Appendix A: Literature Review

A literature search using select key words (e.g., telehealth, videoconferencing, telemedicine utilization) was conducted in early July 2012 through Cochrane Database of Systematic Reviews, DARE (Database of Abstracts of Reviews of Effectiveness, MEDLINE and Google Scholar along with the retrieval other relevant articles and web sites from article reference citations. There were also inquiries and correspondences received from two Canadian telehealth experts, Dr. Marie-Pierre Gagnon of Laval University and Dr. Penny Jennett from the University of Calgary. Attempts to correspond with some Australian researchers (Dr. RJ Cohn and Dr. B Goodenough) have been unsuccessful to date.

There is very little published literature on videoconferencing (VC) as a telemedicine technology that can be generalized to a wide range of health care practitioners, areas of practice and settings. There are also a wide range of definitions and concepts such as:

**Telemedicine** refers to any medical service provided at a distance via electronic communication (Gagnon et al, 2003) or the delivery of health care and exchange of health care information over distances (Craig and Patterson, 2005). This can include diagnosis, treatment and prevention of disease, continuing education of health care providers and consumers, and research and evaluation (Craig and Patterson, 2005). It is also rapid access to shared and remote medical expertise by means of telecommunications and information technologies, no matter where the patient or the relevant information is located (Craig and Patterson, 2005).

**Telehealth** is used to manage patient care remotely or in patients’ homes and includes care over the phone, using videoconference and remote monitoring of signs and symptoms (Wallis, 2012) or the use of information and communications technology (ICT) to deliver health services, expertise and information over distance, geographic, time, social and cultural barriers (Muttitt et al, 2004). **Telehealth** also refers to public health services delivered at a distance to people who are not necessarily unwell but who wish to remain well and independent (Craig and Patterson, 2005).

**Telecare** is a way to monitor safety in the home of vulnerable client groups (Wallis, 2012) and the provision of care at a distance (Craig and Patterson, 2005).

**Telehealth readiness** is the degree to which communities, organizations and professionals are prepared to participate and succeed in telehealth (Gagnon et al, 2006).

**Information and communication technologies** (ICTs) are technologies to help gather, store, process and share information electronically (Gagnon et al, 2009). ICTs include electronic medical records, medical journals and databases on the internet, videoconferencing for provider/patient appointments, or systems on the internet to give feedback to providers so
they can improve the care they provide. ICTs also include informational websites, e-consultations, online communities, online health decision support programs, tailored online health education programs, online health care portals, virtual reality programs, home automation, sensor technology, and robotics.

_Digital interactive television systems_ (DITV) can facilitate communication of information to or from an individual’s home with a health or social care application (Blackburn et al, 2011). Some potential barriers include technology abandonment by people with physical, sensory or cognitive impairments. There can also be infrastructure and costs associated with transmission speeds in some communities. Input control and user interface should be suitable for the intended users, particularly if targeted to the aging population, living independently at home. There is a need to assess clinical and cost-effectiveness.

_ Internet-based Group Support Systems (GSS)_ cover a wide range of application functionalities including systems supporting collaborative authoring, creative group processes, data gathering, statistical evaluation, etc. Examples include white boards, application sharing, shared web browsing, voice over Internet Protocol (IP) and video over IP (Moehr et al, 2005). There may have some telehealth applications e.g., educational but likely insufficient to demonstrate intricate processes such as insertion of central lines or to judge the dexterity, gait or the emotional status of an individual. However, Skype is now being considered as an option since the software is free and most patients have the necessary equipment (personal computers) (Good et al, 2012). Skype uses encryption, cryptography, a digital certificate and authentication to maintain security and prevent data theft. It has been used to accurately perform functional assessments in outpatient follow-up visits for displaced clavicle fractures.

_eHealth_ is promoting the health and wellbeing of individuals, families and communities, and improving professional practice through the use of ICT (van Gemert-Pijnen, 2011; Wallis, 2012;). It can be used to connect providers, patients and governments; to educate and inform health care professionals, managers, and consumers; to stimulate innovation in care delivery and health system management; and to improve the health care system (van Gemert-Pijnen, 2011).

_Health informatics_ is about the practice and science of information, information processing, and information systems in support of patient care (Ellaway, 2010). _eHealth_ (also known as Health Informatics) is defined as ‘the knowledge, skills and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and to promote health’ (RNAO, 2012). Nurse training and continuing education on the topic is available via a toolkit and N e-Health online education program (RNAO, 2012); a number of undergraduate and graduate courses (RNAO, 2012) and through the British Royal College of Nurses (RCN) Learning Zone which has web-based resources e.g.; telehealth explained; eHealth Insider online
news and information service with updates on eHealth education and training opportunities (member access only) (RCN, 2012).

**Benefits and Limitations**

Numerous benefits have been cited for telehealth/telemedicine use (Walker and Whetton, 2002; Jennett et al, 2003; Hebert et al, 2004; Craig and Patterson, 2005; Gagnon et al, 2006; Jarvis-Selinger et al, 2008) including:

- better access, equity, quality and availability to specialized services as well as more complete health care services in remote areas;
- increased access to health services, cost effectiveness (in mainly radiology and mental health), enhanced educational opportunities, improved health outcomes, better quality of care, better quality of life and enhanced social support;
- early intervention, reduced unnecessary use of health services, and help to manage symptoms at home;
- improved continuity of care, increased availability of information, facilitating case management;
- facilitating continuing medical education (CME), contacts with peers and access to a second opinion, exchanges between professionals from various sites and specialties;
- supporting development of regional reference centres to provide a wide range of services to remote populations; retention of local expertise; and cost savings e.g. avoid transfers, travel costs for patients, families; and
- facilitating quality of service by treating patients both rapidly and appropriately with good inter-rater reliability between remote and face to face settings; reducing patient transfers and maintaining care within home community.

Some perceived limitations could be the replacement of onsite human resources; lower recruit and retention to remote areas; and reduced CME outside the region that would allow opportunities to socialize with colleagues (Gagnon et al, 2006). There is also need for more indicators of the social-economic impacts e.g. health status, health outcomes, practice patterns, patient management, health system resources as well as other organizational, social and ethical implications and potential risks (Jennett, 2003). Most studies and reviews focus on general aspects of telemedicine (feasibility, outcomes, economics and satisfaction); economic viability has not been adequately addressed (Bahaadinbeigy et al, 2010).

Various forms of telemedicine are feasible (including VC) with positive patient satisfaction but there is not yet enough evidence to show the effects on health outcomes or costs (Currell et al, 2010). VC modes well to the demonstration of procedures and devices (e.g. communication devices) as experimental learning sessions for teams and groups (Moehr et al, 2005). It has also
been used for in-person meetings and job interviews in British Columbia (BC) (Moehr et al, 2005). There is reported value in VC use by professionals, especially in education and training, and psychosocial applications (Cohn and Goodenough, 2002). More recently, evidence indicates that clinical outcomes are similar between in-person and VC-delivery modes and that patient satisfaction is increasing (Steel et al, 2011). It should be noted that the majority of literature is from the field of telepsychiatry and there is a gap concerning telerehabilitation for physical conditions (Steel et al, 2011).

A BC evaluation did find that clinical applications of VC were more difficult but can be highly beneficial when they involve patient management of chronic conditions with established teams separated by distance, especially if scheduled regularly or well in advance and when case management depends on visual information (Moehr et al, 2005). Educational applications are highly appreciated by practitioners and patients, families, communities with likely unrealized clinical effects. Key is the interactivity and demonstration potential of the educational sessions. Administrative applications can lead to efficiencies that alleviate the financial burden of other applications e.g. clinical and educational.

Despite a number of limitations, a meta-analysis found VC more efficacious than other technologies (web-based interventions, data monitors only, video and data monitors, and telephone only interventions) for three diseases—heart disease, diabetes and psychiatric conditions with positive mild to moderate affects on clinical outcomes (DelliFraine and Dansky, 2008). VC may be useful for conditions that require close monitoring, clinical assessment and early intervention to avoid hospitalization or emergency visits and has the potential to decrease health care costs but cost effectiveness research is limited (DelliFraine and Dansky, 2008).

Overall e-health tools may facilitate self-management and empower patients and professional skills in communication, education and health literacy, information about personal health situations, self-care and support, decision-making and contact with fellow patients (Alpay et al, 2011). But technologies can't help facilitate self-monitoring and self-management or improve patient health outcomes when patients do not accept the technology (Or et al, 2009).

**Knowledge, Attitudes and Uptake**

Integrating VC use into practice requires reliable IT infrastructure, effective clinical demonstrations, assessment of practitioners’ readiness, integration of IT into workflow, change management practices, just-in-time IT support, policy synchronization, and quality assurance of services (Jarvis-Selinger et al, 2008). Other key lessons include organizational readiness and system adoption including protocols to ensure 24/7 preparedness; comprehensive change management; and a user training plan to ensure comfort, competence and readiness to use.
equipment. To be successful, there needs to be activity with large enough workloads to maintain the skills and confidence levels of users.

The technological conditions to operate a clinical videoconferencing service include (Moehr et al, 2005; Jarvis-Selinger et al, 2008):
- basic technological requirements (medium/high bandwidth for adequate audio and visual clarity);
- need to monitor placement and room setup;
- technological compatibility between remote and central sites (interfacing computers and appropriate application software); and
- ongoing technical support.

There may also be key differences in attitudes and communication practices of practitioners and so design, implementation and evaluation of interventions to promote optimal uptake and utilization of VC may need to be targeted by discipline and/or practice setting (Cohn and Goodenough, 2002; Gagnon et al, 2006). Users may be prepared to learn to use a new technology if they perceive that the system is critical to their job performance or quality of service. Rural and remote site users seem more willing to participate in training and be more tolerant of technical difficulties (Walker and Whetton, 2002). Practitioners must recognize that different clinical and communication skills, and information giving approaches may significantly alter the nature of the clinical encounter by VC and also the relationship between the practitioner and patient (Currell et al, 2010).

The degree of success in uptake is associated with factors related to the degree of need for the service and local health service structure as well as ‘people’ factors-acceptance by clients, practitioners and operators (Hailey, 2001). Teleradiology has been well integrated and a majority of teleconsultations are performed in mental health, pediatrics, dermatology, cardiology and orthopediatrics, often with interactive video (Craig and Patterson, 2005). Along with ethical and medicolegal concerns, human and cultural factors include resistance to change, linguistic differences and illiteracy (Craig and Patterson, 2005).

There is a need for increased knowledge in the design, implementation and evaluation of interventions aimed at promoting the optimal integration of ICT in all groups of healthcare professionals’ practice (Gagnon et al, 2009). Identifying the key individual, professional, organizational, and systemic factors would help design more specific and tailored interventions.

Telehealth readiness should be first assessed with the target audience(s) and individualized; this process could include the use of readiness and knowledge assessment surveys or ideally with focus groups and/or key informant interviews (M-P. Gagnon and P. Jennett, personal communication, July 19, 2012). A number of surveys have been designed for a variety of
practitioners including nursing (RNAO, 2012), physicians (Gagnon, 2003), and pediatric health care providers (Cohn and Goodenough, 2002) using various theories e.g. Triandis Theory of Interpersonal Behaviour (Gagnon, 2003) or models such as the technology acceptance model (M-P. Gagnon, personal communication). Whatever tool is used needs to be adapted to the specific topic and that will require interviews or focus groups in order to uncover the beliefs regarding the use of videoconferencing in your target population (M-P. Gagnon, personal communication).

Another approach to assessing telehealth readiness is the following strategies (P. Jennett, personal communication):

1) For those who are not familiar or slightly familiar with e-Health and telehealth, first use community show cases to demonstrate and use those types of e-technologies. Then follow these show cases with focus groups to determine their perceptions and readiness of these types of technologies and how they might assist them with their health or educational needs. The "communities" help design the focus groups and some aspects of the focus groups.

2) For those who had used the technologies in their practices, use focus groups for small identified groups, and then surveys for larger groups. The surveys need to be designed by experts and users in the fields with pre and post-testing.

3) For special types of users- administrators/organizers, health users, and patients, use key informant interviews which are designed based on the input of experts and key informants.

There needs to be a better fit between technological, human and contextual factors to improve uptake and impact of e-Health technologies (Or et al, 2009; van Gemert-Pijnen et al, 2011). Mixed methods of using both quantitative and qualitative designs should be used in order to better measure uptake and impact of e-Health technologies (van Gemert-Pijnen et al, 2011). The needs of patient end-users (physical, psychological, social) also must be adequately addressed (Or et al, 2009).

There is some evidence that individual or group training or providing training materials may improve the adoption/use of ICTs but it is not unknown if some of these strategies are effective in general clinical performance or process outcomes (e.g. decision to prescribe a particular drug/treatment), patient health outcomes, along with health professionals’ knowledge, attitudes or satisfaction (Gagnon et al, 2009). Small effects with use of electronic databases and digital libraries has been documented but not around videoconferencing. Yet telemedicine attributes (feasibility, acceptability, cost, effectiveness, safety, sustainability) will vary from application to application and publication requirements of tightly controlled systematic reviews could limit clinical relevance and uptake into practice (Craig and Patterson, 2005). While many studies are excluded in systematic reviews because of their non-experimental design, there is
likely a general lack of research in the area of healthcare education due to lack of funding or little interest in this research field. More well designed trials are needed (Gagnon, 2009; van Gemert-Pijnen et al, 2011).

**Conclusions**

There is very little published literature on VC as a telemedicine technology that can be generalized to a wide range of health care practitioners, areas of practice and settings. There are also a wide range of definitions and concepts and so a consensus is needed before designing and implementing a process to measure VC telepractice competency of Health Science clinical teachers and learners.

While there are numerous benefits cited on VC applications in health care, there may also be key differences in attitudes and communication practices of health practitioners and so the design, implementation and evaluation of interventions to promote optimal uptake and utilization of VC use should be targeted by discipline and/or practice setting. Also the receptiveness by patient users should be known. There is also the need to determine the need and receptiveness of VC use in educational and administrative purposes.

Telehealth readiness should be first assessed with the target audience(s) and individualized; this process can be complex, as well as time and resource intensive. Therefore, it has been proposed that a broad approach be taken to assess the VC telepractice competencies of Health Science clinical teachers and learners starting with the validation of an analytical framework to determine the degree of readiness and potential next steps.

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