two-year project, the number of counties with access to sexual abuse examinations increased, as did the numbers of cases reported and the proportion reviewed by a consultant. The number of counties with access to sexual abuse examinations by a qualified physician increased from 16 to 23 in the first year, and to 54 in the second. The number of cases increased from 77 to 83 in the first year and to 339 in the second year. The number of consultations increased from zero to eight in the first year, and to 74 in the second. Overall, the seven physicians were very satisfied with telemedicine consultations, which supported their clinical decision making in sexual abuse examinations. Consulting physicians said that they received pertinent and timely physical examination information using telemedicine. Image quality was adequate for making a diagnosis, image colour was clear and lighting was adequate. Mental health professionals, predominantly licensed clinical social workers, were very satisfied with the educational sessions and more confident in working with sexually abused children, but less positive about the use of telemedicine for case conferencing. A user survey showed that the equipment supported clinical decision making, was useful and was easy to use. However, it was not as effective for case conferencing as for one-to-one interactions.

Videoconferencing has been accepted with mixed emotion in the area of social work. Social workers and clients would prefer face-to-face meetings, but sometimes this is not possible due to time and distance. In these situations, videoconferencing has stepped in to fill the gaps. Social workers who have attended videoconferencing sessions have reacted very positively towards its use in their work.

d. Speech Pathology

The treatment of speech and language pathology, with its heavy reliance on the visual and auditory / perceptual aspects of communication, is particularly suited to telehealth. At the Mayo Clinic facilities in the USA, in the late 1980s, speech pathology was among the first clinical consulting services provided through telemedicine. Telehealth technology may provide a valuable way of extending speech pathology services to underserved populations and of making specialist expertise available to those who need it.

Kully (2000) noted that in Canada in the past, participants in speech pathology treatment were assessed in traditional, face-to-face encounters, via closed-circuit television and with a computer-controlled video laserdisc, over the telephone. Their results indicated that a diagnosis based on assessment by television or laserdisc was comparable to a diagnosis based on face-to-face contact. Furthermore, patient performance on standardized measures in the telecommunication conditions was comparable to performance in the face-to-face assessment. Results of these preliminary studies suggest that tele-evaluations of speech pathology can be reliable and acceptable to adults and children with a variety of disorders.

Kully wrote of the potential value of telecommunications systems in treating communication disorders. This mode of service delivery showed particular promise in giving patients access to specialist services for problems like stuttering, which are difficult to manage and often require long-term follow-up support. The Institute for Stuttering Treatment and Research at the University of Alberta (ISTAR) has used videoconferencing to provide follow-up support to

geographically remote adults who have undergone intensive treatment on site. This article described a study in which one patient and one clinician participated. The videoconferencing system employed a digital line with a data rate of 770 kbit/s. The participating patient was a 38 year old man with severe developmental stuttering who had successfully completed an intensive three-week treatment program at ISTAR. The telehealth sessions took place about two months after the intensive program and involved the practice of specific speech skills and strategies as well as a discussion aimed at facilitating self-management and problem-solving skills. Sessions were evaluated informally through patient and clinician reports. The verbal reports of both the patient and clinician were positive. The clinician evaluated the session outcomes as satisfactory and believed that the high quality of the sound and visual images permitted accurate judgments about most aspects of the patient's speech performance.

Sicotte, Lehoux, Fortier-Blanc and Leblanc (2003) conducted a study to assess the feasibility of delivering speech–language services from a distance to children and adolescents who stutter. The telemedicine intervention in this study was organized between a Montreal paediatric tertiary care centre and a local primary care centre, in Matane, a remote area in northern Quebec. The objective of the telemedicine intervention was to offer assessment and treatment for persons who stuttered and were unable to receive these services within their community. A certified SLP based in Montreal was recruited, and in Matane (the remote site), one parent was present in the room with the child, to assist the SLP. Six patients participated in this study: four children, aged between three and 12 years, and two adolescents, aged 17 and 19 years. Patient satisfaction with respect to image and sound quality of the telemedicine unit and the clinical quality of the intervention was assessed on a three-point scale: highly satisfied, somewhat satisfied, not at all satisfied. The perceptions of the six patients were scored at the highest level for both the technical and clinical quality, and were judged as adequate by the SLP. All patients or parents had confidence in the quality of the care they received, despite the physical absence of the clinician. The patients' perceptions regarding a decrease in stuttering were very favourable. In addition, the appeal of this form of care in remote regions was so high that there were few barriers to limit patient attendance. However, telemedicine also had its drawbacks. This type of intervention is more demanding for the clinician, particularly when it comes to dealing with young children. From a distance for example, it is very difficult for a clinician to interact adequately with agitated children who move constantly. It is also difficult to comprehend shy children who speak softly. Although this presents an additional burden for parents, it was not perceived as a constraint and was offset by the convenience of accessing SLP services. The results demonstrated that interactive videoconferencing can provide a feasible and effective care delivery model. Patient attendance was maintained throughout the intervention. All participants showed improved fluency.

Theodoros, Russell, Hill, Cahill and Clark (2003) conducted a study in Australia to assess motor speech disorders in adults with acquired neurological impairment, using a videoconferencing system. Dysarthria, a speech disorder, is characterized by varying degrees of slurred and indistinct speech, which can affect an individual's ability to communicate with others. The authors suggested that by extending rehabilitation therapies beyond the clinic and into the home through the use of telemedicine, it would be possible for therapists to monitor a patient's progress, identify areas requiring improvement, decrease long-term disability and long-term costs, and ultimately improve patient outcome. The online videoconferencing module consisted

of a customized graphical user interface that employed Microsoft NetMeeting software to provide real-time videoconferencing as well as the transfer of store-and-forward data between the participant and therapist. Ten participants, aged 20 to 70 years and diagnosed with a perceptible dysarthria, were studied. Participants were assessed both face-to-face and online. These assessments were conducted independently by two research speech pathologists. Participants were assessed on two separate occasions with at least a one-day interval between sessions to account for fatigue and test–retest effects. Based on preliminary data, the Internet-based application for the assessment of dysarthria appears to have the potential to provide a clinically reliable online method of assessment of this speech disorder.

Rose, Furner, Hall, Montgomery, Katsavras and Clark (2000) reported the findings of a U.K project that investigated the use of high quality videoconferencing technologies to deliver remote speech and language therapy support services to school children with communication difficulties. Videoconferencing was used by two speech and language therapists to communicate with children at remotely located schools. The authors did not provide data on how many children participated in this study. In this project, the four evaluation criteria were quality of therapy, cost of therapy, clinical effectiveness of the therapy, and time allocated to each child. The therapists felt that the technology did add value to the delivery of therapy support services, and that its regular use in the future would be welcome. This program demonstrated that modern videoconferencing technology can be used to support the delivery of speech and language therapy services into schools. This videoconferencing application has the potential to reduce costs while improving access to speech and language therapy services.

The speech pathology studies have demonstrated that videoconferencing has shown promise in giving patients access to specialist services for long-term speech problems. Videoconferencing is especially useful to people who are located in geographically remote areas. In these studies, diagnoses based on assessment via videoconferencing were comparable to diagnoses based on face-to-face contact. Thus, tele-evaluations of speech pathology can be reliable and acceptable to adults and children with a variety of disorders. The ability to offer speech therapy from a distance represents an opportunity to improve access for those who might otherwise be deprived of this treatment. With regard to speech language pathology, the therapists and patients have all reacted positively to treatment via videoconferencing.

However, there are limitations even in the field of speech pathology. Sicotte et al. (2003) noted that videoconferencing in this area is more demanding for the clinician, particularly when it comes to dealing with young children. If children are agitated, fidgety or speak softly, it is difficult to conduct a successful speech therapy session. Another limitation in the field of speech pathology is the small sample size in the studies that were conducted. This has an impact on the conclusions that can be drawn from these studies.

VIII. Interprofessional Contexts

The following section includes studies which utilized videoconferencing in interprofessional contexts. Videoconferencing typically coordinated the effort of the various practitioners involved in the caregiving process which in addition to impacting patient health, resulted in savings of both time and money.

a. General Interprofessional Settings

Fortin et al. (2003) described the implementation and evaluation of a telemedicine network for the Magdalene Islands, located in the middle of the Gulf of St. Lawrence in Quebec, more than 1000 km from a supra-regional medical referral centre. The purpose of implementing the telehealth program was to increase the Islands' health care quality, access to services and reduced expensive air transfers. During the 13 month study period, 118 transmissions were made across 14 applications, the most being store and forward for orthopaedic and radiology consults. However, real-time imaging was used for gynaecology and obstetrics and interactive videoconferencing was used for variety of applications including speech therapy, dermatology, rehabilitation, genetics and psychosocial consults. Specialists were the most frequent users (58 activations) however 16 of the 19 GPs included in the project used it for 44 requests. Over 100 patients benefited from the program. The program was used by most for initial consults, 19 patients used it for follow up, eight emergency transfers were avoided and 15 elective transfers were managed locally via videoconference. The project demonstrated that telemedicine is acceptable to providers, and facilitates access to services otherwise not available. Success they noted, was dependent upon the development of a program that is focused on patients' needs, made use of physicians' usual referral patterns, enabled collaboration between colleagues and had support of key individuals to facilitate the process. The authors cautioned that future telemedicine deployment in the health-care system will require a structured approach, and adequate planning that takes into account lessons learned from pilot projects.

Brown-Connolly (2002) described the Blue Cross Telemedicine Network in California as a primary care network designed to improve access to specialty services from rural areas by way of real-time videoconferencing. The study was designed to measure patient satisfaction with the program and results from this perspective will be discussed in more detail in a subsequent section of this paper. However in addition to satisfaction data collected from 24 primary care sites in 18 counties (793 patients over 1301 teleconsultations in 27 specialties) patients submitted information regarding travel that would have been required had videoconferencing not been used. These results suggested that there was an average decrease in travel distance of 170 km and time savings of 130 minutes.

Delaney, Jacob, Iedema, Winters and Barton (2004) conducted a videoconferencing trial between staff at three public hospitals in Sydney, Australia. The purpose of the trial was to assess the effectiveness of videoconferencing on staff attendance at multidisciplinary meetings for breast cancer patients. A total of 26 people attended at least one meeting including 12 surgeons, four radiologists, four medical oncologists, three radiation oncologists, two nurses and one pathologist. Meetings broadcast by videoconference were found have better attendance than face-to-face meetings. The median number of participants for face-to-face meetings was eight (range =4-10) compared to 10 (range = 8-15) for videoconference meetings. However, results of a post-trial questionnaire (61.5% response rate) found that most participants (68.7%) expressed a preference for face-to-face meetings. The mean number of cases discussed at the videoconference meetings (four cases) was significantly less than the face-to-face meetings (six cases). The study conducted anthropological analysis of the videotaped interactions at both types of meeting and found that face-to-face meetings were more informal, spontaneous and conducive to discussion than the videoconference meetings, which tended to be more formal, regimented and fixed in terms of people's relative positions or roles. The authors suggested that face-to-face

meetings facilitated interaction and willingness to negotiate uncertainty whereas videoconference meetings represent public performance before a camera. The authors emphasized the importance of not “overestimating the capacities of this communication system to compensate for individuals’ geographic absence” (p.491).

Gelfand, Geffken, Halsey-Lyda, Muir and Malasanos (2003) described the use of video-phone and other technologies (email and telephone) for adolescent diabetes management as part of an intensive outpatient diabetes program at the University of Florida. Nine adolescents with diabetes participated in an intensive outpatient treatment protocol designed to improve adherence to their treatment regimen and improve metabolic control. By participating, families had access to medical and mental health professionals and immediate assistance in a diabetes-related emergency. Of the nine adolescents recruited, four dropped out and two out of the remaining five continued to report their blood sugar results to diabetes clinic staff (using video-phone and telephone). Participants’ HbA1c levels (an indicator of the average recent blood glucose level and level of glycation damage to tissues, and thus of diabetic complications) were measured at regular clinic visits over the duration of the study and for each participant their HbA1c levels were lower at the end of the study period than when recruited into the study. This use of telehealth enabled the team to make adjustments to patients’ insulin usage without the need for clinic visits. This considerably reduced the travel requirements for patients’ families. It also helped families identify how adolescents’ behaviour (skipping meals and not performing regular blood sugar checks) affected their blood sugar. The authors noted that because they used different forms of telehealth (telephone supplemented by video-phone or email) that they lack sufficient evidence to determine whether video-phones offer significant advantages over the regular telephone.

Halamka (2001) described the Baby CareLink program at Boston-based Beth Israel Deaconess Medical Centre, an application involving the use of multiple technologies including computers, videoconferencing and high-speed internet to facilitate communication between families, their premature babies, and neo-natal intensive care professionals. Through videoconferencing, parents could monitor their baby from home, schedule visits, and receive doctor notes and updates regarding their baby’s condition. The pilot project involved 58 families; 28 as active participants and 30 as controls who continued to receive regular care. Each of the 28 participating families received free high-speed phone lines, computers, videoconferencing equipment and training. Results of the three year study suggested that the program actually saved money by reducing the average length of hospital stay for participating families by two days. An even more dramatic reduction in length of stay was seen for infants with birth weights of less than two pounds where the average length of stay was reduced by 16 days. Cost savings from \$5000 to \$6000 were achieved for all babies and the reduction in hospital stay for babies under two pounds, resulted in cost reductions up to \$48,000 for each child.

Axford, Askill and Jones (2002) used videoconferencing to link members of specialist cancer multi-disciplinary teams at remote sites as a team-building tool, to enable all member of the team to participate fully in case reviews and agree on treatment plans for patients. The study used audit forms to record details of attendance and track technical difficulties encountered. The team members included physicians, surgeons, clinical oncologists, radiologists, radiographers, pathologists, medical secretaries, clinical nurse specialists in breast and colorectal cancer,

respiratory therapist, chemotherapy specialist nurses, cancer care nurses, oncology art therapist and clinical trial nurses. Average attendance at the meetings was 15 staff. In the first year, 42 videoconferences were held, where 202 cases were reviewed. Only one session was terminated due to an ISDN line fault. The authors reported that the videoconferencing enabled all teamMDT members to review cases reducing delays in diagnosis and improving access to specialist opinion. Videoconferencing also reduced travel for patients and clinicians. The cost savings from travel avoided by core team members amounted to \$35,000 (UK Pound) for each MDT per annum.

Khoja, Casebeer and Young (2005) examined the role of telehealth as a way to coordinate health professionals involved in the treatment of children at a seating clinic. Seating clinics play an important role in the ongoing treatment for children with physical disabilities who require the use of a wheelchair. The clinics are designed to address issues related to fit, comfort and functionality of the child's wheelchair as they age and reach specific milestones related to their disability. Videoconferencing was used to connect the Children's Hospital in Calgary and the Medicine Hat Regional Hospital to facilitate an already existing outreach seating clinic between the two sites. The authors conducted 12 interviews managers and staff including physiotherapists, seating technicians and occupational therapists after the implementation of seating services through telehealth. Staff expressed concern about the potential disturbance of equilibrium among different roles. As well staff felt that telehealth could not provide the "hands on" and "tactile" nature required for seating services. However, several advantages were identified including: more staff involvement; better information and autonomy for outreach staff; smoother running of seating clinics; opportunities to link with community teams; building relationships with hospitals; and sharing resources. Most of the disadvantages were related to problems with the equipment. The authors strongly emphasized the importance of involving staff in decisions related to change in the nature of their work. Staff viewed their involvement in planning as critical for adopting change.

Cohn and Goodenough (2002) conducted a survey to identify attitudinal barriers toward telemedicine among paediatric health professionals in New South Wales. The survey was completed by 43 medical professionals in paediatric public health (e.g., staff specialists), 53 medical professionals in private practice (e.g., Paediatricians and GPs), 62 nurses and 30 allied health staff. Participants completed a survey comprised of 90 items in five areas (demographics, the effect of time and distance on work, perceptions of telemedicine, communication methods and potential applications of telemedicine). Participants were asked to rate their perceptions and experiences with videoconferencing on a five point scale, from 1, strongly agree to 5, strongly disagree. Results showed a higher endorsement of videoconferencing for educational applications rather than patient management or treatment planning across all professions. For example mean ratings for the statement "telemedicine is suitable for professional education" were 4.3, 4.4., 4.5 and 4.7 respectively for medical professionals (private), medical professionals (public), nurses and allied health, compared to 3.5, 3.5, 3.8 and 3.6 for the statement "telemedicine is suitable for patient management". These findings are similar to those reported in Blignault (2000) which reviewed three years of videoconferencing experience in Queensland Australia, where the most common use of multipoint videoconferencing was for educational and administrative purposes.

Campbell, Harris, and Hodge (2001) investigated rural health providers' perceptions regarding the introduction of telemedicine and developed a framework to assess readiness. The Missouri Telemedicine Network has 21 videoconferencing sites in 16 counties. In total 57 semi-structured interviews with physicians (n=13; 8 GPs, 4 internal medicine, one general surgery), nurses (n = 20) and administrators (n=24) were conducted. The participants practiced in 10 different health centres located throughout 4 communities. Rural health providers were found to have a wide variety of perceptions regarding receptivity to technologic change that the authors grouped into the following themes: turf, efficacy, practice content, apprehension, time to learn, and ownership. The authors noted that each theme operated as a perceived barrier or facilitator of change. Overall, providers affiliated with tertiary centres were more likely to use videoconferencing than those in private practice. The authors concluded that successful use of this type of technology required implementation strategies to be tailored to the environmental conditions of the practice, taking into consideration providers' perception of the technology. The authors noted that these findings were limited to recent introductions of telemedicine to rural settings and that further research was needed to determine the extent of rural providers' perceptions in other geographic areas and over time.

Aas (2002) conducted a study to determine whether or not telemedicine changed the distribution of tasks between general practitioners and specialist or between the local hospital and tertiary hospital in Norway. Qualitative interviews were carried out with 30 people from the following telemedicine services: teledermatology, tele-otolaryngology, telepsychiatry and telepathology. Personnel involved in telemedical work provided details about the people and organization with whom they had telemedical cooperation and interviews were conducted. The results suggested that telemedicine did not produce large changes in the distribution of tasks. The effects were largest and most complex in telepsychiatry, followed by teledermatology. In teledermatology, telemedicine resulted in primary care sectors undertaking more patient care. In other words, the learning effect of telemedicine enabled GPs to take care of some patients themselves. Similarly, in telepsychiatry, primary care staff did work that was previously performed in psychiatric outpatient clinics and mental hospitals. Overall the changes in the distribution of tasks between levels of care, where they occurred where for an increased involvement for lower levels of care. The authors suggested that local variation in how telemedicine is practiced may explain the variation in the findings between telemedicine applications.

The studies reviewed suggested that videoconferencing can be used to connect multiple health care providers to deliver services for patients who require coordinated care and management as in the case of chronic diseases such as diabetes. In telemedicine programs with multiple users, specialists tended to use the system more frequently than other users (Fortin et al., 2003). Videoconferencing between care teams and patients facilitated the ongoing management without the need for clinic visits (Gelfand et al., 2003) Additionally, videoconferencing facilitated communication between care providers and family members at a distance and reduced average length of hospital stay (Halamka, 2001). However, as Delaney et al. (2004) found, while videoconferencing enabled better opportunities for multiple-care providers to attend care conferences, it formalized and somewhat reduced interaction among care providers. Results of other studies regarding the perceptions of various disciplines (not interprofessional per se) found that health professionals preferred videoconferencing for educational, administrative and psychosocial applications rather than patient management or treatment planning (Cohn &

Goodenough, 2002; Blignault, 2000). Campbell et al. (2001) recommended that implementation strategies need to be tailored to environmental conditions of the practice and take into account rural providers perceptions of technology. The evidence from the studies reviewed suggested that the use of videoconferencing for interprofessional service delivery has potential but that care providers still prefer face-to-face encounters over videoconferencing for patient management.

b. Emergency Medical Services

In the field of emergency medicine and trauma care it is well established that rapid patient access to medical expertise is critical. The lack of a timely response in trauma situations may have dire consequences for “patients’ families and societies as a whole” (Latifi et al., 2004, p. 194). Patient outcomes in trauma situations are highly related to the presence of senior emergency staff in the first hours of care to oversee or supervise the provision of trauma services (Rogers et al., 2001). Unfortunately, many rural emergency facilities are ill equipped to handle trauma situations as they lack personnel with adequate training and experience to oversee care delivery (Latifi et al., 2004; Ricci et al., 2003). The existing body of literature suggests that videoconferencing can connect rural and isolated facilities with trauma experts which serves to reduce the discrepancy between rural and urban trauma care provision. Latifi et al. (2004) reviewed the existing literature regarding the use of telemedicine in the trauma/emergency field in order to determine its future application. The authors assert that advances in technology including videoconferencing and telepresence may help to eliminate the gap between rural and urban service provision.

Rogers et al. (2001) conducted a pilot study in which videoconferencing units were installed in the homes of three trauma surgeons. These units connected the trauma surgeons with staff at four community hospital emergency departments in upstate New York and Vermont. The purpose of the study was to examine the effect of establishing a consulting link between trauma surgeons and rural emergency medical service providers. The authors recognized the importance of having a senior trauma official present to oversee the trauma team and act as a team leader or “hands off” facilitator. Since this role did not require any physical contact between the team leader and the patient, it was proposed that this role could be fulfilled virtually via telemedicine. The study employed a two video camera system in order to provide the virtual team leader with an adequate view of the trauma room. The first camera was positioned on top of the telemedicine work station and provided an eye level view of the room. The second was mounted on the ceiling and provided birds-eye view of the patient. The virtual trauma team leader had the ability to move both cameras by remote control as well as alternate between the views offered by each. Over the course of the eight month study, 26 consultations were conducted. In two cases, the telemedical link was thought to be potentially lifesaving. Although not directly measured in the study, the authors also associated several other benefits to the presence of the virtual team leader. These included the additional comfort of the rural team in having a senior surgeon present, the ‘Hawthorne effect’ of improved care due to the presence of the team leader, continuity of patient care, and enhanced trauma centre- community hospital relations.

Ricci et al. (2003) reported on a telemedical link between a rural Vermont hospital and trauma surgeons at a level one trauma centre. The purpose of the intervention was to enable rapid

consultation between the two facilities and examine the ability of the system to improve the health outcomes of rural patients. Over the first 30 months, 41 teletrauma consultations were performed, three of which were judged to be life saving. Both rural physicians and trauma consultants (the number of participating health care providers was not provided) felt that the system enhanced clinical care. In 67% of the cases trauma surgeons felt that the consultation could not have been achieved with telephone support alone. In 86% of the cases both rural physicians and trauma consultants judged the system to be easy to use. The authors concluded that their experience demonstrated the feasibility of virtually transporting the trauma surgeon to the rural emergency room and that this type of intervention may equalize the quality of care delivered to rural and urban environments.

Campana, Jarvis-Selinger, Ho, Evans and Zwimpfer (2004) described a case study in which videoconferencing was used to connect a rural practitioner with a neurosurgeon at a major medical centre for emergency consultation. In British Columbia in March 2002, a rural family was involved in a car accident. Their young daughter suffered head injuries that warranted immediate hospitalization at a local health care centre. The attending general surgeon was able to liaise with a neurosurgeon at Vancouver General Hospital. They were able to determine, via videoconferencing, that the patient required an emergency craniotomy. Given the distance involved and the immediacy of the situation it was decided that the attending surgeon would perform the operation with the support and virtual supervision of the neurosurgeon. Although the intervention did not enable the participating health care team to save the patient, all of the participants positively characterized the videoconferencing equipment and its role in facilitating communication between the two sites. The attending surgeon observed that the link provided the family with reassurance in knowing that the neurosurgeon was contributing his expert opinion. The neurosurgeon praised the audio/visual components of the equipment, stating it allowed him to clearly view the procedure being performed. The mother of the patient was grateful to be included in the decision-making process and appreciated the opportunity to communicate with the neurosurgeon. The authors concluded that this case illustrated the potential of videoconferencing technology to bridge the gap between rural and urban health care providers and attend to the needs of underserved areas in need of specialized services.

Tachakra, Jaye, Bak, Hayes and Sivakumar (2000) conducted a simulation study to assess the viability of virtual trauma supervision. A telemedical link was established between a community hospital in England – where a physician provided care in fifteen simulated emergency scenarios – and a senior doctor in a London UK emergency department who provided virtual supervision. After each procedure the virtual doctor recorded his confidence in the supervision of the scenario on a five point scale (1 poor; 5, certain). Some of the challenges to virtual supervision included insufficient camera coverage of the whole scenario and feelings of overdependence on the community hospital physician. However, the authors concluded that challenges related to camera coverage could be overcome with the purchase of additional equipment. Despite these challenges, the authors concluded that establishing a link between a remote trauma care team and their supervisor is a viable alternative to the supervisors' actual presence.

Tachakra, Lynch, et al. (2000) assessed the clinical accuracy of videoconferencing in evaluating trauma patients. In this study, telemedicine for trauma consultation was compared with face-to-face consultations involving 200 hundred patients. Analysis of the data revealed that skin color

changes were accurately defined in 97% of cases, presence of swelling or deformity in 98% of the cases, diminution of joint movement in 95% of the cases, presence of tenderness 97% of the cases, weight bearing and gait abnormalities were defined in 99% of the cases and radiological diagnosis in 98% of the cases. Based on these results, it was concluded that telemedicine could likely provide accurate diagnoses. The authors asserted that the “key elements of clinical examination can be seen well enough to warrant confidence in a videoconferencing system for telemedicine” (p. 181) and conclude that a videoconferencing system could provide sufficient accuracy to facilitate remote diagnosis of trauma.

Kon and Marcin (2005) examined the clinical impact of connecting paediatric specialists via videoconferencing with physicians performing paediatric resuscitations, for the purposes of supervision and consultation. The authors assert that few physicians have sufficient experience in performing paediatric resuscitations. As a result, many medical centres rely on clinicians without advanced paediatric life support training to perform such procedures. Two case studies in California were examined to assess the effectiveness of videoconferencing in facilitating communication between caregivers, thereby improving the quality of paediatric care. In both cases it was found that the telemedicine units allowed the attending specialist to observe and provide support to the care giving team in a way that was unachievable by telephone. For example, the virtual specialist was able to instruct a nurse performing chest compressions to use slower and deeper compressions, an adjustment which subsequently improved the patient’s condition. The specialist’s ability to see the electrocardiogram trace, rather than having it described over the phone, greatly contributed to his ability to make critical decisions about next steps. The authors concluded that this type of intervention may serve to supplement the availability of properly trained personnel when performing paediatric resuscitation, although further study on a larger number of cases is required for more generalizable results.

Marcin et al. (2004) examined patient and provider satisfaction with a pediatric telemedical intervention which connected expert consultants at the University of California’s Davis Children’s Hospital to remote providers. Rural centres often experience difficulties in providing emergency pediatric care, due in part to the small number of pediatric cases. As a result, the responsibility of emergency paediatric care provision often falls on the shoulders of under-qualified practitioners. To assess parent and provider satisfaction with this intervention, a survey was conducted based on 39 consultations with 17 patients over the course of a two-year pilot project. The results indicated a high level of parental and provider satisfaction with the intervention. Parents (n=7) rated the intervention highly (score of 4 out of 5 or above) in the following domains (based on a five-point Likert scale): ability to communicate, questions answered properly, quality of medical care and overall satisfaction. Likewise, providers (n=5 for nurse and 17 for physicians) rated the intervention favorably, demonstrating satisfaction with its ease of use, audiovisual quality and their ability to understand the specialist. The authors concluded that this model of paediatric service delivery could be very valuable for underserved communities, especially for cases requiring around the clock care within the child’s home community. The also suggested this type of intervention could help in limiting the number of potentially risky transfers.

Tachakra et al. (2001) evaluated the impact of 200 teleconsultations between emergency nurse practitioners at a UK based minor accident unit and orthopaedic specialists at the main hospital.

The authors wanted to determine whether the service was good enough to facilitate accurate diagnosis, thus minimizing the majority of patient transfers from the minor accident unit to the main hospital (yet still transferring those patients who were in serious condition). The service was found to facilitate appropriate diagnosis by the emergency nurse practitioners in conjunction with consultation with the virtual orthopedic specialist while reducing unnecessary transfers to the main facility. In 36% (n=71) of cases patients were admitted to the minor accident unit following teleconsultation, compared to 6% (n=12) who were transferred to the main hospitals accident and emergency department for a face-to-face consultation with specialists. The authors suggested the potential benefit of videoconferencing could be to maintain acute care situations within community care settings.

Beach, Goodall and Miller (2000) reviewed the clinical effect of a telemedical link between emergency medical services specialists at a major health centre in Boston and clinicians at two minor accident clinics in Lincolnshire, in rural Massachusetts. In the past, clinicians at the Lincolnshire centres requested that the patient wait until an appropriate clinician was available or referred the patient to another hospital. The objective of the intervention was to reduce patient transfer costs by consulting with an expert via telemedical link. This allowed the Lincolnshire clinicians (the number of participating clinicians was not specified) to make appropriate diagnosis, improve patient health outcomes as well as provide continuity of patient care. Over a six month period, 71 teleconsultations were conducted at the two remote sites for a variety of acute health situations. In some cases, the consultations helped to avoid transfer and referral. Some clinicians also made changes to their diagnosis post-consultation, suggesting a decision-making value in the telemedical link, especially for remote practitioners. The study also highlighted the limited utility of store and forward technologies for emergency teleconsultation due to emergency practitioners' immediate need for current information. The authors concluded that teleconsultation via videoconferencing between major emergency medical services centres and community hospitals provided significant benefit to the quality of patient care and minimizing unnecessary patient transfers.

Brebner, Brebner, Ruddick-Bracken, Wootton and Ferguson (2002) evaluated a pilot project involving an emergency teleconsultation service between three rural hospitals in Scotland and a major emergency medical facility in Aberdeen. The pilot employed an integrated services digital network (ISDN) videoconferencing connection between the participating facilities for a 15 month period. Four-hundred and two videoconference calls were between remote hospital staff and emergency consultants. In 89% of cases, patients were able to avoid transfer and receive treatment in the community hospital. The time required to complete a videoconferencing consultation was on average 20 minutes. Providers in the study indicated that although it took longer to conduct a teleconsultation than a face-to-face consultation that the time taken is reduced with experience. The authors concluded that accident and emergency teleconsultations were technically reliable and effective in maintaining emergency care within the patients' community.

In a subsequent study, Brebner et al. (2004) evaluated an expanded version of the Aberdeen-based emergency consultation service (which in 2004 had expanded to include 14 community hospitals). In this expanded study, 1392 teleconsultations were conducted over a 12 month period. In 77% of the cases, patients were able to be managed locally, thereby reducing patient

travel time and avoiding patient stress. The program resulted in a total of 105,056 km saved in travel for participating patients. The authors concluded this study further demonstrated the viability of telemedicine as an adequate enhancement of rural emergency care.

Ellis and Mayrose (2003) described the telemedicine program at the State University of New York at Buffalo (SUNY) and identified successes and challenges associated with the program. The goal of the SUNY telemedicine program was to improve delivery of emergency medicine to correctional facilities. The program provided 2,294 consultations in 2001. Researchers developed a portable “roll about” telemedicine unit that enabled EMS providers to come to the patients, as opposed to bringing the patients to the service. The authors asserted that the “system provides the flexibility to provide emergency consultations via telemedicine from any room in the department” (p. 76). The mobile telemedicine unit allowed practitioners to maintain 822 (36%) patients over the telemedical system alone. One of the challenges associated with the delivery of telemedical services was gaining the participation of multiple practitioners over multiple locations on a 24 hour, seven day a week basis. In conclusion, the authors emphasized the need for appropriate practitioner reimbursement in order to sustain the system.

Moehr et al. (2005) reviewed the success and failures of the BC Telehealth Project. This program involved two different “tracks”: one supporting maternal and childcare applications (as developed by the Children’s & Women’s Health Care Centre of BC, “C&W” for short) and the other was to support emergency and trauma services (as developed by Vancouver General Hospital, VGH for short). Physicians and nurses working in two rural hospitals (Terrace and Cranbrook) were able to page emergency physicians on call at VGH. When necessary, Vancouver emergency physicians were available to videoconference with the rural health care providers to provide emergency clinical consultations 24 hours a day, seven days a week. Of the 645 consultations that occurred over the evaluation period, 40% were used for education, 31% for administrative tasks and 22% for clinical purposes. Of the clinical consultations, 16% related to maternal and child applications while 6% related to emergency consultations. The most important difference observed between the two “tracks” related to changes in videoconferencing usage over time. Overall, maternal/child scheduled videoconferencing was used more often over time, whereas usage for emergency/trauma consultations decreased over time. Ultimately the emergency/trauma sites disengaged from the project in September, 2002. Some of the reasons identified as to why emergency medical staff failed to adopt the technology included lack of familiarity among physicians with using videoconferencing equipment, poor fit between the service provided from Vancouver and established rural referral patterns, incomplete coverage of service needs, and privacy concerns among health care providers regarding judgment of their professional competence. The authors also highlighted the challenges associated with ad hoc applications under emergency conditions.

Emergency health outcomes are highly related to the presence of an experienced team leader in the first hours of care. Advanced Trauma Life Support (ALTS) doctrine advocates a team approach in which the designated trauma leader oversees the trauma operations and directs team activities but usually has little hands on contact with the patient (Latifi et al., 2000; Rogers et al., 2001). Several studies in the existing literature demonstrated the ability of videoconferencing to facilitate ‘telepresence’ in the delivery of emergency care. This telepresence system has impacted patient health outcomes. Doctors in a study by Ricci et al. (2003) indicated that in three

cases the telepresence link was potentially lifesaving. Further, the reviewed studies suggest that this level of supervision could not be achieved over the telephone alone (Kon & Marcin, 2005; Ricci et al., 2003). The reviewed literature reveals that videoconferencing facilitates the provision of expert care to rural environments (Ricci et al., 2003; Rogers et al., 2001; Brebner et al., 2002; Campana et al., 2004). Latifi et al. (2004) argue that trauma outcomes in rural environments are often poor due to the limited experience of rural practitioners in dealing with major traumas. Additionally, rural trauma centers are often ill equipped to provide specialized services (paediatric resuscitation, orthopedic emergency treatment) due to the low volume of serious trauma cases (Ricci et al., 2003) and the financial unfeasibility of providing specialized services in such small centres (Kon & Marcin 2005). Videoconferencing allows health care practitioners at rural, non specialty facilities to deliver care which is comparable to that received in urban centers.

Videoconference based emergency care has been demonstrated to reduce patient transfer (Beach et al., 2000; Brebner et al., 2004). Unnecessary transfer has both financial and health implications for patients; therefore, the maintenance of care within the patient's home community is an enormous benefit. Perhaps most importantly, linking isolated practitioners with expert consultants via videoconferencing expedites caregiver response to acute trauma (Ricci et al., 2003), enabling caregivers to respond appropriately, within the 'golden hour' after trauma occurs (Latifi et al., 2004). In any case, it is clear that live audio visual communications technology is a must for the delivery of virtual care to trauma patients. The majority of reviewed studies cite the visual aspect of video conferencing as critical. Ricci et al. (2003) described the limited utility of store and forward technologies. Although they provide the practitioner with visual information, in the field of trauma the authors found that only immediate, up to date information is of value to care providers.

Several of the reviewed studies employed relatively small sample sized. Although the potential of videoconferencing to support telepresence and improve service delivery to rural environments is highlighted, larger, more rigorous studies need to be conducted in the future in order to demonstrate the effectiveness of videoconferencing in emergency medicine.

IX. Language Interpretation

In today's multi-cultural, multi-lingual society, interpretation services become essential when accessing the health care system. It is vital for patients to be able to communicate with their physicians about their health issues clearly, so that it results in the best health outcomes. When there is a language barrier, this is not a possibility, so language interpretation becomes a primary component.

Azarmina and Wallace (2005) conducted a systematic review regarding the use of videoconferencing or telephone for language interpretation services in medical encounters. Nine articles were identified: seven which described telephone interventions and two that discussed videoconferenced interpretation. Remote language interpretation was associated with shorter intervals between consultations (which would presumably increase the total number of consultations performed). Remote language interpretation (video or telephone) was found to be

as acceptable as face-to-face for patients and doctors, however interpreters preferred face-to-face. The remote interpretations were also found to be as accurate as face-to-face and offer some cost savings as a result of reducing travel time for interpreters. Based on their findings the authors concluded that remote interpretation represents a quick, accurate and cost effective means by which to deliver interpretation services in medical encounters

Jones, Gill, Harrison, Meakin and Wallace (2003) explored the feasibility and acceptability of the remote provision of a language interpretation service during general practice consultations in the UK. There is a growing need to provide readily accessible interpreting services for the non-English-speaking population who use the UK National Health Service. The large number of languages spoken makes it difficult to deliver adequate language services, especially in London, where 20 different language groups have been identified. In this study, three methods were used to provide an interpretation service: a physically present interpreter, a remote interpreter accessed using an ISDN videoconferencing link and a remote interpreter accessed by telephone. Thirty-five non-English-speaking patients participated in this study. Fourteen consultations took place with a physically present interpreter, 11 using videoconferencing and 10 using the telephone. More patients in the face-to-face group admitted to feeling shy and nervous, compared with the other two groups. For some patients the 'social presence' created by an interpreter being physically present in the room with the patient and doctor may be uncomfortable. Both the patients and physicians responded positively to the remote interpreting method. The visual quality and sound quality of remote interpreting were satisfactory. Both videoconferencing and hands-free telephones can deliver an acceptable interpreting service in primary care.

Language interpretation is not strictly a clinical or educational application of videoconferencing in telehealth, but it is an interesting aside. We did not specifically conduct a search for language interpretation studies, but we did find two studies when we were searching other fields. In these cases, videoconferencing was used to facilitate interaction and communication between the physician and the patient.

X. Clinical Context: Concluding Remarks

This preceding summarized each of the clinical contexts investigated in the current review of the literature. As previously mentioned, this companion document is intended as a reference to the primary document, which includes a cross-context synthesis of all findings.

EDUCATIONAL CONTEXT

XI. Introduction

This chapter is the “**Evidence Companion**” for the educational telehealth applications of this literature review report. For each component of the report, the evidence companion is a comprehensive repository of findings for each area of the literature investigated. This companion is intended to be used in reference to its respective component in the **Primary Document**. The Primary Document provides a synthesized report of findings across the bodies of evidence reviewed. This educational applications component contains an intact report of findings for each educational context investigated – a first level of synthesis that provides in-depth information for each educational context.

This chapter is organized according to the following educational contexts: continuing medical education for general practice; psychiatry; other specialties; continuing nursing education; continuing professional development for other allied health professionals; and continuing professional development in interprofessional settings. In addition, there is a special section dedicated to community health education. Where applicable, findings for a particular educational context are presented in pertinent categories. For a complete listing of subsections, please refer to the table of contents on the first page of this document. Educational context sections each include an introduction, a presentation of findings, as well as summary/synthesis of findings in terms of impact factor or implications.

XII. Continuing Medical Education

Videoconferencing is purported to help professionals, especially those outside of urban academic centres access continuing medical education (CME). For rural physicians, attending CME requires considerable time and cost investment. Patients are inconvenienced when they are left without access to their regular care provider (Lynch, Weaver, Hall, Langlois, Stunt, Schroder, & Bouvette, 2004). In 2001, the Canadian Coordinating Office of Health Technology Assessment prepared a review of the use of multipoint videoconferencing (Noorani & Picot, 2001). It was found that all programs resulted in improved communication, and led to informal learning opportunities and professional skill development for primary care practitioners through their interaction with practitioners at tertiary referral centres.

a. General

This section reviews a number of studies that evaluated or described the use of videoconferencing to deliver continuing medical education to general practitioners. The number of published studies in this area is considerably larger than what was found regarding the use of videoconferencing by GPs for clinical service delivery. Some studies identified factors found to enhance or detract from the videoconference-based education session from the learners perspective. Overall, it would appear that videoconferencing was well received by GPs and used most often to provide CME to physicians who practice outside of urban academic centres. In

some cases, it facilitated access to CME programs that otherwise GPs would not have been able to attend.

Ricci, Caputo, Callas, and Gagne (2005) described a videoconference program that linked 14 hospitals in Vermont and rural North East New York to deliver CME lectures and ground rounds. An evaluation questionnaire was used to collect data on 650 telemedicine sessions having both in person and videoconference attendees in order to compare the two modes. Compared to having the presenter in the room, telemedicine attendance was considered to be more effective 19% of the time (n=334) as effective 60% (n=1074) and less effective for 21% of the time (n=334). In addition, for 82% of remote attendees the CME was delivered where it would not have been available without videoconferencing.

Abrahamian, Schueller, Mauler et al. (2002) conducted a prospective interventional study to measure the effect of specialists' knowledge on the quality of General Practitioners (GP) diabetes care noting that few studies examine communication between specialist and generalist. Videoconferencing systems were installed at a diabetes center and at four GP clinics. They were based on a PC fitted with a VC (Video System) connected to a single ISDN line at 128 kbits/s. Patients who had not achieved their treatment goals or who developed acute complications were introduced to the specialist by the GP via videoconference. The results indicated that the diabetes centre was contacted by the GPs 94 times for teleconsultation most of which were because patients did not achievement a target value (n = 86). Other reasons included a new foot ulcer (n=3) and patient curiosity (n=5). There were significant reductions in certain patient outcomes after 12 months (HbA1C, systolic and diastolic pressures) and patient adoptions of appropriate medications increased as a result of specialist recommendations. Hospital admissions were reduced and quality of care improved. Videoconferencing permitted direct communication between the three individuals involved in treatment triangle and was considered superior to telephone consult or letter. The authors concluded that there is considerable value in implementing education at the point of care that is relevant to their daily practice.

In 2003, Allen, Sargeant, Mann, Fleming, and Premi explored the use of videoconferencing to support small group based practice learning in Nova Scotia. They recognized that one of the challenges affecting face-to-face CME in rural areas is that often, there are too few participants for effective learning. Participants were family physicians from three Nova Scotian communities that had received regular videoconferenced CME for two years. Two communities each contained three physicians with the third having seven physicians (five of whom had been meeting informally to work on modules from the Foundation for Medical Practice Education). Responses to Likert-scale, open ended questions and interviews suggested that videoconferencing was generally well accepted and that learning did occur. However, technical considerations such as muted microphones, video quality, audio quality, and audio lag were reported to hinder discussion. The authors recommended that strict attention be paid to the technology and that cost is an important consideration.

More recently, researchers at the University of Alberta recognized that in rural areas, small interactive group learning sessions are often difficult to achieve (Klein, Davis & Hickey, 2005). The authors conducted a study to determine if videoconferencing could link physicians, located miles apart, in interactive continuing health education. They examined 593 evaluations (51%

response rate) of 29 videoconferences for rural practitioners throughout Alberta, B.C. and remote locations in the Yukon Territory over an eight month period. Average attendance at the videoconference sessions was 40 people. Quantitative findings suggested that the audience was very satisfied with the program including the interactive discussion component. The authors concluded that videoconferencing is useful in overcoming barriers of distance and that a small number of physicians can create a positive environment for adult learners when: 1) the topics have immediacy, 2) the session is interactive and supported with quality presentation aids, and 3) there is an absence of technical problems.

Earlier work in Alberta by Davis and McCracken (2002) compared the feasibility and acceptability of an eight month videoconferencing pilot to an existing telephone conference program and a regional in-person conference program for rural physicians at 14 sites (average attendance was 35 physicians). The results indicated that while 95% of the CME consumers felt that videoconferencing met their expectations, they still preferred regional conference programs citing a lack of interpersonal interaction as a weakness of the videoconference application.

The Department of CME at Dalhousie University began a pilot program in 1998 to deliver 12 CME units via videoconference to four communities in Nova Scotia. Since the pilot projects' introduction, videoconference CME activity at Dalhousie has steadily increased. For example in 1999-2000, 64 videoconference sessions were held for 1059 learners across 37 sites according to Allen, Sargeant, MacDougall and Proctor-Simms (2002). They reported that the lessons learned during an earlier pilot project were used to support the development and expansion of the pilot into a provincial program. These lessons included the need for improved video quality; the development of efficient methods of scheduling and planning; and training of faculty and presenters in videoconferencing techniques. The authors then evaluated these changes by comparing them to those obtained during the pilot implementation. The results indicated that provincial program participants were more satisfied than those in the pilot with video quality and the videoconferencing equipment's ability to effectively use visual aids in the session.

Similarly, in 2000 Airis and Finely conducted structured personal interviews with telemedicine providers (n=20) at the Dalhousie University Medical School to identify challenges associated with implementation. A list of providers was obtained by contacting the telehealth coordinators and surveying individual clinical departments. At the time of the interviews, twenty telemedicine programs were identified of which 15 were operation and 5 were in the planning phase across a variety of clinical and education services including CME, grand rounds, patient education, dermatology, ophthalmology, cardiology, psychiatry, radiology, emergency, and surgery. The three most important obstacles to the implementation of telemedicine were lack of knowledge about it (80%), time constraints such as scheduling problems and the time required to set up equipment and extra time that telemedicine sessions may take (75%) and sources of funding, both for pilot trial and maintaining the program (70%). Interviewees felt that initial costs, such as project establishment (60%), equipment costs (65%) and running costs related to maintenance (55%) were significant obstacles. Seventy percent of the respondents said that a telemedicine coordinator and support staff would facilitate the implementation process and reduce the obstacles identified above.

Lynch et al. (2004) used videoconferencing to providing palliative care education to GPs in rural areas of Renfrew County, Ontario where GPs had limited access to CME. A survey was used to measure learner satisfaction (n=10) with the technology, course content, facilitator, and clinical usefulness. Results suggested that learners were highly satisfied with the videoconference delivered CME and all participants recommended using the technology again. Participants appreciated not having to travel as far for CME. Similarly, the physician educators noted that if had they been required to travel to teach these sessions, they may never have taken place. The authors concluded that CME delivered by videoconferencing over short distances to community physicians using constructivist approaches is a good adjunct to face-to-face learning and supports learners in their practice environment.

Himpens (2003a) described the “Pentalfa Project,” a distance continuing medical education program at the Katholieke Universiteit Leuven in Belgium using multipoint videoconferencing. The paper provided a good description of the technical configuration for the program. At the hub there was a fixed videoconferencing set up with a central technician to supervise the overall technical control of the session. In weekly sessions between five rotating sites a multipoint videoconference dealing with a different medical topic was presented and discussed in a multidisciplinary way. During the three years of the project, 20 different peripheral sites were visited or revisited. Participants (n = 300) rated the image and sound quality using a five-point scale. Average ratings were 3.72 and 3.87 respectively. The authors concluded that to make distance education via videoconferences acceptable to participants requires considerable effort and attention to technical, logistic and interactivity details.

In a follow up study, Himpens (2003b) conducted a study to determine participant evaluation of the interactivity of the educational videoconferences and the effectiveness of project promotion. Each session contained oral presentations followed by an interactive question and answer session and ended with a multi-site panel discussion. Several strategies were developed to ensure interaction between the different sites. First, the videoconferencing bridge was equipped with a “continuous presence” option which enabled a view of the different locations to be projected as a single split-screen image. In addition a moderator was present at all locations to encourage and control the discussion. A questionnaire was given to all participants which was completed by 3864 of the 13, 489 participants present at 74 sessions during the three-year evaluation period (29% response rate). More than 60% of participants rated the interactivity as good or very good. The authors noted that these findings demonstrate the importance of the role of the moderator.

Watson et al. (2001) described a telehealth program using videoconferencing to facilitate the delivery of health and other services to 21 mostly rural communities in northern Queensland Australia. A total of 197 hours of videoconferencing was recorded at 10 of the remote sites over 12 months. Education both professional development and community health education represented the highest usage in the 10 remote communities with over 60 hours of delivery on primary health care topics. Clinical activity only accounted for 10% of usage. Similar findings were reported by Cohn and Goodenough (2002). Health professionals in paediatrics (139 physicians in paediatric public health, 157 physicians in private practice; 179 nurses and 125 allied health staff) were surveyed to identify attitudinal barriers to telemedicine. There were 188 completed surveys (31% response rate). The results suggested a higher endorsement of

videoconferencing for education or psychosocial applications than for patient management or treatment planning.

Sargeant, Allen, and Langille (2004) conducted a study to explore the effect of videoconferencing on rural physician recruitment and retention. They conducted a survey of 140 rural family and community specialist physicians who had received clinical telemedicine services and videoconference CME for two years. Surprisingly, in relation to their decision to stay in a community for one year, respondents rated telemedicine lower in importance than all but one of 17 factors expected to influence physician recruitment and retention in rural communities. There was a positive relationship between higher usage and higher ratings of its value as a community support. It was noted that physicians in rural areas used telemedicine services more often. Comments received from the physicians were equally split between positive (n = 32) and negative (n = 33). Positive comments included its convenience, cost-effectiveness, access to medical knowledge and professional networking. Negative comments included that face-to-face is already available or preferred, and concerns that public spending on telemedicine has reduced funding for more basic health services. The authors concluded that telemedicine is not as important a consideration, relative to other factors influencing recruitment and retention or physicians' decision to stay in their communities.

Generally, videoconferencing is a well accepted method for delivering continuing medical education for physicians (Allen et al., 2003) that meets learners needs (Klein et al., 2005) and is considered as least as effective as face-to-face CME (Ricci, Callas, et al. 2005). It is particularly effective in rural areas for connecting small numbers of physicians for interactive CME and overcome barriers related to distance/geography. Videoconferencing supports learners in their practice environment (Lynch et al., 2004) and enables communities of practice (Smith, Batch, et al., 2003). Abrahamian et al. (2002), found that education at the point of care, relevant to daily practice is valuable to physicians. However, Davis and McCracken (2002) found that rural physicians in particular, prefer face-to-face CME. In studies where videoconferencing telemedicine programs were designed to provide both educational and clinical services for health care providers, the educational value is often noted ahead of clinical applications (Cohn & Goodenough, 2002; Watson et al., 2001).

Research at Dalhousie University demonstrated that for a pilot CME program to evolve into a sustained program requires reliable technology and good video quality, efficient methods of scheduling and planning, and training and support for presenters regarding effective strategies for teaching via videoconference (Allen, Sargeant, MacDougall & Proctor-Simms, 2002). Ricci et al. (2005), and Gaglardi et al. (2003) also noted the importance of dedicated technical support. According to Himpens (2003b) delivery of CME via videoconference requires considerable effort, attention to technical and logistical details and a highly skilled moderator to ensure the sessions are interactive.

In addition, video quality was often cited as a challenge by CME attendees (Ricci et al., 2005) and that as the number of technological problems increased so did the number of complaints. Allen et al. (2003) found that poor video/audio quality, muting microphones, and audio lag hinder discussion. Ricci et al. (2005) also noted the importance of people issues (i.e., attitudes

toward technology, technology and equipment competency). Mea, et al. (2003) reported that minor technical issues can reduce the value participants attach to a seminar.

Most of the studies reviewed explored the feasibility of videoconferencing to deliver CME and learner satisfaction with modality. It is worth considering that a learner's evaluation of videoconference-based CME may be affected by quality of the education and not only the delivery mechanism. In addition, few studies actually measured changes in knowledge as a result of the videoconference education programs tending to use physician satisfaction ratings as the major outcome measure. The need to provide training and or instruction to the educators regarding the unique aspects of delivering education via videoconferencing technologies was also recognized (Allen et al., 2002). Overall, the education literature is comprised of studies with larger sample sizes and a more programs delivered via videoconference, whereas the clinical studies usually had smaller sample sizes and fewer videoconference sessions.

b. Psychiatry

Although it has been found that videoconferencing has been used for mainly clinical purposes, it has also been used for educational purposes. The following five studies examined the use of videoconferencing as a mode of delivery for mental health education.

Harley, McLaren, Blackwood, Tierney and Everett (2002) examined the use of videoconferencing to enhance tertiary mental health service provision to the island of Jersey, in the UK. A videoconference link was established between Jersey and the Social Services department in the Channel Islands and the South London and Maudsley NHS Trust During the pilot project six presentations were held on topics such as: forensic psychiatry, affective disorders, psychosis, eating disorders, crisis disorders, and community specialist teams. Each presentation was a discrete topic and attendance varied throughout. A total of 49 individuals returned the Guy's Communication Questionnaire (GCQ). The GCQ is a five-item self-report instrument that measures the quality of clinical communication. Feedback from the questionnaire indicated high levels of satisfaction from the attendees. Respondents stated that such sessions provided the opportunity for multiprofessional education. For individuals who attended more than one presentation, overall levels of satisfaction increased with videoconferencing familiarity. Levels of satisfaction were also found to be correlated to quality of transmission. Feedback from a number of respondents also suggested that professionals attended such presentations only to experience the actual procedure of videoconferencing and had little interest in the subject matter.

Rees and Gillam (2001) piloted a cognitive-behavioural therapy (CBT) training program using videoconferencing to meet the needs of rural and remote mental health practitioners in Western Australia. A 20-week program was offered at seven sites. Staff from a range of mental health disciplines including mental health, nurses, social workers, psychologists and occupational therapists participated. Of the 12 participants only 11 completed the pre- and post-training knowledge test. Significant improvements in participants' knowledge of CBT from pre- to post-training were found. A majority of participants were satisfied with the training they had received and reported that it had increased their confidence in their ability to use CBT as an intervention with their patients. However, three participants from this study reported that they would have

preferred training to be delivered in person. Professionals indicated that the training resulted in reduced feelings of professional isolation.

Haythornthwaite (2002) evaluated a training program for those who work with at-risk young people in rural areas of Western Australia. This study was guided by the process undertaken by Rees and Gillam (2001). The objective of these sessions was to increase participants' knowledge, skills and confidence in relation to the training topics. A total of 26 workers completed the program. Twenty workers from a variety of settings completed both before and after training questionnaires. The findings indicated that workers experienced significant improvements in a number of areas of knowledge, perceived confidence and perceived competence in relation to the training topics. A majority of participants reported high levels of satisfaction with all aspects of the training course. Moreover, there were few significant differences in the improvements between those who attended the training remotely and those who attended face-to-face.

Mitchell, Robinson, McEnvoy and Gates (2001) used telemedicine to deliver training and development services for health, education and welfare staff in South Australia. Services were provided by the Child and Adolescent Mental Health services. Results from nine interviews showed that videoconferencing was not considered an impediment to communication and was viewed favourably despite occasional technical problems and despite poor-quality audio and video signals. Clinicians also felt less isolated when they used telemedicine to interface with other clinicians. Prior to the set up of the program, a needs analysis was conducted. The authors noted that determining the needs of the remote professionals was an important factor contributing to success of the telemedicine education. Cornish et al. (2002) examined the role of telemedicine in providing interdisciplinary mental health training and support to health professionals in Atlantic Canada. Another focus of this study was to examine how this training might affect interdisciplinary collaboration among rural participants. A total of 34 professionals from 11 disciplines participated in the 12 video-satellite conference presentations held over a 14 months period. Satisfaction with the video-satellite presentations were measured after each presentation and responses show that satisfaction was generally high and stable throughout the duration of the project. During the follow-up interviews, participants reported feeling frustrated with technical transmission failures in several sessions. The reliability of the satellite conferencing signal was a problem at times. Weather seemed to affect the visual signal of the presentations and half of the presentations had at least one technical problem. Unfortunately, there was much variability in professionals' attendance as well as attrition. Specifically, 18 of the 34 participants left their positions before the completion of this study. As a result, only four professionals completed the post-intervention questionnaires; with this limited sample, no meaningful statistical comparisons could be made. Despite this limitation, qualitative data from the follow-up questionnaires and interview revealed five positive impacts: expanded knowledge skills, heightened sensitivity, enhanced knowledge of roles, increased cross-disciplinary connections, and greater cohesion and collegial support.

In sum, studies on the evaluation of mental health education via videoconferencing have supported the use of videoconferencing in telemental education. A majority of participants reported they were satisfied or highly satisfied with the educational services (Harley et al., 2002; Haythornthwaite, 2002; Mitchell et al., 2001; Rees & Gillam, 2001). Clinicians reported reduced feelings of isolation and increased support (Cornish et al., 2003; Hilty, Luo, Morache, Marcelo,

& Nesbitt, 2002; Rees & Gillam, 2001). It would seem that conducting needs assessment before the implementation of an educational program is an important step in implementation (Cornish et al., 2003; Mitchell et al., 2001). Many programs have failed because of inadequate needs assessments (Hilty, Marks, Urness, Yellowlees, & Nesbitt, 2004). It is interestingly to note that in all the studies above, education was delivered to audiences from various disciplines.

Another interesting point to note is that satisfaction was measured in all of the studies above, yet only two of these studies evaluated participants' pre- and post- knowledge of the educational topics (Rees & Gillam, 2001; Haythornthwaite, 2002). It would seem that in the field of telepsychiatry, a majority of the research on the clinical and educational purposes of videoconferencing measure satisfaction. However, research on satisfaction fails to adequately explain the underlying reasons for satisfaction (Mair & Whitten, 2000). Pre- and post-knowledge tests can be as easily administered and easily measured yet not all studies conducted such tests.

By measuring pre- and post knowledge, these two studies managed to provide preliminary evidence that education delivered via videoconferencing can provide significant improvement in knowledge (Rees & Gillam, 2001; Haythornthwaite, 2002). In addition to that, Haythornthwaite (2002) also found few significant differences between the improvements of participants who attended the training via videoconferencing and those who attended training in-person. Although both studies have examined an important feature of education, they had small sample sizes. Small sample sizes were found in all of the studies discussed except one with a total number of participants being 84 professionals of whom 49 of those participants were from Harley et al.'s (2000) study.

Although only five studies on the telemental health education have been reviewed, it is possible that videoconferencing for educational purposes may be under examined in the field of telepsychiatry. For instance, several studies have simply stated that the videoconferencing system was used for clinical and educational purposes yet failed to explore the educational uses of videoconferencing (Buist, Coman, Silvas & Burrows, 2000; Hockey et al., 2004; Gelber, 2001; Grealish et al., 2005). The use of videoconferencing for educational purposes needs to be examined further and to better understand the usefulness of this delivery mode, measures of knowledge level should always be examined instead of just satisfaction level.

c. Specialist

This section reviews published studies regarding the use of videoconferencing for specialist education in a variety of disciplines including surgical resident training, oncology, orthopaedics, pathology and neurology. The number of studies reviewed is relatively few. To some extent this might be explained by the fact that specialists often deliver continuing medical education to generalist and less often to their specialist peers in the same discipline and even less likely to specialists of other disciplines.

1. Surgery

Mutter, Bouras and Marescaux (2005) discussed how videoconferencing allows trainees to view high quality real-time surgical images with interactive sound transmission from an expert operating surgeon. In addition, they suggested that videoconferencing enables surgeons to

observe multiple experts and procedures in a limited period of time during dedicated educational sessions. For these reasons they argued that multimedia computer-aided learning will introduce important changes in surgical education.

Kingsnorth, Vranich and Campbell, (2000) evaluated the use of videoconferencing to deliver surgical education to minimize the costs and inconvenience associated with traveling to teaching centres for surgical trainees located in regional hospitals throughout the South and West regions of England. The TETRASUR (TElematics TRAIning for SURgeons) course included lectures, case presentations and interactive discussions by videoconference and satellite television links. Post-course interviews were conducted to measure user satisfaction; however the study did not report on the number who completed interviews, only that 300 surgical trainees were in the program. Digital satellite television receivers and ISDN videoconferencing equipment was installed in hospitals to deliver course material and live, interactive videoconferencing into satellite broadcasts. The authors noted there were distinct advantages in using live digital satellite technology including superior audio and visual quality, high security and low transmission costs compared to terrestrial networks. Overall, there were some difficulties related to scheduling so that trainees at different hospitals were available on the same day but post-course interviews with trainees suggested their experience was generally very positive. Trainees valued the opportunity to interact with experts in the field of study. However, while supportive of the delivery of the technology they noted some shortcomings including inferior visual quality with ISDN lines at 128 kbit/s included time lag and the need for more interaction during the lectures. The authors noted that these comments were considered for future iterations of the program and improvement to the video feed was being addressed using ISDN at 384 kbit/s.

Stain et al. (2005) used videoconferencing to provide education to third year surgical clerkship students in Nashville Tennessee. Students (2-3 students per rotation) were randomly assigned to a 4 week rotation 75 miles from their medical school to receive lectures by interaction teleconference via ISDN lines. The authors noted limitations of previous studies that only assessed student satisfaction, and therefore they compared the results of weekly quizzes for students receiving videoconference versus conventional lectures. There were found no significant differences in mean quiz scores. The authors concluded that the high degree of interactivity of their system contributed to their success and that they specifically challenged faculty to engage remote students in question/answer activities and the use of a voice activated mobile camera on the lecturer. The technology allowed students to receive interactive lectures at distant clinical sites and limit travel.

Durst (2000) described how the Centre for Minimal Access Surgery in Hamilton, Ontario intended to extend its teaching opportunities to enable students to observe telesurgery and participate in telementoring. They noted that education in a virtual environment has been limited by technology and that effective synthetic environments must have high fidelity and human-computer interaction, and a natural interface that provides a good approximation of the real world. To this end, the centre commissioned the development of an integrated videoconferencing system that permits high quality, rapid transfer of multi-feed video and audio data of surgical procedures from an operating room to the classroom. The authors anticipated that their future research will validate the use of multidisciplinary minimal access techniques and

new technological educational methodologies. There were no published papers found that described the findings of their research as proposed in this paper.

Anaestad, Rotnes, Edwin and Buanes (2002) described a telemedicine research project with five participants: the two largest hospitals in Norway (Rikshospitalet and Ulleval Hospital), two information technology companies (Telia and Ericsson) and a research institution (the University of Oslo). The purpose of the study was to determine whether image quality produced using broadband technology was sufficient for teaching and consultation purposes related to image-guided surgery and interventional radiology. A broadband 34 Mbits/s ATM network was used. Quality of transmission medium they noted is crucial to surgical work which has a low tolerance for disturbances (i.e., delay, stability and security) because adverse effects (for surgical procedures and patient safety) are not acceptable. During the project concerns were raised regarding cameras and microphones in the operating room and surveillance issues. Other challenges identified included the need for the surgeon to increase communication with the remote viewer since they could only see one image source yet the surgeon needed to shift between several image sources. Surgeons were required to perform procedures for teaching purposes and constantly attend to how best deliver the information. Findings suggested that the surgeon and operating team require feedback on how to present themselves and the procedure in order to facilitate high quality performance.

2. Oncology

The Cancer Care Ontario Surgical Oncology Network explored the feasibility of using videoconferencing to facilitate multidisciplinary oncology rounds for community-based surgeons in remote locations throughout Ontario (Gagliardi, Smith, Goel, & DePetrillo, 2003). They recognized the need for community based providers to have opportunities to benefit from “communities of practice” usually only available in academic centres. A median of 22 community-based surgeons participated in each session excluding the discussant panel members and the facilitator. A series of 6 oncology rounds was delivered via videoconference during 2001-2002 academic years. An evaluation form assessed participant satisfaction with the videoconferencing format (i.e., image, sound, and interaction), content, presenter and usefulness to practice. The response rates for each session ranged from 44.8% to 67.7%. Overall 74.6% of participants agreed or strongly agreed they were generally satisfied with the event, including format, content and speakers. The authors noted that the cannot be generalized to the larger population of general surgeons elsewhere due to self-selected participation of those attending and small number of participants (median of 22 per session).

Mea, Carbone, Greatti and Beltrami (2003) explored technical aspects and user satisfaction related to the delivery of educational oncopathology seminars via videoconference. Using videoconferencing equipment, six educational seminars were held between a central University site in Udine Italy and a remote site 60 km away. Eighty-two participants answered a questionnaire (43% response rate) on user satisfaction (56 at Udine and 25 at remote site). The results suggested that videoconferencing may be as good as on site and that visual material did not suffer noticeable degradation because of transmission with ISDN at 384 kbit/s.

3. Orthopaedics

Videoconferencing for Orthopaedics distance training in Bologna, Italy was studied by Baruffaldi, Giangiacome, Paltrinieri and Toni (2003). Four surgical operations on patients and one lesson in ultrasound techniques were transmitted as videoconferences to remote users who were orthopaedic surgeons, students and residents. At the end of each event, a questionnaire was administered to assess audio/video quality, efficacy of training and participants' perception of distance training for surgery as opposed to conventional methods. A total of 31 surveys were returned. This feedback enabled the authors to steadily improve the perceived technical quality between events. Overall results suggested that video quality was good for viewing surgical techniques. Residents and students appreciated videoconferencing more than senior orthopaedic surgeons. In addition, residents and experienced surgeons valued the videoconferencing for different reasons. Residents valued the level of image detail that was visible which could not be obtained during conventional theatre access. Surgeons identified videoconferencing as the only effective means of sharing a surgical technique with a large audience. The authors recommended that since direct participation in surgery represents the ultimate practical learning experience, that a complementary approach incorporating both methods as the most effective way to train students and residents.

4. Pathology

Faoagali, Coles, Price and Siebert (2001) reported on the successes and failures of a telepathology service that developed out of the videoconferencing network across Queensland, Australia. In 1999, weekly videoconferences began with remote labs and clinical staff in four peripheral hospitals and the Royal Brisbane Hospital. In 2000, biweekly, videoconference pathology grand rounds started across Queensland with up to six sites from Cairns to the Gold Coast participating. Fifty videoconferencing meetings were held between August 1998 and May 2001 for a total of 48 hrs. The average number of sites connected was three in 1999, 3.5 in 1999 and 4.4 in 2000 and 4.5 in 2001. The number of participants at each session was not recorded, however, records indicated that attendees included, consultant physicians, pathologist, laboratory staff, registrars, medical students, infection control staff, the videoconference coordinator and anyone else free and interested at the time. The authors reported that ongoing support ensured the success of the telepathology sessions but no evaluation process was reported. The authors concluded that videoconferencing is a relatively easy and quick means to disseminate new information widely; allows remote sites to access a variety of expert opinions and learning experiences to be shared widely and it's cheaper than flying patient or consultant. Challenges noted included a number of unresolved issues related to individual consultation preferences, state laws and ethics, privacy and confidentiality, concerns about malpractice claims, and reimbursement.

5. Neurology

Telemedicine for distance education in neurology in India was discussed by Misra, Kalita, Mishra and Yadav (2004). They noted that in the developing world telemedicine may be the only means of providing specialist care and identified a few examples of its clinical application in neurology. The authors then described their experience in conducting regular videoconferences as a means of teaching neurology. Over 3 years 30 videoconferences were held between a tertiary care teaching institute in Lucknow and two medical colleges in Cuttack and Burla each

located 1500 km from the tertiary centre. A total of 59 patients with various neurological disorders were discussed at these learning sessions. Desktop videoconference systems were used, connected by ISDN lines at 128 kbits/s. All participants expressed satisfaction with the quality and usefulness of the sessions and a desire to continue the program and extend it to other sites. Seventy-three of the session was successful, 8 sessions there was a loss of connection (power failure).

In most of the studies reviewed, learner participants including from various specialties, were generally satisfied with their educational experiences (Gagliardi, Smith, Goel, & Depatrillo. 2003; Mea et al. 2003, Mirsa et al., 2004; Kingsnorth, Vranich, & Campbell, 2000). Gagliardi et al. (2003) reported that videoconference CME helps create communities of practice. Other studies identified some of the technical considerations required to make videoconference based education appealing to the learner. Mea, et al. (2003) found that satellite offered superior audio and visual quality, high security and low cost transmission compared to terrestrial networks. Stain et al. (2005) recommended the use of voice activated or mobile cameras to increase interaction.

XIII. Continuing Nursing Education

This section describes the use of videoconferencing for continuing nursing education (CNE).

Hoxby (2000) described the use of videoconferencing and other technologies to provide education and training to nurse practitioners in Ontario. Ten university Schools of Nursing in Ontario joined forces to provide a single, standardized educational program at all 10 sites in both official languages. During the trial phase however, videoconferencing proved to be unsatisfactory for the sites due to equipment incompatibilities, timing delays and high costs. Only two sites (francophone participants) preferred video to audio conferences. Ultimately, a website based program was implemented using a general information site and a password protected site to support administrative functions. Audio conferences were used to connect learners throughout the province with peers and course teachers. The authors concluded that this demanding, clinically focused education initiative required better access, support and efficiencies than could be provided by print copies and videoconferences alone.

Sawada, et al. (2000) examined the effect of distance learning on nurses' clinical skills in a rural Japanese hospital. Videoconferencing was used to provide training to nurses in a 100-bed rural hospital 250 miles from Sapporo Medical University. Teaching new respiratory rehabilitation skills was provided via one face-to-face session, followed by two 30 minute sessions delivered by videoconferencing. Responses were collected from 15 out of 32 nurses participating in the face-to-face session (47% response rate). After two videoconference sessions, 73% of the nurses said they used the new skills either always or sometimes and 0% reported never using it. There was a significant increase in nurse's opinion regarding effectiveness of their new skills after completing the second videoconferencing session. The authors concluded that videoconferencing was a useful tool for providing continuing education for nurses working in rural settings in Japan.

Fukue, Ando and Mitani (2000) examined the possibilities of an education support system via videoconference for nurses engaged in a transitional education program in a region of Japan characterized by severe winter climate and low population density. Continuing studies opportunities in the area were difficult due to limited facilities, limited means of transportation and few opportunities for students engaged in self-directed independent learning or to communicate with their peers or instructors. The study concluded that a support system using telecommunications such as videoconferencing, and the internet (email and the World Wide Web) will be essential for the success of their transitional education program. It enables nurses who otherwise would not otherwise be able to take the course to receive ongoing support and continue with their studies.

Martin and Klotx (2001) described the development of a Bachelor of Nursing program delivered via videoconference at the University of Texas to nursing students working in Palestine, (a medical hub for numerous isolated and medically underserved rural counties in East Texas located 45 miles from the main campus). Most of the students in the program were defined as mature adult learners who were unlikely to leave the area after graduation because of family and work ties. A severe nursing shortage forced the university to consider increasing nursing education opportunities and make programs as accessible as possible. By offering all required courses in the nursing curriculum via interactive videoconferencing, students had the opportunity to continue to work, spend time with their families, and attend class and clinical experiences close to home. Starts up costs were met through generous donations from community and legislative support (total \$520,000). The authors learned the importance of flexibility in scheduling and sensitivity to meeting educational needs of a diverse student population. Faculty experienced some initial challenges, however seminars and in-services were provided to assist faculty with equipment and new teaching strategies required. There was some increased burden on instructors to convert their materials to power point. When the system went down, video copies of lectures were sent to distance students within 24 hours. In five years the program had grown to 100 students and 6 full time faculties with a permanent site and administrative support. Authors concluded that the benefits outweigh the costs. One weakness of the article was that there was no student evaluation results reported.

Godoy, Amelia, Mendes, Hayashida, Nogueira and Alves (2004) used videoconferencing to support collaborative research and education at a Brazilian nursing college and teaching hospital. Videoconferencing was used to train nursing auxiliaries in the intramuscular administration of medication in the ventrogluteal site. The nursing department of the obstetrics and gynecology clinic was connected to a teaching facility about two kilometers away. A 30 minute lecture and demonstration (participants practiced during demo) on the topic was transmitted and delivered 11 times to groups of 2 or 3 students during normal working hours. Completed participant questionnaires indicated that most responses were favourable. Eighty-seven per cent felt interaction with distant lecturer was good and 100% felt that the videoconferencing was useful as an in-service education tool. The principal reasons given for attending were the opportunity to combine work and education. The authors concluded that not having to leave the workplace or attend outside of working hours was an important factor in the nursing auxiliaries' professional education and that videoconferences can be used for distance education in nursing.

Emde (2003) described the development of a nursing education program designed to provide education to nurses newly hired to work in emergency departments in King County, Washington. The program began as a nine day course (one day per week for 8 weeks) including eight days of didactic material and one day of clinical practice. The course was offered twice as a live lecture to 50 nurses and was very well received. Interest expressed from hospitals outside of their area led the authors to explore videoconferencing technology in order to share the course with nurses in more distant locations. They connected with two existing telehealth networks (University of Washington Telehealth Network and Inland Northwest Healthcare Services Network) to determine if their networks could support multi-day broadcast to multiple sites. Cost was not a barrier as both networks donated the network time using grant funds they had received to facilitate education of rural nurses. Since all hospitals had the same equipment and both networks used the same equipment, there were no issues of incompatibility. Each site also had a designated site coordinator to facilitate administrative and technology issues. In January 2003, the first videoconference course was offered across Washington State. Thirty-four nurses from 10 hospitals attended at eight hospital sites. The technology enabled nurses to stay in their own hospital or travel to a nearby hospital thereby keeping their costs minimal. The feedback from the initial broadcast was overwhelmingly positive (no data reported to support this). Future broadcasts are scheduled for Alaska, Montana and Idaho and the authors intend to explore which technologies (satellite uplinks or internet-based methods) are best suited to reaching nurses in remote sites.

Sackett, Campbell-Heider, and Blyth (2004) described the first application of H.323 technology using Internet Protocol H.320 (IP) connectivity and the evolution of ISDN and IP systems in nursing education and practice. The authors described how the lack of an ISDN line at a conference to present their findings of their earlier helped them identify the potential capability of IP rather than ISDN for multipoint videoconferencing. Their findings suggest that the limitations of infrastructure that require ISDN-based connections to accomplish good audio and visual capture can be replaced with IP devices that are cost-effective, easy to use and facilitate access to students in rural and remote areas lacking ISDN connections.

Tachakra and Creagh-Brown (2001) examined the use of videoconferencing as an educational tool for students and emergency nurse practitioners based in a minor injuries unit located six kilometers from the main hospital emergency department at the Central Middlesex Hospital in London, United Kingdom. Nineteen teaching sessions were included in the study, without providing the number of participants but does note that they were emergency nurse practitioners, medical students, recently qualified nurses and student nurses. The education sessions included discussion of recent interesting or challenging cases, scenarios and topics for presentation and discussion by the students. After each session students and teachers made observations about the educational and methodological aspects of the session. The results suggested that all participants felt that telemedical education was rewarding but the success decreased as the size of the group increased. Other sentiments from the participants suggested that telemedicine encouraged more open communication between peers and the medical consultants, consideration of problems from different points of view, critical thinking, and self-reliance.

The studies reviewed with respect to continuing nursing education suggested that videoconferencing is acceptable to nurses. Once again, few studies measured knowledge change

as an outcome measure. 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 move.

XIV. Continuing Professional Development for Allied Health Professionals

There are very few articles which address continuing education for allied health professionals. When allied health professionals need extra training, videoconferencing enables them to access this training without needing to relocate or commute. When these professionals are located in rural and remote communities, training and continuing education via videoconferencing enables them to overcome their feelings of isolation.

a. General

Fitzgerald et al. (2002) described a pilot study that used videoconferencing for the delivery of a child development education program for allied health professionals and paediatricians working in the community-based teams of the Child Development Unit (CDU) of Royal Children's Hospital in Brisbane, Australia. Six community-based sites of the CDU participated in a series of monthly multidisciplinary case discussions via videoconference delivered using ISDN bandwidth of 128 Kbit/s. The case discussions provided opportunities for clinical discussion of complex cases, peer review, professional development and networking for allied health professionals and paediatricians. Participants completed a questionnaire regarding the effectiveness and satisfaction with the use of videoconferencing to deliver the multidisciplinary problem based education. Attendance varied between sessions. The average number of sites participating was 5.5 and the average number of participants per session was 26. In total, twenty-five questionnaires were completed. The average number of sessions attended by each participant was 4.3. Respondents rated the organizational aspects of videoconferencing very positively (90% agreed or strongly agreed); 87% felt that the format of case discussion was effective, 83% that the case summaries facilitated participation and 84% that the facilitation during the videoconference was adequate. Overall 96% reported that videoconference was an effective medium. Three sites did comment on poor sound and picture quality received from other remotes sites.

b. Telerehabilitation

A Japanese study conducted by Jin et al. (2000), described a telehealth project for supporting an isolated physiotherapist in a rural community of Hokkaido. With videoconferencing, the therapist was able to access continuing education in general rehabilitation. Regular videoconferencing with other professionals helped a great deal. The authors noted that a long term goal was to establish a centre of telehealth for individual continuing education and technical support for health-care professionals, especially in rural communities. Realization of a telehealth network in Hokkaido is essential, as the Japanese population will begin to age rapidly in the early 21st century. For physiotherapists who are located in remote areas, it is essential that a support network be maintained to combat feelings of isolation in their work. The article concluded that the telehealth project was a great success in supporting the isolated physiotherapist in the rural community.

c. Pharmacy

Ward, Rey, Mobley, and Evans (2003) described how Nova Southeastern University in Fort Lauderdale, Florida, expanded its traditional Doctor of Pharmacy program to West Palm Beach, Florida, using compressed videoconferencing. Unlike correspondence and television courses, which lack two-way communications, compressed videoconferencing offers synchronous learning opportunities with two-way audio and visual capability. Live (face-to-face) lectures were simultaneously broadcast in a two-way interactive format by transmitting a combination of data, voice, and video to students at multiple distant sites. Despite physical separation, this technology allowed both the instructor and the students to work in real-time, similar to a traditional classroom setting. With compressed video technology, student-instructor interactivity was maintained, with the ability to conduct planned group discussions as well as question and answer sessions. Interactivity is further enhanced with two-way visibility, so that neither party is speaking or being spoken to by a faceless voice. Student and faculty surveys were conducted regarding their impressions of the distance teaching methods. During the first two years of the program, the West Palm Beach faculty members conducted midterm surveys with their student advisees to ascertain the students' likes, dislikes, and overall thoughts on being in a distance education environment. In general, the students realized that the use of the compressed video technology afforded increased access to pharmacy education, and for some with family commitments, did not require them to relocate or commute to the main campus in Fort Lauderdale. Technology, instructor, and student performance assessments were an ongoing process so that areas for improvement could be addressed in a timely manner. As pedagogy evolves from the traditional face-to-face setting to a videoconference-based environment, continuing education and the development of innovative ways to incorporate technology into the classroom is encouraged.

Using videoconferencing for the continuing education of allied health professionals is beginning to show promise. More studies need to be conducted to determine its successes and failures. This is an area which can be further developed in the future.

XV. Interprofessional Education

This section reviews several studies that evaluated the use of videoconferencing to deliver continuing education to interprofessional audiences using a grand rounds format with connections from a central site to one or more remote sites. Some studies identified learner reasons for attending or not and some important factors related to effective teaching methods for videoconference delivery. Videoconferencing also provides a unique opportunity for incidental learning whereby some clinical applications enable involved care providers to enhance their skills and learn about the care provided by other professions.

McCrossin (2001) described the program of Grand rounds at the Royal Children's Hospital in Brisbane, Australia. In 2000, a total of 44 multisite videoconferences were delivered to an average of 10 sites across Queensland. The remote audience for each conference was about 60 people. Overall, the program was successful however, there were challenges related to meeting the demands for growth of the network with respect to program design including a reluctance to change the time of the program (7:45 a.m. every Wednesday); and difficulty in accommodating

the large variety of topics (56) given that in a typical year there are only 44 Wednesdays available. Some areas like general paediatrics have been squeezed out of program slots which the author recognized as a systematic failure to be addressed. In addition, the current technical infrastructure was unable to support the demand from other centres to join the grand rounds. Presentation shortcomings usually involved content, the platform, and the delivery all of which could be solved by good design and fulltime technical support and back up. Program presenters were provided support and education on effective teaching techniques for videoconference delivered CME which was well received. The authors concluded that the rounds were successful and that equity funding from the Hospital foundation had not only enabled the program to be sustained but “to do the job properly” (p. 28).

Callas, Ricci and Caputo (2000) studied patterns of use and users perceptions of an interactive videoconference education program. Over a 33 month period of operation, providers from 14 remote sites (hospitals and physician offices) used videoconferencing 927 times to attend 394 continuing education programs at the Fletcher Allen Health Care Centre, the major teaching hospital of the University of Vermont. Of remote attendees, 70% were physicians, 5% were nurses, 2% were nurse practitioners, 2% were physician assistants, 1% was psychologists and 20% were other or unspecified. After an initial start up period, the number of programs attended by each site during the 33 months ranged from one to 121, with a mean of 39 programs per site. Seventy-four percent of attendees said that videoconference sessions were as effective as having the presenter in the room, 23% said it was less effective and 4% said it was more effective. Seventy-seven percent reported that they would not have attended the program if it had not been available via videoconferencing and 23% reported that the videoconference program had enabled them to avoid travel. The study did not collect data on who did not participate and their reasons for not participating, nor was there a cost-effectiveness evaluation. The authors noted that feedback they received suggested that the program facilitated connections among peers and reduced professional isolation experienced by some rural health care providers.

To address an increasing demand for education in the field of geriatric medicine, the University of Alberta delivered geriatric medicine grand rounds via videoconference weekly to health care providers at nine urban and 14 rural sites across the province (Sclater, Alagiakrishnan & Sclater, 2004). The response rate was 85% (n=625) for all participants and 99% (n=123) for physicians alone. The audience was composed of registered nurses (42%), physicians (17%) and (41%) other healthcare professionals. Results of questionnaires administered to participants attending the 20 consecutive presentations indicated that interest in topic was cited by 95% as the main reason for attendance. The results also indicated that allied health professionals dominated attendance at the rounds, physicians, residents, and interns accounted for only 17% of participants. Participants at remote sites gave lower evaluations of quality than those at the hub site. Difficulties were reported by participants included textually crowded slides that were difficult to read and the failure of speakers at hub to repeating questions for benefit of the remote audience. The authors noted that bringing a sense of community to a large number of small remote groups is a major challenge.

In another study conducted in Nova Scotia over five months, the department of CME at Dalhousie University delivered 19 general medicine and 10 cardiology videoconference grand rounds between two sites (a tertiary care hospital to a regional hospital) (Allen et al., 2002).

Attendance at the remote site (n=103) was comprised of 70 physician specialists, 9 family physicians and 24 other health-care professionals. A five-point Likert scale (higher scores indicated better quality) evaluation was completed by 55 participants (53% response rate). Ratings by remote site participants regarding technical quality indicated that improvement to video quality was needed, especially for visual aids and sound. However despite this, focus group participants found videoconference rounds to be valuable education experience. The study concluded that videoconference grand rounds can provide economic and academically sound education for community specialists.

Krupinski, Lopez, Lyman, Barker, and Weinstein (2004) developed a questionnaire to assess reasons for attending or not attending continuing education broadcasts. Since 2000, the Arizona Telemedicine Program has delivered over 800 continued education events. Over 1000 people have attended with a total of 400 questionnaires being sent out and 158 returned (39.5% response rate). Thirty-four percent of respondents were medical doctors, 27% nurses, 16% mental health workers, 7% dentists and 16% miscellaneous (e.g. radiology technologist, respiratory technologist). The top three factors influencing attendance were the topic itself and the perception that the broadcast would provide new and useful information. The three least common factors influencing attendance were number of continuing education credits, the chance to ask the speaker questions and others who attended. The most common factor influencing the decision not to attend a tele-education broadcast was a preference for attending conferences followed by a preference for courses delivered via CD-ROM. The authors concluded that tele-education supplements traditional continuing education rather than replace it and that attending conferences in person is still attractive especially to healthcare professionals in rural environments.

Loewen, Seshia, Askin, Cronin and Roberts (2003) compared face-to-face and videoconference delivery of an education program for health professionals on neonatal stabilization skills in Manitoba. A pre-test/post-test control group design was used to compare knowledge acquisition and satisfaction. The number of participants in each group ranged from 12 to 16. Both groups showed significant gains in knowledge. Responses to most satisfaction items did not differ significantly. The face-to-face group expressed high comfort interacting with the presenter and videoconference groups expressed more willingness to do a videoconference course in future. The authors noted that the delivery of specialist training in Manitoba is difficult with few instructors, many isolated communities along with high staff turnover. Cost to bring in specialist educators is high (more than \$900 for two face-to-face sessions in this study including airfare and accommodation). Authors also suggest that acceptance may develop with exposure to the videoconference technique.

West, Adams, O'Sullivan, Hall-Barrow and Hine (2004) evaluated a two day multidisciplinary review course delivered via videoconference for health professionals in rural areas of Arkansas. Two-way interactive compressed video was used and sound and images were sent simultaneously via telephone lines to the receiver. Over 200 health care professionals participated with 66% of participants attending the presentation via videoconference. Dietitians and nurses accounted for 75% of the attendees. Twelve pharmacists (5%) and other health professionals accounted for 20% of the participants. Nearly 75% of the course evaluation forms were returned. Some challenges relevant to the videoconference were identified including

equipment scheduling and the need for trained staff at all sites. The program enabled nurses, dieticians and pharmacists in rural areas to have access to a two day continuing education course in diabetes.

Several studies suggested that videoconference based telemedicine often enables incidental opportunities for education or learning for practitioners. For example, nurses engaged in a Scottish telemedicine program reported that using videoconferencing to consult with a specialist during the treatment and management of a patient, who normally would have been transferred to another facility, enabled them to learn (Brebner et al., 2005). Tachakra, Newson, Wootton, Stinson (2001) drew similar conclusions in a study which examined the teleconsultation patterns of emergency nurse practitioners at a minor accident clinic in the U.K. The authors found that over time the total number of teleconsultations decreased, which the authors attributed to the nurses increasing competence in making complex diagnosis. The authors assert that this increase in diagnostic capacity is owed to the nurses participation in specialist teleconsultations (Brebner et al., 2005; Tachakra, Newson, et al., 2001).

Overall, the studies reviewed suggested that videoconferencing is an effective means of delivering continuing education to interprofessional audiences (Allen, Sargeant, MacDougall, & O'Brien, 2002). It reduces the need for participants to travel and in some cases, facilitated access to education that participants would not have been able to attend (Loewen et al., 2003; West et al., 2004). However, it was recommended that tele-education supplement traditional continuing education rather than replace it as rural providers in some cases still enjoy to opportunity to travel to attend education (Krupinski, et al., 2004).

XVI. Community Health Education

Community Health Education is an emerging field that has found success in providing community oriented educational programming. Access to this type of educational intervention is purported to both expand the reach of medical educators as well as improve the disease management/wellness maintenance related behaviors of community members. Furthermore, the members of these communities may have little or no access to these types of services in the absence of videoconferencing which makes the potential of this type of intervention all the more promising.

Reznik and Ozuah (2004) examined the effectiveness of educational videoconferencing in the delivery of an adult oriented Asthma education program. The authors employed a case control, pre-post test design in which a videoconference group (n=47) participated in a 60 minute interactive lecture on Asthma while a control group (n=43) participated in a lecture about American civics where participants learned about the purpose and foundation of the US government. After the intervention both groups answered a ten item test about asthma, and while the controls showed no measurable knowledge gain, the videoconference group demonstrated significant improvement from pre-post test scores (mean score improvement of 7. to 8.3, $p < 0.0001$).

In a similar study, Reznik, Sharif and Ozuah (2004) delivered two 90 minute, interactive asthma education videoconferences to a group of Latino immigrants (n=60) living in the Bronx, New

York. The authors tested the participant's subject relevant knowledge both pre and post videoconference in order to determine if any increase in knowledge had taken place (by way of a seven item quiz which included questions related to the seminar content). Participants were tested three months post intervention to assess whether the any long term knowledge retention had occurred. Participant responses to quiz items three months post intervention revealed that correct response rates achieved three months prior were stable. The study established that not only does the delivery of health education programming to community members' result in a measurable increase in knowledge but that there is significant retention of knowledge several months after participation.

Faulkner and McClelland (2002) discussed the impact of Women's Health Queensland Wide (WHQW), a "world first" health promotion/education program located in Queensland Australia in which Queensland nurses used multipoint videoconferencing to provide health education to women in rural or remote communities. In 2000, WHQW used videoconferencing technology to present a public education seminar on menopausal health to female health care consumers distributed amongst a variety of locations in south-west Queensland. Videoconferencing allowed for a variety of speakers including a Gynecologist, a Dietician and an Herbalist to communicate 15 minutes worth of information to a predominantly female audience comprised of 75 health care consumers and 53 health care providers distributed across ten videoconference linked sites in Queensland. Ninety-eight percent of health care providers and 85% of consumers in the WHQW women's health care forums expressed that they had gained an increased knowledge of the material presented in the forums. The authors asserted that this type of service expands the reach of medical educators and experts and that without the establishment of a videoconference based communication network many potential participants in programs of this nature would not be able to access this information.

In a subsequent evaluation of the WHQW program, McClelland, Faulkner, Gale and Johnstone (2003) examined the impact that telehealth initiatives can have on the community, beyond typical indicators of telehealth success, such as health outcomes and cost effectiveness. The focus of this evaluation was the impact of community health education on behaviors related to social cohesion. The authors administered questionnaires to health care providers (n=51) and audience members (n= 571) who had participated in WHQW seminars in previous months. The authors discovered that three types of relationship building activities emerged as a result of the educational programs which served to increase the 'social capital' of participating communities; these activities included 'bonding', which represents establishing a connection to others like yourself, 'bridging' links to wider networks within ones community and 'linking' health care consumers to institutions. A reported 35% of interviewees were able to name specific 'bonding' activities they had engaged in as a result of their participation in a videoconference while 45% of respondents confirmed that the educational programs enabled them create 'linking' opportunities or partnerships with other services in their area. The authors concluded that videoconferencing facilitates valuable opportunities for communities to increase their "social capital" by developing relationships and that this process is valuable in community building.

Izquierdo et al. (2003) examined the effectiveness of delivering diabetes education via videoconferencing. A total of 56 diabetic patients were randomized into two groups. One group received three consultative visits with a diabetes nurse via telemedicine to discuss nutrition and

glycemic control. The second group experienced the same program face-to-face. Questionnaire data revealed that patient satisfaction was high in the telemedicine group. Most importantly however, subjects in both groups improved equally on objective measures of health and disease management. These included glycemic control, lipid profile and baseline levels of Low Density Lipoproteins. Patients in both conditions demonstrated an improved appraisal of their diabetic condition (as evaluated by the appraisal of diabetes scale). The aforementioned effects were found to be equal in both conditions. The authors concluded that telemedicine can be effective in the education of diabetic patients.

The synthesis of literature in the field of community health education reveals that videoconferencing technology represents a viable opportunity for communities to develop denser, more interconnected social networks or “social currency” (McClelland et al., 2003) and for health care providers to overcome the challenges associated with distance and provide equitable access to educational resources for a dispersed population (such as Canada’s). The ability to overcome distance is one of the principal benefits associated with utilizing videoconferencing in the context of community health education as it is established that without the presence of such an intervention many communities would be unable to resource health information or participate in dialogue with experts situated in urban centers (Faulkner & McClelland, 2002) Additionally, the literature demonstrates that the delivery of health care education via videoconferencing, in addition to penetrating isolated communities provides consumers with meaningful educational experiences. Not only do health care consumers attain new knowledge which promotes increased self management through this medium (Izquierdo, 2003; Reznik & Ozuah, 2004) but the information is demonstrated to be retained over time (Reznik et al. 2004). This illustrates that this medium of program delivery has the capacity to go beyond access alone to provide meaningful educational experiences that stay with the consumer.

Finally, although the studies described above took place in Australia and the USA we may extrapolate from their findings that similar positive outcomes may be attained by those who would attempt to capitalize on the potential of videoconferencing for the delivery of health care education to isolated Canadian communities. It appears from the existing body of evidence that videoconferencing represents a significant opportunity for health care providers to reach members of isolated communities and provide educational forums which ultimately contribute to increased health knowledge and improved self management.

XVII. Educational Context: Concluding Remarks

The preceding section summarized each of the educational contexts investigated in the current review of the literature. As previously mentioned, this companion document is intended as a reference to the primary document, which includes a cross-context synthesis of all findings.

XVIII. Patient Perspective

The following analysis is a discussion of the patient's perspective regarding the use of videoconferencing in the delivery of health care services. Although this perspective has been briefly discussed in the clinical section a more in depth treatment of this very important component of telehealth evaluation is required. The following section is inclusive of studies in which measurement of patient satisfaction was of central importance and expands on the patient's perspective in the fields of Specialty medicine, Psychiatry, Allied Health and Home Care.

a. Specialist Services

The existing body of literature suggests that patient satisfaction with videoconferencing for the provision of specialized medical services is quite high. This is not surprising as videoconferencing offers patients a means to access expert diagnosis without having to travel the distances often associated with obtaining adequate care. Evaluations of patient satisfaction with services demonstrates that patients are happy with both the interactions they have with their caregivers via videoconferencing as well as the reduction in travel time and costs that it affords them.

Fortin et al. (2003) evaluated patient satisfaction with a telemedicine network for the Magdalene Islands, located in the middle of the Gulf of St. Lawrence in Quebec, more than 1000 km from a supra-regional medical referral centre. The purpose of implementing the telehealth program was to increase the Islands' health care quality, access to services and reduced expensive air transfers. During the 13 month study period, 118 transmissions were made across various applications which included speech therapy, dermatology, rehabilitation, genetics and psychosocial consults. The program was used by mostly for initial consults. The authors interviewed 15 patients who utilized the videoconferencing services in order to gain their impressions of their experiences. Thirteen of 15 patients interviewed said that they were satisfied or very satisfied with the teleconsultation and would agree to use telemedicine again for consultation with the same specialist or for another health problem. Major benefits reported by patients were the rapidity of obtaining specialized health services that were not available in the Islands, the decreased waiting time for diagnosis or treatment and the possibility for the treating physician and the spouse to be present during a consultation with a specialist by videoconference. There were also time and money savings for patients as a result of eliminated travel.

Brown-Connolly, (2002) assessed patient satisfaction with the use of telemedicine in rural California, in comparison with usual face-to-face care. They described the Blue Cross Telemedicine Network as a primary care network designed to improve access to specialty services from rural areas by way of real-time video-conferencing. Data from a standardized patient satisfaction questionnaire from 24 primary care sites in 18 counties was collected. From a total of 1301 teleconsultations in 27 specialties, 793 patients (61% response rate) rated their satisfaction. Overall telemedicine was well received. Ninety-one percent reported that telemedicine made it easier for them to receive specialty services, 87% were generally satisfied with telemedicine, 90% were willing to continue receiving services and most felt they would not receive better care in person (61%).

b. Rheumatology

Davis, Howard and Brockway (2001) conducted a review of videoconference consults between a rural physician in northern Alberta and a rheumatologist in an Edmonton. Fifty two patients utilized the service and a patient satisfaction survey found that patients agreed or strongly agreed that the telehealth consult met their needs and the care they received was as good as a traditional consult. If the telehealth consult was not available, 13 said they would not have bothered and 37 said they would have traveled to another location, namely Edmonton.

c. Paediatrics

Marcin et al. (2004) reported the results of 130 telemedicine consultations for 55 children with special health care needs from a rural community in California. They found that paediatric subspecialty consultations via videoconference were feasible and highly satisfactory to both parents and the rural health care providers. All of the parent/guardians (130 surveys from 55 individual parents/guardians) rated their satisfaction with telemedicine care as either 'excellent' or 'very good', as did all but two of the rural providers (81 surveys from 3 physicians and 2 physician assistants).

d. Dermatology

Hicks et al. (2003) examined patient satisfaction with tele-dermatology services. One dermatologist saw 321 patients via tele-dermatology during a 27 month period. Each patient filled out multiple satisfaction questionnaires which included items such as "how easy was it to talk to the provider?", "how much did the telemedicine provider seem to care about you as a person?" The authors found that 84% of the patient responses were in the top two positive categories on a seven point Likert scale. In an open ended written section of the questionnaire several patients indicated that they felt they had the specialists "undivided attention" during the teleconsultation, whereas this was lacking in the face-to-face condition (Hicks et al., 2003, p. 44).

Nordal et al. (2000) in their comparison of face-to-face and tele-dermatology discovered that patients (n=106) rated the two interventions as being "as good as each other" (p. 261) on several dimensions which included feelings of contact with the dermatologist, thoroughness of the examination, and the perception that sufficient time was allowed for the examination. Several patients in the teledermatology condition noted that they appreciated the presence of their general practitioner during the consultation (GP was in the teleconference room with the patient while they were evaluated by the dermatologist) as it resulted in a more thorough examination from the specialist.

Eedy and Wootton (2001) in their review of the literature concluded that high patient satisfaction with videoconferencing in the delivery of dermatological care is a prominent theme in several studies as most patients are pleased that their condition is being treated as soon as possible. Eedy and Wootton (2001) asserted that most patients agree that tele-dermatology saved them time and expenditure in traveling to a hospital.

e. Orthopaedics

In a study conducted in Finland, Haukipuro, Ohinmaa, Winblad, Linden and Vuolio (2000) assessed patient satisfaction with outpatient orthopedic services. One group (n=69) received specialist care face-to-face at a hospital outpatient clinic 160km away while the other group (n=76) consulted with a specialist via videoconferencing. Patients in both groups completed a questionnaire which assessed their satisfaction with the intervention. The two patient groups were equally satisfied with the specialist service. The telemedicine patients were more willing to have their next visit by videoconferencing than the conventional patients which the authors concluded was a sign of the high quality of the services offered in the telemedicine condition. Ninety percent of the videoconferencing patients assessed the image on video equipment as good or very good. Voice quality was assessed as slightly worse than image quality. The patients in the videoconferencing group saved a great deal of time in comparison with the conventional group. The average total time (home to home) taken by a videoconferencing visit was 1.5 hours, compared to 8 hours in the conventional group.

In a subsequent evaluation of the costs of virtual Orthopaedics, Ohinmaa, Vuolio, Haukipuro and Winblad (2002) determined that by accessing specialist services via videoconference patients saved both time and money. Because of videoconferencing, patients (n=145) saved costs related to transportation, lost hours of work and the cost of home help. In the videoconferencing group, the average total time of home to home was 1.5 hours. With the conventional group, it was 8 hours. Some patients who required ambulance or taxi transportation were able to save those costs due to videoconferencing. Videoconferencing also reduced the need to transport severely ill patients. The study demonstrated that videoconferencing was less costly from a patient perspective than conventional care, and it was more favourable than conventional medical visits.

Vuolio, Winblad, Ohinmaa and Haukipuro (2003) found that patients who had been previously introduced to videoconferencing were more likely to seek out videoconference based consultation again than those who had never used it. In this study, after their first visit, the patients (n=145) were free to choose whether they wanted to have their next follow-up visit in the outpatient clinic or via videoconferencing. If the patient was first managed by videoconferencing, it was found to be likely that the next consultation would also be via videoconferencing. In this study, the videoconferencing group proved to have similar patient management outcomes as the conventional group. The authors argued that if videoconferencing proves to be feasible, useful and economically beneficial in other fields of medicine, it will save a lot of travel time and promote equal access to services for people living in remote areas. The study showed that videoconferencing is a valid alternative to outpatient clinic visits for orthopedic specialist consultations.

Lemaire, Smith, Nielen and Fawcett (2004) examined patient satisfaction amongst 15 patients who participated in an Ottawa based orthopaedics program in which they had lower extremity prosthetics fitted by a remote specialist via videoconferencing. Nine of 15 clients participating patients considered the time to complete the session was 'as expected', while the other six considered it to be 'less time than expected'. Twelve felt 'very comfortable' when participating in the session, and the other three felt 'comfortable.' All clients were confident in the results

from the session. Overall satisfaction ratings from clients, based on a questionnaire were encouraging with 47% of patients rating the service as excellent, 33% above average and 20% average.

f. Emergency Medicine

There are no studies in the field of emergency medicine which endeavor to gauge the patient's perspective regarding the use of videoconferencing technology in the provision of care. Perhaps this is due to the serious nature of the care being provided or perhaps because in many cases of acute trauma care (e.g. Stroke, traumatic brain injury) patient populations lack sufficient awareness of their surroundings to make judgments regarding their satisfaction. In any case, there exists a paucity of data concerning patient evaluations of emergency/trauma care provision.

Data yielded concerning the patients perspective on the provision of specialized services via videoconferencing is encouraging. In the vast majority of cases in which study participants, across the aforementioned specialized fields, were asked to compare face-to-face and virtual service delivery the two modalities were rated equally. This implies that from a patient's perspective this method of service delivery is indeed viable. Similarly, data regarding patient evaluations of the technical aspects of videoconference based service provision are positive. Patients typically evaluated both the audio and visual aspects of their videoconferencing experience to be sufficient to facilitate interaction with their caregiver.

Videoconferencing appears to offer some significant advantages over traditional face-to-face assessment as well. Videoconferencing enabled patients to rapidly access specialty services within their own community and avoid the travel associated with accessing specialist care. Patients in a study by Ohinma et al. (2002) saved 6.5 hours of travel time by consulting with a specialist via video conferencing. In one study patients reported that the prospect of lengthy travel would have discouraged them from seeking treatment at all (Davis et al., 2001). Additionally, videoconferencing with specialists without having to leave their home community saves patients money. Cost effectiveness data demonstrated that consultation costs for teledermatology patients were remarkably cheaper than the costs associated with traveling to a major center to access care (Loane et al., 2000).

Finally, it appears that the use of videoconferencing in the provision of specialized services impacts the perceived 'quality' of the interaction that occurs between the patient and specialist. Participants in the above studies stated that presence of their general practitioner during the consultation was an appreciated benefit of videoconsultation (Fortin et al., 2003) which ensured a thorough examination (Nordal et al., 2000). Additionally it appears that patient exposure to videoconferencing bears influence on the patient's perception of the quality of the service and desire to participate in subsequent sessions (Voulio et al., 2003). With increased exposure patient populations appear more willing to accept this modality of service delivery.

g. Psychiatry

Videoconferencing has very broad application in the field of Psychiatry/Psychology. It has been used to deliver services to a diverse array of patient populations with psychological issues including children, geriatric patients with dementia issues, incarcerated populations and patients with eating disorders. Generally, telepsychological applications have been well received by the aforementioned patient populations as they have succeeded in meeting their complex cognitive and emotional demands. Perhaps most notably, it appears that telepsychiatry provides patients with psychological issues with a sense of personal empowerment and autonomy not demonstrated in conventional therapeutic processes.

1. General Psychiatry

Simpson, Doze, Urness, Hailey, and Jacobs (2001b) examined patient's perspectives concerning a telepsychiatry service in rural Alberta. The service was established between Alberta Hospital of Ponoka and hospitals servicing small towns in central Alberta. Waiting times, assessment of the equipment, patient satisfaction and cost analysis from the patient's perspective were all assessed in this study. Of the 379 patients who had telepsychiatry consultations as a part of the routine service, almost two-thirds were female. Most of the patients (67%) also had a history of mental illness for longer than one year and had seen a doctor or a therapist before being referred for telepsychiatry. Data regarding patient satisfaction with the service was obtained through questionnaires and through follow-up telephone interviews. Two-hundred and five of the 230 patients who completed the survey agreed that they were satisfied with the session. In a follow-up interview, 25 of 31 patients reported being able to follow the recommendations made at the teleconsultation. Of these interviewees, 28 were very satisfied or satisfied with the service they had received. More than 90% of the patients who completed surveys said that they would recommend telepsychiatry to a friend and preferred using telepsychiatry to waiting until a conventional consultation was available. In addition to that, 83% of the patients who completed surveys preferred telepsychiatry to having to travel for a face-to-face consultation. Patients were asked to describe what effect having to travel to their psychiatric consultation, rather than using telemedicine would have had on them. The majority (23 of 31) would have encountered some kind of financial challenge. Fourteen patients stated that to travel to the city they would have had to miss work, and nine would have had to pay for child care. Patient's opinions on the quality of the equipment showed that there was a high level of approval of telepsychiatry. Almost all the patients rated the equipment as 'good' in terms of sound and picture quality and ease of use. Patients appeared to tolerate equipment problems in order to receive rapid service.

Bose, McLaren, Riley and Mohammedali (2001) examined patient satisfaction (n=13) with a London based telepsychiatry service. The service was setup between the Grovel Medical Centre and the Ladywell Unit, an inpatient unit for psychiatry. The Grovel Medical Centre is located in a borough that is poorly serviced by transport and one of the most health resource deprived boroughs in London. The aim of this study was to assess patient satisfaction with brief counseling (treatment with six or less sessions), provided via videoconferencing. Thirteen non-psychotic patients with a range of psychiatric diagnoses completed 29 sessions over the four-month study period. Sessions were used as an opportunity for emotional release and discussion of techniques for coping with problems. Twelve of the patients completed a questionnaire and commented that the 'closeness' between the patient and the therapist was sufficient to achieve

the goals of the session. Eleven of twelve stated that they were able to hear everything they needed to hear and that they would like to use this medium for communication again.

Simpson, Morrow, Jones, Ferguson & Brebner (2002) evaluated patient satisfaction with a videoconference based hypnotherapy program. A single session was conducted with 11 patients living in Shetland, UK. Of these patients, the majority had attended video-therapy sessions in the past. Results of patient satisfaction surveys indicated that 10 of the 11 patients were satisfied with the video-hypnosis session and all stated that in the future they would like to have further video-hypnosis sessions. Four of the patients reported that they preferred the video-therapy over the conventional face-to-face hypnotherapy. Patients noted that they felt more in control because they were alone in the room and that face-to-face sessions were more intimidating. Moreover, a few of the patients commented that the rapport they built with the psychologist in the previous sessions increased their level of trust in the clinician and their ability to relax during the video-hypnosis. This study provided preliminary results to support the acceptability of video-hypnosis.

Bishop, O'Reilly, Maddox and Hutchinson (2002) compared the level of satisfaction between patients receiving face-to-face psychological assessments and patients receiving assessments via videoconferencing. The study was conducted in Ontario at the Thunder Bay Regional Hospital a facility which has experienced longstanding problems recruiting and retaining psychiatrists. A telepsychiatry link was established between London Psychiatric Hospital and Thunder Bay Regional Hospital. Patient satisfaction was assessed using the Client Satisfaction Questionnaire, which was completed four months after the initial consultation. A sample of 21 patients was assessed in this study, 11 in the face-to-face group and 10 in the videoconferencing group. Results of the questionnaire showed that patients were more satisfied with the face-to-face consultation, however differences were not significant.

2. Child Psychiatry

Pesämaa et al. (2004) conducted a systematic review of the literature concerning the use of videoconferencing in child psychology. Twenty-Seven articles were identified that fulfilled the selection criteria. The authors found that overall satisfaction of nearly all family members in the studies reviewed was generally high. Clients noted that telepsychiatry increased the availability of therapy, consultation and education in remote regions. However, there seemed to be problems with some aspects of patient, caregiver communication. In an article reviewed by the authors, the lack of eye contact was considered disturbing and some disliked repeating things frequently to a psychiatrist because they did not hear what they had said or did not understand their facial expressions.

A Canadian study by Elford et al. (2000) analyzed patient satisfaction amongst 18 children and 23 parents, with a tele-psychiatry program. Overall, children involved in the study were very positive about the videoconferencing system. The majority of the children surveyed liked talking to the doctor on the monitor and when asked which assessment they preferred, an equal proportion favored videoconferencing and face-to-face assessment (29% respectively) and the rest had no preference. Additionally, 89% said that they would use the system again. The majority of parents felt that it was 'somewhat easy' or 'very easy' to talk to and understand the

child psychiatrist using the videoconferencing system. Overall, 21 of 23 parents said that they would prefer to use telepsychiatric services as an alternative to traveling to access care. There were no statistically significant differences between patient assessments of videoconferencing and face-to-face care provision.

Grealish et al. (2005) evaluated adolescent and parent satisfaction with telepsychiatry service. A total of 20 consultations were performed with five adolescents in this study. All five adolescents and their guardians reported that telemedicine was at least as good as in-person consultation. Telemedicine was also seen as the preferred method of consultation because it was less disruptive to the participants' school and home routines than traveling to access care. Additionally, participants stated that the telepsychiatric consultation was as private as an in-person one. Adolescents and their families reported heightened empowerment when using the equipment. They felt that clinicians behaved differently in the teleconsultations than in-person. According to the clients, clinicians spoke more slowly and explained things clearly. Adolescents and their guardians felt that they were 'spoken to' rather than 'spoken at'. Adolescents also reported that telemedicine enabled the transfer of power and control because it made them feel more comfortable about terminating the consultation or walking out. Clients also indicated that they felt the process was more structured and therefore they felt they were better informed, thus resulting in a better understanding of their problems. Adolescents also expressed that they experienced increased participation in the decision-making of their own health care.

Keilman (2005) investigated whether videoconference based consultations were comparable to face-to-face interactions in terms of both quality and participant acceptance amongst families in the New Mexico child welfare system. Keilman administered a survey to the 56 participants (including staff) who had used the system over the past year in order to gauge their satisfaction with the telemedical intervention. Participants were asked to complete a brief questionnaire regarding their attitudes toward the session. Only the parents of the children in this study were involved in completing the survey. A total of 25 participants completed the survey. The majority of the respondents rated the sessions favourably and 65% compared telemedicine favourably with face-to-face consultations.

3. Prison Psychiatry

Brodey, Claypoole, Motto and Arias (2000) compared the satisfaction levels of prisoners receiving remotely conducted psychiatric evaluations with those receiving in-person psychiatric evaluations. A sample of 43 inmates in a large urban jail participated in the study. The forensic psychiatrist interviewed 20 inmates in person and 23 inmates remotely. The remote evaluations were conducted using a workstation on a personal computer. Overall, inmate satisfaction with the psychiatric evaluation was moderately high in both groups. Results indicated that satisfaction rates did not differ significantly between the groups nor did perception of the psychiatrist's professional or technical skill. However, the group interviewed remotely typically rated the psychiatrist's explanation of the evaluation more harshly. Despite their relatively high satisfaction, prisoners expressed that they would not recommend the virtual psychiatrist to a family member or a friend. The psychiatrist involved in this study felt comfortable with his ability to achieve diagnosis via videoconferencing despite the relatively slow transmission rate.

4. Psychiatry for patients with eating disorders

Simpson et al. (2003) examined patient satisfaction (n=12) with a videoconference based eating disorders service. This intervention employed a multi-disciplinary approach which allowed various members of the caregiving team to communicate with the patient via videoconference. Patients participated in twelve to twenty sessions of cognitive behavioral therapy with a virtual therapist and then participated in interviews after the intervention. Patients were satisfied with the video quality in 84% of the sessions, the sound quality in 94% of sessions. Patients also reported a strong sense of control, which they attributed to their ability to turn off the screen and leave the session whenever they felt it appropriate. Patients also indicated that they found communication via videoconferencing very easy for the majority of the sessions. At the end of the last session, 67% of the patients indicated a preference for video-therapy compared to face-to-face therapy. Those who preferred video-therapy stated that it enabled them to access treatment locally, and provided them feeling of control and personal empowerment.

Simpson et al. (2005) reported on patient satisfaction with a videoconference based therapy program. Patients (n=6) reported that they were generally satisfied with the quality of the image and sound in their videoconferencing sessions and were able to focus on the content of the session without being distracted by the technology. Two patients indicated that they felt less self-conscious in video therapy compared to face-to-face therapy. However, most participants did indicate that when the picture in picture function was on it made them feel more self-conscious to see a picture of themselves on screen.

5. Geriatric Psychiatry

Poon et al. (2005) assessed patient satisfaction amongst a group of elderly patients with memory problems receiving cognitive intervention via videoconferencing. Responses from a satisfaction questionnaire indicated that over 90% of the videoconferencing group (n=22) was satisfied with the audio and visual quality of the system. The majority of this group also preferred the videoconferencing program because they felt that this mode of care could save time and costs associated with traveling. The authors concluded that telemedicine was a feasible and acceptable means of providing cognitive assessments and interventions to older people with mild cognitive deficit.

Hildebrand et al. (2004) examined patient satisfaction amongst older adults undergoing neuropsychological testing via videoconferencing. The study's aim was to determine whether videoconference based cognitive testing was an accurate measure of: memory and learning, letter fluency, expressive word knowledge, reasoning, verbal attention, and visual-spatial processing. Twenty-nine participants were recruited in central Alberta. All participants were 60 years of age or older and without neurological or psychological disturbances. Participants were tested both face-to-face and via videoconferencing and by the same psychologist. Nineteen participants completed a questionnaire on their reactions to videoconferencing and all stated that they were comfortable with the technology.

The majority of participants in the reviewed studies were satisfied with the telepsychiatry treatment received (Dobscha et al., 2005; Kopel et al., 2001; Simpson, 2003; Simpson et al.,

2002). Perhaps most interestingly, in studies regarding the use of telepsychiatry for children and adolescents, some participants expressed a preference for telepsychiatry over face-to-face treatment (Elford et al., 2000; Elford et al., 2001; Grealish et al., 2005). It is postulated that children and adolescents tend to grow up with technology and therefore accept it more readily than other age groups (Nelson et al., 2003). Adolescents in one study even reported that comfort increased over time (Grealish et al., 2005). This suggests that with increased exposure is a relevant variable in predicting and encouraging technology uptake in patient populations.

Providing psychological services via videoconferencing appears to have an impact on the emotional state of the patient. Two studies reported that clients with eating disorders preferred therapy conducted via videoconferencing because they felt less self-conscious in this condition than when receiving face-to-face therapy (Simpson, 2003; Simpson et al., 2005). Videoconsultation appears to contribute to patient empowerment as well (Simpson, 2003). Patients in several studies felt more comfortable about terminating the teleconsultation and walking out when they wanted to thus enabling the transfer of power and control (Grealish et al., 2005; Simpson et al., 2002; Simpson, 2003; Simpson et al., 2005).

The reviewed literature indicates that the 'quality' of doctor-patient communication is impacted by videoconferencing. For example, Adolescents and their families in a study by Grealish et al. (2005) reported that clinicians behaved differently in the teleconsultations than in-person. According to the participants, clinicians spoke more slowly and explained things clearly. Adolescents and their guardians felt that they were 'spoken to' rather than 'spoken at'.

Finally, Videoconferencing was demonstrated to benefit patients in a logistical sense. Almost all participants preferred to use videoconferencing over traveling to access services. This sentiment was voiced by the majority of participants in the studies that were reviewed (Elford et al., 2001; Grealish et al., 2005; Hildebrand et al., 2004; Simpson et al., 2001b). Participants overall preferred face-to-face consultations but felt that telemedicine was less disruptive to their routines and further felt that this mode of care could save time and costs of traveling (Grealish et al., 2005; Poon et al., 2005; Simpson et al., 2001b).

h. Allied Health

The reviewed literature concerning patient's perspectives on videoconferencing interventions in allied health fields is relatively positive. Across studies, patients were generally satisfied with this modality of service delivery and its ability to provide the education and support required to manage their own rehabilitation process. Studies which aimed to assess patient satisfaction with videoconference based allied health interventions were limited. Three studies, two in the field of rehabilitation and one in pharmacy have been reviewed.

Russell, Buttrum, Wootton and Jull (2004) assessed patient satisfaction with an Australian tele-rehabilitation service. Patients (n=29) rated their satisfaction with several dimensions of the service on a ten centimeter 'visual analogue scale'. There was a high level of patient satisfaction with videoconference based physiotherapy services. Mean participant responses of nine or greater (based on a ten centimeter scale) were yielded for items concerning the perceived benefit

of the treatment, patient contentment with the method, desire to engage in videoconference based treatment again and perceived audio quality. The only aspect of the videoconferencing condition which participants scored below nine related to the visual clarity of the session (mean score of 7).

Many patients expressed a preference for the videoconferencing method of rehabilitation over the traditional, face-to-face model, as they thought the treatment was more 'personalized' via videoconference. Attempted videoconferencing consultations between the physiotherapist and patients were successful in all cases. The participants in this study were very enthusiastic and compliant with the exercise program prescribed via videoconferencing. The authors concluded that patient satisfaction with the intervention allowed them to feel empowered to take an active role in understanding and managing their condition.

Lai, Woo, Hoo and Chan (2004) assessed patient satisfaction (n=21) with a Hong Kong based telerehabilitation program which provided stroke patients with both treatment and education via videoconference. The treatment consisted of education, exercise and social support. The education component included talks covering the pathophysiology of stroke, signs and symptoms, medical management, rehabilitation pathways, the identification and modification of risk factors, psychosocial impact, community support, and home and environmental safety. A focus group was conducted eight weeks into the intervention to gain qualitative data from the 21 participants. The focus groups revealed that most of the subjects felt that the program had been very useful. The main reason was that there had been insufficient patient education when they had been in hospital. They also felt that the program provided for continuation of their rehabilitation. All the subjects accepted the use of videoconferencing. The method of treatment used in this study improved both physical functioning and psychosocial wellbeing in the subjects.

Clifton, Byer, Heaton, Haberman and Gill (2003) assessed patient satisfaction (n=93) with two way, videoconference based dispensing services. Patients involved in the study lived in remote areas and lacked access to conventional pharmacy services. Over 75% of patients seen at the remote sites were satisfied with their videoconference interactions with the pharmacist. Of the patients seen at the remote site, 55.6% agreed or strongly agreed that they were satisfied with the time required to obtain medications and counseling. 46% agreed or strongly agreed that they would not have been able to have their prescriptions filled easily without this program. The majority of patients at the remote sites indicated that they had no preference between traditional face-to-face counseling versus counseling via two-way videoconferencing.

Although a small number of studies regarding patient satisfaction with videoconference based allied health services were identified in the reviewed literature, it appears that patients in these fields derive both psychosocial benefits from connecting with their care providers. Additionally, videoconferencing seems to contribute to improved self management amongst patients in allied health fields (Clifton et al., 2003; Lai et al., 2004; Russell et al., 2004).

i. Home Care

Patient satisfaction with virtual home care service is well articulated in the literature. In fact, patient and provider satisfaction are the most common measures of the viability of virtual home

care delivery. It seems that patients are satisfied with the technical/audio visual aspect of this mode of delivery, and feel that it facilitates personal contact with their caregivers, families and similar others. Some technology adoption challenges exist for elderly populations; however these effects appear to be mitigated with increased exposure. The following studies examined the patients' perception of telehomecare services.

Bratton and Cody (2000) examined patient satisfaction with telemedicine (including but not limited to videoconferencing) amongst a group of generally healthy elderly residents of a Florida retirement community. The 20 participants were visited by a practitioner via the "electronic house call", a telemedicine unit which enabled the clinician to communicate with the subjects regarding their health and monitor their vital signs. At the end of the eight week pilot 18 of the 20 participants completed a questionnaire concerning their satisfaction with the telemedical intervention. Sixty-one percent indicated that they were comfortable using the system without assistance and 94% reported that they felt that the electronic house call did not erode their relationship with their primary health provider. Some challenges associated with introducing videoconferencing technologies into the homes of senior citizens were identified including the perceived dependability of the equipment (only 44% of the subjects felt the ISDN lines were reliable) and cost (only 22% indicated that they would be willing to pay to have the equipment in their house).

Chan, Woo, Hui and Hjelm (2001) assessed residents' acceptance of a videoconference based system which connected patients in a Hong Kong nursing home with members of a multidisciplinary care team. Of 198 residents who participated in the study, 47 were able to complete an acceptability questionnaire, which was designed to assess the patients' ability to see, hear and communicate with their caregivers via videoconferencing as well as their desire to continue to use this modality in the future. Residents had favorable regarding this mode of health care. Based on a five point Likert scale (1=strongly disagree, 5=strongly agree) the median score for the following question items was either four or five. "I could hear everything", "I could see everything", "The consultant could ask me questions", "I was able to communicate with the consultant", "I would like to use teleconsultation again" (p. 44).

Savenstedt, Brulin and Sandman (2003) conducted a study in Sweden with family members of demented patients who were given videophones for communicating with their husband/wife/parent once a day. Five spouses and two children were provided with low broadband videophones and interviewed after three months on order to gauge their perceptions of the intervention. Qualitative data analysis of interviews with the patients' spouse/family member revealed that the visual link established by the videophone 1) reduced travel and improved convenience, 2) facilitated their involvement in the caring process, 3) allowed them to interpret their relatives well being and 4) confirmed their relationship. The authors attributed the aforementioned benefits to the visual aspect of the videophone communication. In addition, the authors found that because the videophone interaction was short it increased patient alertness and therefore was superior to that achieved during face-to-face visits in the hospital. One of the significant challenges was the need for nurses to assist those patients unable to operate the videophones independently. This proved frustrating for the spouse/family members as it interfered with natural communication. Overall, the authors concluded that videophones have the

potential to be useful tools for improving communication between family members and elderly, institutionalized relatives.

In a study conducted at the University of Minnesota, Demiris, Speedie and Finkelstein (2001) measured patients' pre-and post-perceptions of a telehomecare system. Prior to the intervention, patients (n=28) viewed a videotape which showed a virtual home visit and then completed a questionnaire (pre-test) designed to measure their perceptions. Subsequently, patients were randomly divided into a control group (n=11) with no telemedical support from nurses and an intervention group (n=17) which received videoconference visits from nurses in addition to standard care. Although the questionnaire data revealed no change in the control group's feelings towards videoconferencing based care, the experimental group's perception of videoconference based telehome care improved dramatically from pre-to-post test. Furthermore, pre-to post-test changes in participants' responses to question items were found to be statistically significant. After exposure to videoconferencing patients reported increased comfort with the technology and were confident that the nurse could understand and respond to their medical over the television. The authors concluded that this study illustrates the potential for wide acceptance of telehomecare amongst patient populations

The available body of literature suggests that patients are satisfied with several aspects of telehomecare. From a technical standpoint it appears that home care technologies are sufficiently easy to operate (Valero et al., 2001) and provide adequate audio and visual quality to allow patients to interact with their caregivers (Chan et al., 2001). Furthermore, videoconferencing doesn't negatively impact the patient-provider relationship, but rather promotes feelings of personal contact (Bratton and Cody, 2000). Perhaps the most powerful benefits, from the patients' perspective, of videoconference based home care are emotional. Videoconferencing enables often isolated home bound patients to communicate with their caregivers (Chan et al., 2001) their families (Savenstedt et al., 2003) and similar others (Ezumi et al. 2003) which has considerable impact on their emotional well being. The greatest barrier to patient acceptance of home care technologies is cost. Although patients appreciate the ability to communicate with those involved in their caregiving process they appear unwilling to invest in either videoconferencing or videotelephony technologies themselves (Bratton and Cody, 2000).

The reviewed literature regarding patient satisfaction with videoconference based intervention is generally quite positive. Patients reported a high level of satisfaction with the audio-visual quality of the equipment as well as its ability to connect them with their clinician in a meaningfully interactive fashion (Haukiporo et al., 2000). Perhaps the most salient theme which emerged from the literature relates to the increased convenience that videoconferencing afforded patients and their families. Videoconferencing saved patients a great deal of time and money by maintaining care within their home community, all while allowing them more rapid access to care and diagnosis (Fortin et al., 2003; Simpson et al., 2005), and greater continuity of care than would be possible otherwise (Lai et al., 2005). Additionally, Videoconferencing has been demonstrated to positively impact physician-patient communications by increasing the patient's sense of empowerment and anonymity in dialogues with caregivers (Grealish et al., 2005). Home bound and institutionalized elderly patients derived communications based benefits from videoconferencing interventions as well as it increased the frequency with which they communicated with their caregivers and family, which positively impacted their emotional well

being (Chan et al., 2001; Ezumi et al., 2003). Finally, patient satisfaction with videoconferencing interventions was demonstrated to improve over time and with increased exposure (Demiris et al., 2001). This would suggest that patient satisfaction with this modality of health care delivery is likely to continue to improve with more widespread application of videoconferencing in clinical contexts. Assessing patient receptivity to this modality is critical as the success of any videoconferencing intervention is undoubtedly related to the willingness of the patient population to accept it.

XIX. Aboriginal Context

There exists disproportionate rates of social and community ill health among Aboriginal peoples in comparison to the Canadian population in general (Department of Indian and Northern Affairs Canada, 1996). These inequalities are especially acute in rural and remote Aboriginal communities, where poor health status is often compounded by geographic isolation, poor environmental conditions, inadequate housing and inconsistent delivery of health care services (Muttitt, Vigneault and Loewen 2004). Muttitt et al. (2004) argued that access cannot fully explain differences in health status as Aboriginal people access the system at a higher rate.

According to a report on First Nations and Inuit Telehealth Services (First Nations and Inuit Health Branch, 2002) three conditions currently exist which make First Nations and Inuit Communities natural environments for telehealth implementation. First, over 1/3 of First Nations and Inuit communities are isolated; second, there are significant inequities in health outcomes among Canadian and Aboriginal populations; and third, both Health Canada and the Assembly of First Nations have identified that telehealth has the potential to address several First Nations health priorities.

In 1999, the Minister of Health's Advisory Council on Health Infostructure made specific recommendations to federal and provincial Ministers on a national strategy for a pan-Canadian Health infostructure (Advisory Council of Health Infostructure, 1999). One recommendation was that Health Canada consider an Aboriginal Health Infostructure (AHI), strategically interconnected to Health Canada Infoway, yet autonomous and distinct and consistent with Aboriginal interests. Despite this recognition, Aboriginal representatives were not invited to participate in the Federal/Provincial/Territorial (F/P/T) Advisory Committee on Health Infostructure. The AHI was not mentioned in the Blueprint and Tactical plan released by the F/P/T Advisory Committee on Health Infostructure in 2000, nor in its updated version in 2001.

As a result of this lack of response to the original Council's recommendations, the First Nations and Inuit health Branch (FNIHB) invited Aboriginal leadership organizations to launch the planning phase of the Aboriginal Health Infostructure (AHI). The AHI committee planning committee is made up of representatives from the Assembly of First Nations, The Inuit Tapiriit Kantami, the Metis National Council, First Nations and Inuit Health Branch, National Aboriginal Health Organization and the First Nations Statistical Institute. The planning committee explored ways in which the AHI could support Aboriginal Peoples to address their needs with respect to health services and health information. Success of the AHI according to the planning committee, is not dependent upon the technology itself, rather its capacity to address the human issues tied to

individual and community ownership of their own health (National Aboriginal Health Organization, 2005).

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).

Although it would appear that further development regarding the organization and development of an Aboriginal Health Infostructure at the policy level has come to a halt, interest in the growth and development of telehealth application including videoconferencing is still high. In September 2005, the National First Nation and Inuit Telehealth Summit was held in Winnipeg. This event, the first of its kind aimed to bring together First Nations, Inuit, Federal, Provincial, Territorial and community telehealth stakeholders in a national meeting to share knowledge, practices and lessons learned. At this conference a number of presentations were made regarding various unique and effective telehealth programs. In addition, the conference highlighted the growth and increasing interest in Aboriginal Telehealth in Canada with emergence of a special interest group, known as the Aboriginal Telehealth Knowledge Circle (ATKC). The ATKC was formed in November 2003 as a community based group with expertise in Aboriginal Telehealth Initiatives from across Canada. Prior to ATKC, many Aboriginal initiatives worked in isolation unaware of other aboriginal initiatives facing similar issues. ATKC received funding for one year for one paid position, to develop a strategic plan and web-based organization. One of the organizations major objectives was to establish a network of Indigenous expertise in technology and develop a national strategy for promoting use of telehealth in indigenous communities.

The e-health Solutions Unit of the First Nation and Inuit Health Branch (Health Canada 2004a) published a backgrounder document entitled Aboriginal Crossing Boundaries- On-Line Discussion Document which identified system-wide barriers and constraints influencing the potential for broader adoption of telehealth including:

- The lack of adequate telecommunications bandwidth and connectivity;
- The fragmented regulatory environment, lack of uniform statues and codes of practice for the implementation of technologies by health professionals;
- The general impact of information technology within the health sector and the impact technology is having on the delivery and management of services and
- The challenges of long term funding and sustainability.

Similarly, the Health Telematics Unit at the University of Calgary (2003) identified the following critical success factors for telehealth implementation in First Nation and Inuit communities: community, funding, management, healthcare/education practice.

The Division of Continuing Medical Education at the University of British Columbia (2004) conducted qualitative and quantitative research in nine rural and remote First Nations Communities across BC to identify healthcare providers' perspectives regarding the potential

impact of telehealth. Healthcare professionals completed surveys, as well as participated in focus groups and interviews. Survey data was analysed to compare responses from various healthcare professionals. Content analysis was performed on interview and focus group transcripts to extract themes. Focus group participants felt strongly that telehealth has the potential to mitigate some issues faced by those working in rural and remote First Nations communities, namely: lack of decision support, lack of continuing education, acute care services shortfalls and lack of continuity of care. Participants also expressed apprehensions about telehealth, including: decreased quality of care, reduction of opportunities to travel outside the community for educational purposes, availability of funding to cover the high cost of telehealth and lack of both human and technical resources necessary to sustain telehealth. The study concluded that telehealth has the potential to alleviate some of the challenges faced by those working in rural and remote First Nations communities. Success of sustainable telehealth implementation is dependent on overcoming significant barriers such as lack of funds and technical support.

The National First Nations Telehealth Research Project was initiated in 1998 as the first concerted effort on a Pan-Canadian scale to implement telehealth in First Nations communities. Pilot projects were implemented in communities in 5 different provinces, Anahim Lake (BC), Fort Chipewyan (Alberta), Southend (Saskatchewan), Berens River (Manitoba) and La Romaine (Quebec). Key lessons learned included: 1) telehealth is about people, it's acceptance by patients, providers and families depends upon commitment and capacity of individual people; 2) telehealth generates care, so it generates costs in the short to medium term and it is unreasonable to expect that initial capital and organizational costs would be offset until much later; and 3) telehealth is vulnerable to existing instabilities in First Nations health services. The single most important contributor to success of the pilot projects was the presence of stable and committed staff throughout the implementation period. Staff turnover in northern communities is traditionally high and telehealth is sometimes proposed as a means of compensating for these difficulties. However, the results of this study demonstrated that telehealth, like any other form of care, is subject to the forces which produce frequent turnover among nursing station staff. Communities that had an identified telehealth service need, community and health provider buy-in, collective partnerships in place, and network connectivity were the most successful (First Nations and Inuit Health Branch, 2002)

Muttitt, Vigneault, Loewen (2004), described the Canadian perspective on integrating telehealth into Aboriginal health care. They identified a number of challenges related to infrastructure, organization and jurisdictional limitations which must be addressed in order to expand telehealth in remote Aboriginal communities. They noted for example, that geographic factors and poor road access incur high costs related to equipment, whereby travel and shipping costs can account for up to 40% of telehealth project costs. In addition, technical infrastructure to support telehealth is sorely lacking - only 26 of 625 First Nation communities have access to broadband networks. They also noted that recruitment and retention are significant challenges in providing health care services to First Nations while telehealth requires additional or dedicated support personnel. First Nations peoples receive services from Federal Government when on a reserve, but may also receive provincial or territorial services when off reserve. Therefore delivery of services virtually to the reservations blurs traditional jurisdiction lines.

However, Muttitt et al. (2004) argued that the challenges in implementing telehealth are not unique to Aboriginal settings but in many instances are more pronounced as a result of cultural, political and jurisdictional issues. Muttitt et al. (2004) noted that there has been steady growth of telehealth activities in Aboriginal communities in past 3-4 years but the full potential of telehealth as a solution has yet to be realized. Success, they argue, is dependent on full and seamless integration of telehealth as part of the healthcare system.

Muttitt et al. (2004) provided an overview of selected telehealth programs in Canada replicated below as Table 1. This table is intended to provide a general overview of some Canadian Telehealth programs that provide videoconferencing services to First Nations and Inuit populations. Each program is then described in more detail following the table

Table 1. Canadian Telehealth Program Providing Videoconferencing to First Nation and Inuit Populations

Program	Location	Start Date	V/C	Clinical	Cont. Ed	Admin	Visitation	# Sites Aboriginal	# Sites Non-Aboriginal
Alberta First Nations	Alberta	2001	Yes	Yes	Yes	-	-	24	0
IIU Network	Nunavut	1999	Yes	Yes	Yes	Yes	Yes	15	-
Keewaytinook Okimakanak/NORTH Network Partnership Pilot	Ontario	2001	Yes	Yes	Yes	Yes	Yes	12	-
MBTelehealth	Manitoba	2001	Yes	Yes	Yes	Yes	Yes	2	21
Western NWT Health Network	NWT	1998	Yes	Yes	Yes	-	-	12	0
Yukon Telehealth Network	Yukon	2001	Yes	Yes	Yes	-	-	9	0

The Alberta First Nations TeleHealth Program which began in 2001 is an initiative aimed at redefining health care service delivery to First Nations communities in the Alberta Region. The initiative's objectives include developing the technical infrastructure to support telehealth programs, installing videoconferencing equipment, providing continuing education for nurses in remote communities, and deploying an information portal that will enable on-line access to thousands of health-related documents. The project developed a technical infrastructure within 41 Alberta First Nations communities. The Alberta First Nation Telehealth Project started with addressing programs for disease prevention and education and achieved success. As a result 7

First Nation communities participated in 3 teleconsultation pilot programs including the National Native Alcohol and Drug Abuse Program, the Diabetes Foot Care Teleconsultation Pilot Program and the Diabetes Nutrition Teleconsultation Pilot Program. This has put the Alberta First Nations Telehealth Program in a better position to expand to deliver specialty services and develop a Memorandum of Understanding with the province for the provision of services via telehealth (Muttitt et al., 2004).

Beginning in 1999, the IIU Telehealth Network, known as the Ikajuruti Inungnik Ungasiktumi Telehealth Network in Nunavut operates in 15 communities in the territory. In each of the communities local Inuit have been trained as site technicians to operate and maintain the telehealth stations. Their training included a train-the-trainer program and continued follow-up training in using the community telehealth stations. The IIU network aims to improve accessibility to health care services by increasing the frequency a patient will be seen by a specialist or their community physician and increasing the services from outside specialists at the community level. The IIU network reduced the need to travel to other locations for medical and social care (University of British Columbia – Division of Continuing Medical Education, 2004).

Keewaytinook Okimakanak Telehealth, of KO Telehealth began in 2001 and is a provincial partner of North Network and one of the most successful telehealth networks in Canada. The applications were developed with a First Nations focus, specific to the disease entities and needs of the communities and is in fact, owned and operated by the First Nations Communities. It serves as a strong model for the future development of First Nations telehealth and according to Geordi Kakepetum, KO Telehealth's Executive Director "Our lives have been completely changed by the services we now receive over the network. Having telehealth care and also having secondary education services available in our communities is making us stronger as a people" (Keewaytinook Okimakanak Telehealth Homepage, 2005).

In October 2005, the KO Telehealth/North Network released an Interim Evaluation Report regarding their expansion program (Hogenbirk, Ramirez, Ibanez, Pong and Hardy, 2005). The project began in September 2003 with 5 First Nations communities and expanded to 22 First Nations communities located in the Siouz Lookout Health Zone. Usages rates for First Nations communities rose from nine in September 2003 to 22 in August 2005, with an average of 12 session/First Nations community/month. Of the total 2926 sessions (including First Nations and North Network), clinical consultations comprised 42%, followed by training (19%), education (17%) meetings (13%) and demonstrations/test/family visits (8%). Over 90% of the 73 patients said that they found the telehealth session helpful, 96% would repeat the appointments by telehealth and 89% would recommend telehealth to another person.

The KO Telehealth network also undertook the largest First Nations Telemental health project in which both patients and providers expressed high satisfaction with telemental health services and a desire for more. Evaluation of the project led to recommendations about the need for a strategic approach to the creation of telemental health programs in Aboriginal communities (Health Canada, 2004c). The project is now being integrated with the services of the Nodin Centre and expanded from 6 to 24 sites with funding from Health Canada's Primary Health Care Transition Fund.

The MBTelehealth network was launched in 2001 has been designed to be versatile enough to provide a number of services, including televisitation, teleconsultation, teleadministration and tele-education. Clinical services such as specialist consultation, discharge planning, and case conferencing are available on the Network. MBTelehealth is also an integrated and accessible network providing continuing education of health care providers and client based education to support high quality care and regional health authorities commitments to health services in their regions (MBTelehealth, 2005).

Very recently, (November 1, 2005) the MBTelehealth Network announced it was undertaking a First Nations Expansion Project. According to MBTelehealth, First Nations leaders have aggressively lobbied for telehealth as a means to enhance health care services in their communities. Manitoba has the largest concentration of First Nations of all provinces in Canada, and, as such, serves more First Nations clients through the provincial health care system than any other Canadian province. Currently there is a lack of telehealth activity in any of the First Nations communities with the exception of Berens River and Norway House which were part of the original launch of MBTelehealth. Through a joint collaboration between MBTelehealth, the First Nations and Inuit Health Branch, Keewatin Tribal Council, and Canada Health Infoway, there was an opportunity to expand the provincial telehealth network into ten First Nations communities located in the most remote, northern part of Manitoba (MBTelehealth 2005 b).

The WestNet Telehealth Pilot started in the Northwest Territories in 1998 to offer scheduled telehealth services between Yellowknife, Fort Smith and Inuvik for orthopedics, internal medicine, and urgent/emergent x-ray consultations. By December 2000, telehealth service provision had increased to include scheduled ear, nose and throat services, and 22 non-scheduled clinical and social services. As well, continuing medical education activities from Stanton Territorial Hospital and Alberta Capital Health Authority continued to expand to communities. In 2001, the WestNet Telehealth Program expanded to the communities of Hay River, Fort Simpson, Deline, and Holman. In 2002, Yellowknife HSS Authority commenced telehealth service to Lutselk'e and Fort Resolution. The Government of Northwest Territories plans to "telehealth enable" all communities and is engaged in WestNet Telehealth strategic action planning to restructure governance and operations to better serve telehealth role in primary community care (WestNet Telehealth, 2005).

The Yukon Telehealth Network began in 2001 and is led by the Yukon Department of Health and Social Services and involves partners from British Columbia and Alberta. It was designed to meet the health care challenges in remote northern communities including: 1) restricted and expensive access to specialist services for Yukoners living in communities outside Whitehorse, 2) meeting the health needs of Yukon First Nations and non-First Nations, and 3) helping address difficulties in the recruitment and retention of health care professionals. There are nine participating communities including: Watson Lake, Haines Junction, Old Crow, Mayo, Whitehorse, Dawson City, Pelly Crossing, Destruction Bay, and Beaver Creek. The majority of specialist services are contracted outside the Yukon and partnerships were required with the following clinical service providers: Children's & Women's Health Centre of British Columbia (C&W); BC Children's Hospital; BC Women's Hospital and Health Center; BC Sunny Hill Health Center for Children; University of British Columbia, BC Mental Health Evaluation and Community Consultation Unit (MHECCU); Alberta Ponoka Hospital, Ponoka, Alberta - partner

of MHECCU. Services included: telementalhealth; telelearning; telefamily visits; emergency radiology consults (store and forward of digital x-ray images for emergency consultation at Whitehorse General Hospital); therapy services; early childhood development services and discharge planning (Yukon Telehealth Network, 2005).

The following section reviews four primary research studies regarding the use of videoconferencing for specific clinical applications with Aboriginal populations in the US, Australia and the Pacific Islands. Reynolds, (2005) described the School of Medicine's telemedicine program at the University of North Dakota. To launch the program key staff members were charged with identifying the State's rural health care needs and concluded that indigenous Native Americans living on reservations lack access to specialty healthcare and could benefit from the program. The program went live in November 2003, and began by providing Optometrist consultation services (a priority health care need identified by the community). One month after the initiation of optometrist services, physicians began using the program to send images of suspected child abuse cases to trained specialists for validation. In 2004, dentists working out of the hospital used the system to obtain second opinions of patients with dental trauma. Program now extended to a second reservation. The authors noted that the program provides technical support for doctors using the system which takes much of their human resource time.

Post traumatic stress disorder (PTSD) is highly prevalent among indigenous populations in isolated areas, such as tribal reservations and the Pacific Islands (The National Center of Post Traumatic Stress Disorder, 2005). In a pilot study on PTSD, Morland et al. (2004) wanted to determine the feasibility of videoconferencing to provide coping skills to a group of veterans. Three participants withdrew from the study and the demographics of the final sample were not recorded, however the initial sample did include 11 indigenous Asian Pacific Islanders. Patient satisfaction was similar in both the face-to-face group and videoconferencing group, with no significant differences found. At week four of the pilot, both groups had similar scores for information retention but by week eight the face-to-face group retained more information although these differences were not significant. The authors concluded that videoconferencing can be used to provide coping skills for veterans with PTSD.

Shore and Manson (2004) described a case study of an American Indian Veteran who was evaluated and assessed through the Veteran's Administration Telehealth clinic. The clinic provided videoconferencing technology to deliver weekly mental health assessment and treatment to the community where he resided. The patient had used support groups via telehealth to learn coping mechanisms to help him deal with and tolerate post-traumatic stress disorder symptoms. Through interviews with the patient, the author learned that the patient felt benefits of the telehealth clinic are privacy and confidentiality, which he felt could not be guaranteed by attending the mental health clinic his community. The author also concluded that the distance provided via telemedicine gave the patient the ability to open up in a meaningful way whereas face-to-face treatment felt intrusive and made it difficult for the patient to explore traumatic issues.

Lessing and Blignault (2001) conducted a national survey of mental health telemedicine programs in Australia. The authors were particularly interested in the usage of such programs by

Aboriginal people, Torres Strait Islanders, non-English-speaking migrants and people living in rural areas. The authors identified 36 mental health telemedicine programs. Program managers from each of the 36 programs were asked to complete a survey (3 responded). When asked about the steps taken to meet the needs of these under-served populations, seven program managers indicated that their program made use of indigenous health services in their area and four stated that indigenous staff were employed to meet the needs of these groups. A total of 694 clinical sessions were recorded over three months with a total of 526 clients. Of these clients, 37 (7%) were Aboriginals or Torres Strait Islanders and 19 (4%) were from non-English-speaking backgrounds. The results suggested low use by underserved populations (Aboriginal, Torres Strait Islanders, etc.). However, these results are likely an underestimate of their use given that one program specifically designed to provide services to indigenous people declined to participate in the survey.

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 infrastructure development, one that emphasizes coordination, linkages and leveraging of investments that takes into consideration unique federal/provincial/Aboriginal jurisdictional issues (First Nations and Inuit Health Branch, 2002).

XX. FINANCIAL CONTEXT

Videoconferencing has improved access to health-care for those people who live in rural and remote communities. The ability to access services in the local community via telehealth represents a significant benefit in terms of quality of life. In addition, videoconferencing has proved to be cost effective as well.

Jennett et al. (2003) conducted a literature search on cost-effectiveness of telehealth in Canada. The review of literature covered:

- the social determinants of health poverty, social isolation, education, life stress, early life, access to transport, nutrition, access to health services and care;
- factors affecting the socio-economic performance of a community economy, labour markets, innovation, environment, education and health.

The study focused on nine main areas: paediatrics, geriatrics, First Nations (i.e., indigenous peoples), home care, mental health, radiology, renal dialysis, rural/remote health services and rehabilitation. The main benefits of telehealth identified in this study were: increased access to health services, cost savings, enhanced educational opportunities, improved health outcomes, better quality of care, better quality of life and enhanced social support.

Under paediatrics, cost-savings can be achieved with videoconferencing for paediatric subspecialty consultations (e.g., paediatric congenital heart disease), from the perspective of both the healthcare system and the patient/family, such as reduced travel costs, accommodations, etc. Studies in pediatric tele-echocardiography have demonstrated the following socio-economic

benefits: fewer neonatal hospital transfers, reduced length of stay in neonatal intensive care, and improved efficiency and quality of care.

Among First Nations, the most commonly identified socio-economic benefit of telehealth was improved access to health-care. In addition, the ability to access services in the local community via telehealth may represent a significant benefit in terms of quality of life (e.g. mental health). With regard to rural/remote health services, there is evidence that interactive videoconsultation is effective and efficient in these remote areas, and increases access to healthcare. Other socio-economic implications include the avoidance of travel for patients and providers, improved access to services, increased quality of care and cost-savings.

In the area of Home Care, there is evidence that the use of telehealth improves the quality of diabetes home care, including improved self-monitoring and self-care, and better physiological control. Furthermore, telehealth can be used to monitor patients with chronic heart failure and those using pacemakers. In other care contexts, for example, in rehabilitation, video-based and telephone-based telehealth techniques have been used successfully in the follow-up care and education of patients with spinal cord injuries, with socio-economic benefits such as increased quality of life, decreased hospitalization rates, increased rate of patients returning to work, improved health outcomes and increased patient empowerment.

Conclusions of this review suggest that indicators of the socio-economic impact of telehealth need to be developed and validated, since many studies have assessed only the feasibility or costs of implementing telehealth applications. For instance, the effects of telehealth on health status, health outcomes, practice patterns, patient management and health system resources need to be measured, as well as other organizational, social and ethical implications and possible risks associated with telehealth.

Kitt and Clayton (2002) conducted a study in Australia where they established a telehealth link between two inner-city health services about 10 kilometres apart. The video-link between the sites was based on IP videoconferencing. Short-term, acute patients are usually treated at The Alfred hospital, and then transferred to the Caulfield General Medical Centre (CGMC) for longer-term, sub-acute rehabilitation. Technically the patients remain as inpatients of the CGMC for rehabilitation, but they are regularly transferred back and forth to The Alfred hospital for outpatient care related to their acute stay (e.g., for orthopedic reviews or for reviews of infectious disease or burns). Although the two sites are geographically quite close, patients are often away from their inpatient wards for four hours per appointment because of problems with ambulance transport and outpatient service demand. Consequently, they can miss rehabilitation therapy sessions as well as other important aspects of care. For many of these patients transportation is a difficult and painful process. The cost of a conventional consultation, in which the patient travelled to an outpatient appointment, was Australian \$170. Because existing equipment and telecommunications could be used, the cost of a telehealth consultation was only Australian \$74. The results suggest that the cost savings from telehealth can be substantial. In addition there were major social benefits to continuity of patient care and clinical communication within the organization.

In another 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.

Hassall, Wootton and Guilfoyle (2003) calculated the cost of providing allied health assessments to high-dependency residents of a facility for elderly people in rural Australia. The costs of conducting assessments via videoconferencing were compared with the costs of conducting assessments face-to-face. The videoconference assessments were conducted by five therapists at a metropolitan allied health centre who worked in dietetics, occupational therapy, physiotherapy, podiatry and speech pathology. Variable costs for videoconference assessments included ISDN call charges and salaries for the nursing staff assisting with each assessment. Variable costs for face-to-face assessments included the costs associated with travelling to and from the residential facility, accommodation expenses and running costs for the vehicles used. Given an annual workload of 1000 occasions of service, each videoconference assessment cost Australian \$84.93, compared with Australian \$90.25 for face-to-face assessments. Allied health assessments delivered by videoconferencing became cheaper at workloads of approximately 850 occasions of service annually. Additional increases in the workload further improved the financial viability of this approach to service delivery.

Jong (2004) analyzed the cost of sending patients from a small isolated community in Newfoundland, Canada, to a secondary health centre in Goose Bay for suicide assessment, compared to the cost (maintenance and on-line charges) of the same assessment delivered via videoconsultation. User satisfaction was also assessed via a qualitative questionnaire. The results indicated that both patients and health providers were satisfied with the videoconsultation. In addition, for 71 mental health assessments performed via videoconference, the provincial

government saved \$140,088 as a result of travel avoided for patients and RCMP escorts. The cost for a mental health assessment via videoconference was \$206.36 compared to \$1745.00 for a face-to-face conference which requires the patient and their escort to travel to Goose Bay. This service was set up as part of a pilot project for Industry Canada and is a shared resource in the community for justice, education and business sectors as well. The authors suggested that where there are similar high costs for patients to travel to distant health facilities, videoconferencing can be cost effective.

In a Canadian study, Davis, Howard et al. (2001) found the delivery of rheumatology services via videoconference in geographic areas where traditional consultations are not readily available, to be both time and cost effective. Results indicate that telehealth consults are associated with greater fixed technology costs which vary depending on how the expenses are attributed. Their evaluation of the Keeweenaw Lakes RHA telehealth system estimated a prorated cost of \$220.00 per hour of usage incorporating both capital and operating costs based on a current utilization rate of 40 hours/month. Therefore they were more cost-effective at higher volumes of services. Based on their data they calculated that the total costs of services (both fixed and variable) would be equal for the teleconsultation and traditional consultation at 247 consults a year. They note that the system utilized in the study used satellite which is more expensive than more commonly used land-line links.

A Canadian study by Sicotte, Lehoux, Van Doesburg, Cardinal and Leblanc (2004) examined the cost-effectiveness of a paediatric telecardiology service after five years of operation. Interactive telecardiology consultations were held between a tertiary care centre in Montreal and an acute care hospital located 640 km away. A retrospective study was performed on 78 infants who had received paediatric cardiology teleconsultation and the cost effectiveness of telecardiology was compared with that of conventional care. While teleconsultation proved to be an effective and reliable means of enhancing access to tertiary services, a cost analysis did not demonstrate overall cost savings. The total cost of telecardiology was \$272,327 CAD over the entire study period (four years) and conventional care would have been \$157,212 over this same time. There were direct savings for the patient, but not for the health care system due to the high cost of equipment and telecommunications fee. The authors found that the supplementary cost of telemedicine was equal to \$1500 per patient. Finally the incremental cost-effectiveness ratio of teleconsultation was estimated at \$3488 CAD per patient journey avoided.

Rumpsfeld, Arlid, Noruma and Breivik (2005) described the use of a videoconferencing system to link a university department and two remote dialysis centres together in the provision of haemodialysis services in Norway. During an eight month study period, 225 videoconferences were performed for daily visits and regular rounds. Economic analysis showed that annual savings amounted to \$46,613 including \$24,260 in avoided costs associated with routine hospitalizations (travel costs and costs of overnight stays at the hospital), \$15,356 from avoided emergency hospitalizations and \$6997 from travel costs and doctors' fees saved as a result of one-third fewer planned visits by nephrologists to the satellite units. Annual costs of providing haemodialysis services via videoconferencing were \$79,489. The cost minimization analysis showed that to improve cost-effectiveness, the number of patients benefiting from the services or number of satellites connected to the network must be increased.

Others studies reported that cost-effectiveness of videoconferencing has yet to be clearly demonstrated. In the United States, Whitten, Mair, Haycox, May, Williams and Hellmich (2000) concluded that there was no proof that telemedicine was a cost effective way of delivering health care. The Agency of Healthcare Research and Quality in the U.S states that large gaps remain in both efficacy and effectiveness research regarding access, satisfaction, quality of care and cost-effectiveness of telemedicine applications. In Canada, Roin, Ohinmaa and Hailey (2001) reviewed literature and reported that telepsychiatry was one application where there was evidence of effectiveness but evidence of cost-effectiveness was lacking. In the Finnish orthopaedic study by Vuolio, Winblad, Ohinmaa and Haukipuro (2003), videoconferencing was shown to be cost-saving to society at workloads of about 80 patients per year. Surgeons consider videoconferencing to be a useful tool for the future, but their primary worry is about the cost to set it up.

In the field of neurology, Chua, Craig, Wootton and Patterson (2001a) compared the costs of teleneurology with the cost of conventional neurological care in the UK. In this study, financial implications were analyzed by calculating the costs for: investigations and reviews, and doctors' time. For the face-to-face group, travel time and distance of travel was also measured. For the telemedicine group the ISDN call charges and the time of the junior doctor were also recorded for the analyses. Results indicated that the average cost of a face-to-face consultation and teleconsultation was £49 and £72 per patient, respectively. Telemedicine was therefore more expensive than conventional neurological care. Interestingly, telephone charges for ISDN calls cost a little more than a doctor's hourly rate (ISDN £29.40 per hour versus a consultant fee at £29 per hour). It is possible that the cost effectiveness analysis would be different if the communication charges were lower. This article does not mention any additional ways that costs could be lowered.

With regard to teledermatology, in a study conducted in Northern Ireland by Wootton et al. (2000), a comparison was done between teledermatology and outpatient dermatology in terms of clinical outcomes and cost effectiveness. Despite their similar clinical efficacies, the two interventions differed radically in terms of cost effectiveness. The net societal cost of the virtual consultation was \$132.10 (Irish pounds) and \$48.73 for face-to-face consultations. The authors asserted that this type of service delivery 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 traveling great distances to receive face-to-face consultations. Analysis of the data revealed that certain variables would serve to reduce the discrepancy in cost between these two modes of service delivery. Increased frequency of virtual consultations (to justify the capital cost of the equipment), depreciation of videoconferencing equipment costs over time, and increased patient distance from the dermatology clinic all serve to equalize the two conditions. The authors suggested that replacing the general practitioner (who was present with the patient in the videoconferencing room), with a nurse practitioner would also reduce the cost of virtual service delivery. The authors concluded that virtual dermatology has the potential to maintain care within the primary health sector in the vast majority of cases.

Persaud et al. (2005) examined the costs of providing teledermatology and telepsychiatry services in Nova Scotia from a societal perspective. 215 questionnaires were completed by

patients, 135 by specialists and eight by telehealth coordinators regarding the cost of service provision. Additional cost information was obtained from the Nova Scotia department of health office. Patient costs were found to be dramatically lower for videoconference based consultations (\$17-\$70 compared to \$240-\$1048). However, it was determined that from a societal perspective the cost of providing telehealth services was much more expensive, as the total societal costs of face-to-face service ranged from \$325-\$1133, whereas the total costs of telehealth services ranged from \$1736 to \$ 28,084. The authors attributed the high cost of telehealth service delivery to the comparatively high fixed costs associated with developing a telehealth infrastructure (buying and maintaining equipment). The authors identified a “threshold point” at which based on all associated fixed and variable costs, the two forms of service provision become equal. This threshold point was calculated to be 45 consultations, after which point telehealth services become cheaper than face-to-face services. The authors argued that in order for telehealth initiatives to justify their associated expense, they must operate beyond the identified threshold point.

Telehealth services have improved access to care for patients in rural areas, as well as the access of rural physicians to specialist consultations and diagnostic services. When comparing telehealth to face-to-face treatment, this study shows that if cheaper equipment was purchased, and the travelling distances were greater, teledermatology 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. Telehealth administration costs included the salaries for both telehealth site coordinators and regional coordinators, and the cost of running the Nova Scotia Department of Health Telehealth Office.

In the field of Psychology, cost analysis videoconferencing was examined in a study conducted in Hong Kong (Tang et al., 2001). It was assumed that the set-up and maintenance costs of the system were shared among various disciplines according to the proportion of time used. The cost per consultation was \$91.81 HKD and this included set-up and maintenance costs of the system and the charges of three ISDN lines divided by the number of consultations. The average cost of traveling to the home for the psychiatrist per consultation was calculated to be \$105.78 HKD and this included doctor costs and traveling costs.

An Australian pilot study conducted by Kennedy and Yellowlees (2000) examined the costs for providing specialist mental health services to the study area. The average cost per consultation was \$145 AUD for videoconferencing, \$162 AUD for a visiting private psychiatrist and \$326 AUD for the visiting public mental health team. A combination of videoconferencing and visiting private psychiatry services was estimated to cost \$307 AUD per consultation.

In a U.S study by Ruskin et al. (2004), the cost effect from the provider’s perspective was measured by estimating marginal costs of operating the telepsychiatry session compared to the in-person session. Costs were also measured by examining whether the telepsychiatry intervention increased or decreased total Veteran Health Administration health care consumption for these patients during this study period. The estimated marginal costs for the institution were \$86.16 USD for telepsychiatry and \$63.25 USD for face-to-face treatment. The cost for telepsychiatry was therefore higher than in-person therapy. When the cost of the psychiatrist’s

travel time was factored in, the cost of remote treatment was equal to that of in-person treatment only if the psychiatrist had to travel more than 22 miles from the medical centre to the clinic.

In a Canadian study, Elford et al. (2001) conducted a cost analysis in Newfoundland and looked at the cost of transportation, food and accommodation. Parents were asked to estimate their costs of traveling. However, since this estimate does not take into account any other costs such as loss of income from missing work, costs for baby-sitting and any incidentals, it is most likely that this total travel cost is an under estimation. The costs for telepsychiatry (equipment and personnel cost) was also analyzed and for the three-month pilot, the estimated cost (\$419 CDN) was slightly lower than the costs for traveling to see a psychiatrist in-person (\$428 CDN).

However, even though these calculations revealed that telepsychiatry was slightly less expensive than traveling, 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 for telepsychiatry 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. Moreover, further analysis revealed that telepsychiatry was in fact the less expensive option for only nine of the parents and these nine travel costs had skewed the average cost to travel for everyone.

Overall, Elford et al. (2001) 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. Another important factor to examine is the billing of telepsychiatric services. When conducting a cost analysis, it is important to know who will pay the travel costs and who will benefit economically if the patient uses telemedicine. Responses from this study indicated that most parents felt that the government should pay for telepsychiatry. If the government started to reimburse telepsychiatry costs for all individuals, then it would pay more overall than it currently does. Findings revealed a possible second barrier to the government paying for telehealth services in Canada. According to the authors, the department or organization that pays to set up and operate a telehealth system (e.g. the regional health authority) is usually not the same one that reimburses patients' travel costs (e.g. social services department). Consequently the initial department that invests in the money is often not the same one that would save money.

In a Canadian study conducted by Simpson et al. (2001b), the cost of telepsychiatry and the cost for traveling to see a mental health specialist in Alberta were compared. It was estimated that the cost for telepsychiatry was \$30 CDN per consultation. This estimate includes the loss of work (estimated at a rate of \$20/hr) and travel time. On the other hand, the cost from the consumer's perspective for traveling to receive services in-person was estimated to be \$240. By these calculations, telepsychiatry offered a substantial financial advantage.

Simpson, Doze, Urness, Hailey and Jacobs (2001a) conducted a cost analysis of a telepsychiatry service in Alberta. The cost analysis analyzed the break-even point, the number of consultations per year at which the costs of the telepsychiatry service would be equal to services provided by a traveling psychiatrist. It was estimated that the break-even point was 348 consultations. Results from this study revealed that during routine use, the telepsychiatry service averaged 273

consultations per year. This would indicate that the costs for telepsychiatry services was greater than the costs for the services provided by a traveling psychiatrist. However, the telemedicine network was used frequently for administrative and clinical committee meetings. Increased usage of the service reduced the fixed costs attributable to telepsychiatry and the break-even point decreased to 224 consultations per year. When these meetings were factored into the cost analysis, it was estimated that the videoconferencing system was used 423 times per year, which is well above the break-even point.

Karlinsky (2000) discussed telepsychiatry and the problem of physician reimbursement in Canada. Telepsychiatry would seem to be an obvious and important way for increasing access to psychiatric services given the scarcity of these resources across Canada. This service would be particularly important for many underserved rural and remote communities in this country. There are however, many potential obstacles to the introduction of sustainable telepsychiatry programs. The author identified two major obstacles to this: physician reimbursement and high costs of telehealth technology. For instance, most health insurance plans have not addressed the way in which physicians are to be reimbursed for telehealth services. The high costs of telehealth technology have also been a barrier to implementation of telehealth programs. Due to high costs of technology, most telepsychiatry initiatives remain relatively small-scale pilot projects that are often located at universities or hospitals.

As the costs for technology decrease, the issue of physician reimbursement remains. Canadian psychiatrists are usually reimbursed on a fee-for-service basis. However, provincial fee-for-service health care insurance plans assume a face-to-face encounter with the patient, which is not the case for telepsychiatry. It appears that aside from Nova Scotia, there are no official fee schedules or policies regarding reimbursement that apply to telemedicine. Until standards and guidelines for physician reimbursement have been addressed, it is unlikely that telepsychiatry services will be widely implemented. Another problem related to telemedicine is the cost and availability of this service (Mitchell et al., 2003, Tang et al., 2001). Telemedicine equipment is not widely available yet and there is also less flexibility in rescheduling missed or cancelled appointments due to the limited times the videoconferencing room is available (Mitchell et al., 2003.)

When conducting a cost analysis, it is important to analyze who will benefit economically if a patient were to use telemedicine (Elford et al., 2001). The following are the cost analysis from the patient's and from the health provider's perspectives. Cost analysis from the patient's perspective showed that telemedicine is estimated to be less expensive than traveling to seek treatment in-person (Elford et al., 2001; Simpson et al., 2001b). Another factor to bear in mind when dealing with telemedicine is billing of such a service. Parents from the studies feel that the government should at least pay partially for the costs of telemedicine (Elford et al., 2001). This would increase medical costs for the government however, it has been postulated by several authors that such costs would be in the long run less expensive for the government because those in need of care would have received treatment earlier before problems became complicated and thus more expensive (Elford et al., 2001; Simpson et al., 2001b; Tang et al., 2001). The average cost per patient varies according to infrastructure costs, operating costs, cost of travel, usage levels and volume of patients (Elford et al., 2001). Infrastructure costs however, may decrease over time because the cost of equipment tends to decrease with the advancement of technology.

(When technological equipment becomes more widely available, the purchase price decreases.) (Bouchard et al., 2004; Karlinksy, 2000; Tang et al., 2001).

Four studies also examined costs from the provider's perspective (Kennedy & Yellowlees, 2000; Ruskin et al., 2004; Simpson et al., 2001a; Tang et al., 2001). Two of these studies estimated telepsychiatry to be less expensive than the traditional face-to-face encounter (Kennedy & Yellowlees, 2000; Tang et al., 2001). The other studies indicated that first calculations revealed that telepsychiatry was not as cost-effective as face-to-face consultations. However, when other factors were included in the analysis, costs for telepsychiatry were found to be cost-effective (Simpson et al., 2001a) or equal to an in-person encounter (Ruskin et al., 2004).

An interesting factor that Simpson et al. (2001a) noted was the fact that the videoconferencing system was frequently used for administrative and clinical committee meetings. This study brings to light an important aspect of how videoconferencing units are used, and usage frequencies of videoconferencing should be included in cost analysis (Hilty et al., 2004). In addition to that, it has been suggested that maintenance and setup costs for the videoconferencing system can be shared amongst disciplines according to the proportion of times used (Tang et al., 2001). Travel costs should be included in cost analysis. Ruskin et al. (2004) discovered that if the psychiatrist traveled more than 22 miles for in-person treatment, then the costs for telepsychiatry was equal to that of in-person treatment.

Tang et al. (2001) did note that there are hidden costs associated with telemedicine. Such hidden costs include: the cost of updating equipment, training staff, maintaining duplicate records, transmitting written copies of treatment encounters and acquiring space for the system. Cost analysis show that telepsychiatry is estimated to be less expensive than traveling to seek treatment in-person. However, studies have yet to record actual costs (Pesämaa et al., 2004). It is therefore hard to claim that telepsychiatry is less expensive than the traditional method.

Despite reports of successful applications, many projects in telepsychiatry have ended when the funding expired (Tang et al., 2001). Telepsychiatry needs the support of the health service, the government and ongoing funding in order to survive (Hilty et al., 2002; Leonard, 2004a; Tang et al., 2001).

Cost effectiveness

With regard to financial implications, studies have not been conducted to examine whether videoconferencing in clinical contexts are more cost-effective than videoconferencing in educational contexts.

Davis and McCracken (2002) conducted a pilot study of a videoconferencing continuing medical education program for rural physicians in Alberta and compared its feasibility, acceptability and cost implications with existing teleconferencing and regional conference programs. As discussed in the evidence companion, 95% of the participants felt that the videoconference format met their expectations and satisfaction, but most participants expressed a preference for the regional conference program. From a cost perspective videoconferencing was more expensive than teleconferencing (due to higher line charges). However, it was significantly cheaper than the

regional conference program due to savings (up to \$1000 per session), depending on the distances involved.

Allen et al. (2003) as reported in the evidenced companion found that videoconferencing was well accepted among rural providers and facilitated small group practice-based learning. While they concluded that videoconferencing has potential to bring benefits of small group practice based learning, they noted that cost was an important consideration. Their analysis found that the telecommunication cost per videoconference module was approximately \$1200 CDN.

Lynch et al. (2004) piloted the use of videoconference to deliver palliative care CME to rural physicians practicing just outside of Ottawa, Ontario. The details of the study were described in the evidenced companion associated with this report. The authors claim that a crude cost analysis (not described in the study) demonstrated that CME delivered via videoconference can be potentially less expensive than on-site education, especially if certain costs (capital equipment, depreciation and telecommunication surcharges) are borne by third party payers.

Krupinski, Lopez, Lyman, Barker, Weinstein (2004) conducted a study that explored reasons for attending or not attending continuing education programs delivered via videoconference through the Arizona Telemedicine Program (ATP). The details of the study were described in the evidenced companion associated with this report. In earlier research, the same authors (Barker, McNeill, Krupinski & Weinstein, 2000) measured the cost-effectiveness of delivering continuing medical education through the ATP and found that tele-education saved each health care professional approximately \$1544 per year compared to traditional continuing education based on 20 hours/professional/year.

Videoconferencing has proved to be cost beneficial to patients, as it means less time away from work, less money spent on accommodation, meals, gas, childcare, etc. Videoconferencing is also more economical to health care providers, and these savings increase as more patients use this service.

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Appendix A: Databases Searched and Keywords Used

Databases	Limits	Keywords
Medline	2000 - 2005	Video-conferencing Telemedicine Telehealth Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Emergency Medicine Teletrauma Telerehabilitation
Pubmed	2000 - 2005	Video-conferencing Telemedicine Telehealth Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Emergency Medicine Teletrauma Telerehabilitation
Psychinfo	2000 - 2005	Video-conferencing Telemedicine Telehealth Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Telepsychiatry

Databases	Limits	Keywords
Cinahl	2000 – 2005	Video-conferencing Telemedicine Telehealth Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Nursing Telenursing Emergency Medicine Teletrauma
Lexis-Nexis	2000 - 2005	Video-conferencing Telemedicine Telehealth Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Emergency Medicine Teletrauma
IPA	2000 - 2005	Video-conferencing Telemedicine Telehealth Telepharmacy Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Pharmac\$ and videoconf\$

Databases	Limits	Keywords
Embase	2000 - 2005	Video-conferencing Telemedicine Telehealth Telepharmacy Telecommunication Remote consultation Delivery of healthcare Continuing Medical Education Professional Education First Nations Aboriginal Native Rural / remote Pharmac\$ and videoconf\$

Appendix B: Bibliography

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Appendix C: Grey Literature (URLs)

1. Canadian Society of Telehealth – Canadian eHealth Initiatives Database
<http://209.217.71.106/cgi-bin/starfinder/0?path=hihinit.txt&id=webber&pass=ANON&OK>
 - Keyword: ‘Videoconferencing’
2. BC Cancer Agency Videoconferencing Network
<http://209.217.71.106/cgi-bin/starfinder/15189/hihinit.txt>
3. North Network Program (Ontario)
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-north/north_intro_e.html
4. VideoCare [formally known as Southwestern Ontario Telehealth Network (SWOT-N) project]
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-swontario-telehealth/synopsis/index_e.html
5. Project Outreach (Ontario)
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-swontario-telehealth/synopsis/index_e.html
6. BC Telehealth Program
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-bcb-telehealth/index_e.html
7. BC NurseLine
http://www.findarticles.com/p/articles/mi_qa3916/is_200404/ai_n9380595#continue
8. Mental Health Evaluation Project

http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-bcb-yk-telehealth-mheccu/synopsis/index_e.html
9. Literature Review and Environmental Scan of Preferred Practices for Deployment of Health Human Resources and Decision Support Tools: Final Report

http://www.hc-sc.gc.ca/hcs-sss/pubs/care-soins/2004-hhr-rhs-tools-outils/2_e.html
10. Seniors and VC - From Ageing to Ageing Well

http://www.hc-sc.gc.ca/dhp-mps/prodpharma/activit/bulletin/tpd_dpt_bulletin05_2004_e.html

11. MBTelehealth Network (Manitoba & Winnipeg)
http://www.mbtelehealth.ca/services_clinical.php
12. Telemental Health in Canada: A Status Report
http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2004-tele-mental/index_e.html#annex1
13. Using Internet Video Technology to Improve Health Care Delivery to the Deaf and Non-Verbal Population in Canada
http://www.unb.ca/biomed/rvi/rvi_report_web.pdf
14. The Physical Rehab Distance Communication Initiative
<http://www.rehab.on.ca/telehealth/index.html>
15. Telehealth Saskatchewan Network
http://www.health.gov.sk.ca/ps_telehealth.html
16. BC/Yukon Telehealth Final Project Report
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-bcb-yk-telehealth-mheccu/mheccu_summary_e.html
17. Prescription & Assessment of Technical Aids Using Internet Video
<http://209.217.71.106/cgi-bin/starfinder/3816/hihinit.txt>
18. Yukon Telehealth Network (YTN)
<http://www.hss.gov.yk.ca/prog/cn/telehealth.html>
19. Information and Communication Technologies and Continuing Health Professional Education in Canada: A Survey of Providers
http://www.hc-sc.gc.ca/hcs-sss/pubs/kdec/nf_intic/nf_intic1_e.html
20. Surgical Support Network
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2004-surg-support-network/intro_f.html
21. Feasibility study of multidisciplinary oncology rounds by videoconference for surgeons in remote locales
<http://www.biomedcentral.com/1472-6947/3/7>
22. River Valley Health (NB)
<http://www.rivervalleyhealth.nb.ca/english/progserv/telehealth.htm>

23. Alberta First Nations Telehealth Program
http://www.hc-sc.gc.ca/fnih-spni/services/ehealth-esante/tele/ab_e.html
24. IIU Telehealth Network
http://www.findarticles.com/p/articles/mi_m0LVZ/is_12_18/ai_106028062
25. First Nations Health Care in Transition: The Alberta Story – Finding new ways to improve client health
http://www.hc-sc.gc.ca/fnih-spni/services/ehealth-esante/alta_clients_e.html
26. First Nations Health Care in Transition: The Alberta Story - Focus on the health professional
http://www.hc-sc.gc.ca/fnih-spni/services/ehealth-esante/alta_prof_e.html
27. First Nations Health Care in Transition: The Alberta Story - Overcoming the challenges of distance
http://www.hc-sc.gc.ca/fnih-spni/services/ehealth-esante/alta_distance_e.html
28. Interactive Video Specialty Consultations in Long-Term Care
<http://www.blackwellpublishing.com/abstract.asp?aid=21&iid=5&ref=0002-8614&vid=52>
29. BC/Yukon Telehealth Final Project Report
http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-bcb-yk-telehealth-mheccu/mheccu_summary_e.html
30. WestNet Tele-Ophthalmology
http://www.hc-sc.gc.ca/hcs-sss/pubs/kdec/ab_alliance/ab_alliance1_e.html
31. Personal Information Privacy Assessment of CHIPP Projects
http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2003-priv-chippics/index_e.html

32. Evaluating Telehealth 'Solutions'. A Review and Synthesis of the Telehealth Evaluation Literature

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-tele-eval/index_e.html

33. Mental Health Evaluation Project – ended - Policy and Research Implications

http://www.hc-sc.gc.ca/hcs-sss/pubs/chipp-ppics/2003-bcb-yk-telehealth-mheccu/synopsis/index_e.html

34. Policy Implications for Geography and Scope of Services for Telehealth

http://www.hc-sc.gc.ca/hcs-sss/pubs/kdec/on_geograph/on_geograph1_e.html

35. Telehealth and Electronic Health Record - A Guide to Sustainability

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2002-tele-sustain-viab/index_e.html

36. Framework for Remote and Rural Readiness in Telehealth

http://www.hc-sc.gc.ca/hcs-sss/pubs/kdec/ab_alliance/ab_alliance1_e.html

37. Investing in Telehealth

http://www.gov.bc.ca/bvprd/bc/content.do?brwId=%402NyRf%7C0YQtuW&navId=NAV_ID_premier&crumb=B.C.+Home*Health&crumburl=%2Fhome.do*%2Fchannel.do%3Faction%3Dministry%26channelID%3D-8387

38. How Canadian eHealth Initiatives are Changing the Face of Healthcare: Success

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2002-succes/index_e.html

39. Telehealth

http://www.hc-sc.gc.ca/fnih-spni/services/ehealth-esante/tele/index_e.html

40. eHealth Resources

http://www.hc-sc.gc.ca/hcs-sss/ehealth-esante/res/thesaurus/index_e.html

41. Assessment of Videoconferencing in Telehealth in Canada

http://www.ccohta.ca/publications/pdf/104_telehealth_tr_e.pdf

42. Health Canada - Reports & Publications – eHealth

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/index_e.html

eHealth - Reports

Canada E-Health 2000: From Vision to Action -

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2001-econf/index_e.html

Tactical Plan for a pan-Canadian Health Infostructure: 2001 Update

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2001-plan-tact/index_e.html

Evaluating Telehealth Solutions: A Review and Synthesis of the Telehealth Evaluation Literature

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-tele-eval/index_e.html

Information and Communication Technologies for Better Health Canada

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-hisp-psis/index_e.html

eHealth - Articles

Lessons from the Past: How other disruptive technologies became mainstream

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2002-lesson-lecon-pass/index_e.html

Public Speaking: How Canadians View the Roles of ICTs in the Health Sector

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2002-publi-opin-speak/index_e.html

Sharing the Wealth for Better Health: The case for broader exchange of information about the use of ICTs in health

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2002-sharing-partager/index_e.html

Canada E-Health 2000: From Vision to Action

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2001-econf/index_e.html

Integrated Provider Solutions: Unleashing the Power of Technology for Canada's Health Care Providers

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2001-provide-fournis-integr/index_e.html

Providing the Public with Reliable Health Information: A Key Priority for Health Canada

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2001-provide-fournir-public/index_e.html

An Agenda for the Future: A National Electronic Health Records System

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-future-avenir-ehr-dse/index_e.html

The Canada Health Infoway: A Vital Link to the Future

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-chi-ics-link-lien/index_e.html

The Canadian Health Infostructure (CHI): A Vital Link to the Future

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-chi-ics-link-lien2/index_e.html

Health Care of the Future: Vision 2020 Leads the Way, Part I

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-care-soins-part1/index_e.html

Health Care of the Future: Vision 2020 Leads the Way, Part II

http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/2000-care-soins-part2/index_e.html

eHealth - Bulletins

eHealth InfoSource Cybersanté [2003-]

Volume 2 Number 10, April 2005

http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/2-10_e.pdf

Volume 1 Number 8, January - February 2004

http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/1-8_e.pdf

Volume 1 Number 6, November 2003

http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/1-6_e.pdf

Volume 1 Number 4, September 2003

http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/1-4_e.pdf

Volume 1 Number 3, July - August 2003

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Volume 1 Number 2, June 2003 http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/1-2_e.pdf

http://www.hc-sc.gc.ca/hcs-sss/alt_formats/iacb-dgiac/pdf/pubs/2001-ehealth-esante-bulletin/1-2_e.pdf

43. Nova Scotia Telehealth Canada

<http://www.gov.ns.ca/health/telehealth/links.htm#Telehealth%20Initiatives%20-%20Canada>

44. Videoconferencing Technology Saves Time and Money

http://www.bcpublicservice.ca/innovation/case_studies/cs_video_conference.htm

45. Telemedicine Research Center

<http://trc.telemed.org/about/background.asp>