Factors Affecting Interprofessional Collaboration When Communicating through the Use of Information and Communication Technologies: A Literature Review

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Abstract

Background: Information and communication technologies (ICTs) are increasingly being used internationally as a cost-effective and efficient way to provide care for patients in rural and remote settings, often referred to as telemedicine. There have been various studies that have examined the effectiveness of telemedicine implementation on patient outcomes, and the factors that enable successful telemedicine program implementation. The purpose of this narrative literature review was to explore a different side of the issue, with the objective of examining the factors that affect interprofessional collaboration when communicating through the use of ICTs in telemedicine settings.

Methods and Findings: A total of 56 papers were included in this review. Using a narrative review design, analysis of the papers revealed several factors that act as facilitators and barriers to interprofessional collaboration when communicating through the use of ICTs. Facilitators included training and planning; ICT system supports; establishing good rapport and communication patterns; patient-centredness; willingness to adapt to and accept the technology; and key individuals providing leadership and administrative support. Barriers included technical issues; coordination and organizational challenges; and problematic relationships. From the facilitators and barriers, recommendations have been compiled for stakeholders involved in telemedicine initiatives to consider on how to support interprofessional collaboration in telemedicine.

Keywords: Telemedicine; Interprofessional; Communication; Collaboration; Literature review

Introduction

For the last two decades, the use of information and communication technologies (ICTs) to provide healthcare at a distance, also referred to as telemedicine, has increasingly been used across the world as a cost-effective and highly useful way to improve access to care and promote communication among healthcare teams [1]. The emergence of telemedicine applications has created opportunities for at-home or close-to-home monitoring and treatment follow-up for patients [2]. In addition, interprofessional teams can now

work together via telecommunications when not co-located, providing patient-centred care in situations that previously would have been difficult.

Telemedicine, although a promising delivery of care method, does not always live up to its expectations. Despite the many known benefits and genuine need for telemedicine programs, it seems there are many barriers to successful telemedicine programs, and difficulties in implementation have resulted in projects often failing to meet expectations [3]. In fact, the European Union has found that implementing telemedicine strategies around the world has "proven to be much more complex and time-consuming than initially anticipated" [4] (p. 357).

Interprofessional teams are increasingly communicating through the use of ICTs as an innovative opportunity to improve patient access to more convenient and coordinated care. Therefore, research is urgently needed to advance our understanding of interprofessional practice related to telemedicine interventions, particularly given the opportunities to improve access to community-based primary healthcare services for those in remote, rural, and underserviced areas.

After a brief review of the literature, it was found that relatively few studies have focused on interprofessional collaboration surrounding telemedicine initiatives. Most studies to date have focused on frequency of usage, feasibility assessment, technological matters, clinical outcomes, diagnostic accuracy, and the economic impact of telemedicine programs. Although there have been reviews that come close to addressing this topic [4-15], there is a deficiency of a current review that is primarily focused on the interprofessional team and how working relationships are altered when communicating through the use of information and communication technologies. Since the definition of interprofessional collaboration in healthcare includes patients as an important member of the team [16], factors related to communicating with patients through ICTs have been included in this review.

Many questions remain related to the factors that help or hinder providing care as an interprofessional healthcare team when communicating through the use of ICTs. It was, therefore, the aim of this study to compile information regarding the facilitators and barriers to effective collaboration within interprofessional teams when communicating through ICTs. This literature review aims to address the following research question: what are the known factors that act as facilitators or barriers to interprofessional collaboration when communicating through the use of ICTs?

Methods

Design and search methods

This study used a narrative review design to explore the facilitators and barriers for effective interprofessional collaboration. The authors chose a narrative review design, as we were interested in a broad review of the topic, inclusive of all methods. This encompasses both quantitative and qualitative studies for two reasons: first, there is important information in both bodies of literature; and second, there is limited research on this topic and thus the authors wanted to be as inclusive as possible. Searches were conducted from July to October of 2014 across the following seven databases: the Cumulative Index to Nursing and Allied Health Literature

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(CINAHL), the Excerpta Medica dataBASE (EMBASE), Google Scholar, PubMed, Science Direct, TRIP, and the Cochrane Library database. Search strategies were designed in consultation with a research librarian. The searches were conducted using Boolean searching techniques and combinations of the following commonly used terms and their derivatives: telemedicine, telehealth, e-health, mHealth, interprofessional, interdisciplinary, multidisciplinary, team, collaboration, communication, relations, health professionals, facilitator, enabler, barrier, and challenges. Additional literature was located by examining citations of the retrieved literature.

Inclusion criteria

This literature review includes reports of primary qualitative, quantitative, and mixed-method studies published in peer-reviewed journals. Primary studies included in this review were required to include all of the following criteria: have a focus on ICTs in healthcare and interprofessional collaboration; include an examination of interprofessional practice in a clinical environment; be unrelated to interprofessional learning, education, or research; and be published in English after the year 1995.

Due to the limited number of studies on telemedicine and interprofessional collaboration, all research designs were included. Initially, 2,593 articles were found using our search strategy. Of these, 1,384 articles were further examined for potential inclusion based on their title and abstract. The first author and the individual mentioned in the Acknowledgements section, Elaine Loney, did the data extraction. The results of each study were examined, and data was extracted if it was determined to be applicable to our review. Any disagreements were discussed and a consensus was reached on whether or not the results were suitable. This yielded 137 articles that were included in the final pool for full review, of which a total of 56 articles met the inclusion criteria and were included in this review. The literature search process is shown in Figure 1.

Initial Search Yield	PubMed: 1492	CINAHL: 41	Cochrane: 6	Embase: 111	Google Scholar: 870	Science Direct: 38	TRIP: 35
Retrieved	2593 articles						
Initial title and abstract review	1384						
Excluded based on review titles & abstracts	− 1247						
Articles retrieved for full review	137						
Did not meet inclusion criteria	− 81						
Final articles included in this review	56						

Figure 1. Literature search process

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Data extraction

Data extraction and selection was done by the first author, and then by the individual mentioned in the acknowledgements section, Elaine Loney. Early in the process, an attempt was made at extracting data and relating findings pertaining to apparent barriers and facilitators to specific behaviours for each competency—team functioning, role clarification, patient/client/community-centred care, collaborative leadership, interprofessional communication, and interprofessional conflict resolution—as specified in the Canadian Interprofessional Health Collaborative (CIHC) National Interprofessional Competency Framework [16]. This approach was abandoned because it was forced and deductive, and was leading to information being missed because the specific behaviours did not seem to capture the range of findings present in the literature. Finally, data were extracted by reviewing results of each study and determining how they were applicable to our review. The few disagreements we had were discussed over the phone and a consensus was reached on whether or not both parties agreed the paper was suitable for this study. No checklist was used to assess the quality of data extraction.

Results

After examining the 56 studies included in this review, many factors were found to affect interprofessional collaboration when communicating through the use of ICTs. After analysis and the comparison of findings in the literature, results were stratified as either a facilitator or a barrier to interprofessional collaboration, which is summarized in Table 1.

Table 1. Factors affecting interprofessional collaboration when communicating through the use of ICTs

Facilitators	Barriers
1. Training and Planning a) ICT training b) Patient suitability c) System reorganization d) Setting out ground rules, roles, and responsibilities 2. ICT System Supports a) High quality technology b) Design and usability c) IT support team 3. Establishing Good Rapport and Communication Patterns a) Initial face-to-face meeting b) Adhering to camera etiquette c) Relationship building and increased trust	1. Technical Issues a) Poor media quality and perceptual difficulties b) Privacy and safety concerns 2. Coordination and Organizational Challenges a) Fragmented work processes b) Ambiguous responsibilities and resistance to shifting roles c) Time investment and increased workload d) Coordination demands e) Staff retention and recruitment f) Medicolegal concerns 3. Problematic Relationships a) Tension and mistrust in professional relationships b) Threats to therapeutic relationship

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Table 1. (continued)

Facilitators	Barriers

4. Patient-Centredness
  a) Triangular relationships
  b) Presence of a second clinical eye
  c) Supports maximized
  d) Continuity of care
 	
5. Willingness to Adapt to and Accept the Technology
  a) Willingness to adapt work processes
  b) Perceived relative advantage
 	
6. Key Individuals Providing Leadership and
   Administrative Support
  a) Champion
  b) Ownership
  c) Coordinator	

Facilitators of interprofessional collaboration

Several factors were discovered to facilitate interprofessional interactions when using telemedicine as a mode of service delivery. Themes included:

1. Training and planning;
2. ICT system supports;
3. Establishing good rapport and communication patterns;
4. Patient-centredness;
5. Willingness to adapt to and accept the technology; and
6. Key individuals providing leadership and administrative support.

Training and planning

Training and planning were cited by many studies as crucial to the overall success of telemedicine programs. This theme includes key factors that are imperative to consider in the initial stages of telemedicine program implementation, such as training for ICT users, determining patient suitability, reorganization of the current system as necessary, and defining ground rules, roles, and responsibilities when operating through ICTs.

a) ICT training

Health professionals and, to some extent patients, involved in telemedicine programs are required to learn how to operate ICT equipment and develop the skills necessary to ensure telemedicine appointments run smoothly from a technological standpoint. Preparing patients through basic ICT training exercises addressing telemedicine nuances, as well as experience with videoconference technology, has been found to increase patient feelings of comfort with the technology and strengthen the link between patients and their providers [17,18]. To make effective use of resources, it

was found that both technological skills and confidence in using those skills are essential for health professionals delivering care through ICTs, underlining the importance of education and training for end-users of telemedicine systems [19]. The users themselves have expressed the need for more education and training before the implementation of information technology (IT)-based work systems [19]. Pre-implementation simulation-based training in the tele-ICU setting has also been found to be a facilitator to staff acceptance [20]. Consequently, adequate technology systems training and education, as well as training in communication, were thought to be essential steps in order to achieve collaborative and capable teams who connect through ICTs.

b) Patient suitability

Another consideration that was found to facilitate collaborative care delivered through ICTs was a concentration of efforts on those patients who would benefit most from a telemedicine intervention. For example, focusing telemedicine efforts specifically on patients with chronic conditions that required visual information for proper management contributed to the success of a Canadian telehealth program [21]. Day and Kerr [22] also underlined the importance of determining patient suitability for telemedicine interventions, and noted that this requires clinical skills and experience.

c) System reorganization

Implementing a new telemedicine program also requires the reorganization of current systems, putting new work procedures in place, and tweaking current practices. As an example, the long-term establishment and routine use of a teleconsultation program studied by Esterle and Mathieu-Fritz [23] required the reorganization of the initial system to promote teamwork, which consisted of: making the system more flexible for referrals; including teleconsultations in the time budgets of physicians and nursing staff; constructing a new teleconsultation room; establishing a telemedicine administrative assistant coordinator position; developing an electronic health record; and creating guidelines that outlined practical details for making appointments and explaining requests for an opinion, as well as how to prepare, inform, and obtain consent from patients [23]. Attention to such details and preparing for reorganization are necessary and can facilitate collaboration and acceptance by creating smooth transitions from old to new systems.

d) Setting out ground rules, roles, and responsibilities

Researchers such as Careau, Vincent, and Noreau [24] and Kuziemsky, Borycki, Purkis, Black, Boyle, Cloutier-Fisher, Fox, Mackenzie, Syme, Tschanz, Wainwright, Wong, and the Interprofessional Practices Team [25] discovered that teams must set out "ground rules" on how the technology is to be used in order for the program to run efficiently and be perceived as a useful means of collaborating within interprofessional teams. For instance, agreement on the usage frequency of telecommunication devices, such as emailing or videoconferencing, must be clear from the outset in order to avoid uncoordinated teams [25]. Additionally, Tremblay, Proulx, Vermette,

and Gaudreault [26], as well as Careau et al. [24], stated the importance of determining an appropriate team size for meetings, suggesting that an interprofessional team communicating through the use of ICTs should not be larger than a dozen people, in order to promote constructive communication. In a study of team cooperation by Bolle, Larsen, Hagen, and Gilbert [27], latency in transmission during simulated videoconference critical care scenarios required the development of new rules for communication, such as muting specialists' discussions so as not to disturb the remote team and agreeing on when to initiate consults.

Along with the establishment of basic ground rules for communication, the negotiation and definition of team members' roles and responsibilities before implementation [28], as well as the establishment of guidelines outlining duties and responsibilities [23], were important factors that influenced the implementation of telehealth collaborative care programs. Furthermore, the organization of telehealth clinics through policies and standards was an important step toward successful clinic appointments for those involved in a telehealth program, with attention to policies and standards resulting in both maximization of the patients' experiences, as well as the protection of the health professionals' time [29]. In a study of the professional struggles surrounding satellite and mobile dialysis units, the formalization of work procedures, geared to the new and non-traditional setting by nurses throughout design and implementation phases, was said to be pivotal to the project [30]. Agreement among teams on the above items regarding roles and responsibilities, as well as the establishment of guidelines for communication, were therefore found to be vital issues to be considered and delineated at the outset of telemedicine programs.

ICT system supports

Communicating through ICTs has become more and more common with the advancement of technology and the evolution of high-quality media and excellent resolution. Interprofessional teams that are not co-located and collaborate primarily through ICTs require ICT system supports, which include the design and development of a high-quality technology system; a system that is well-designed and user-friendly; as well as an IT support team available for troubleshooting.

a) High-quality technology

Factors related to high-quality technology were commonly cited necessities for efficient interprofessional communication through ICTs. When ICT systems allow for high-quality videoconferencing and image sharing, interprofessional collaboration, which includes collaboration with patients, can be enhanced through the increased sharing of information and more meaningful communication. For example, healthcare providers have noted that there must be consideration and planning for high-quality media, a sufficient view of participants' faces, and a wide-angle view of the room—permitting a view of all participants, a feeling of physical presence [24,31], as well as the ability to monitor for understanding [32]. Viewing the same image in real time during consultations, as well as having the capacity for remote pointing, were both found to be valuable facilitators for communication, as each reduced the verbal

strain of providing descriptions [32,33]. An additional facilitator was the use of electronic patient record technologies that included task notes, which was used in a program for patients with HIV receiving follow-up care through a telehealth collaborative care program [28]. A picture archiving and communication system in secondary care was found to have a very positive impact on physician-patient relationships because it allowed for easier sharing of images with patients (as well as other health professionals) than a system using images on film [34]. Shared visuals and system feedback (patients' ability to see themselves on screen) promoted communication and helped build relationships [17]. High-quality media that were able to convey words, gestures, body movements, facial expressions, and other visual data supported understanding, communication, and a sense of presence among participants in hospital-based telehealth programs [31]. Furthermore, allowing patients to hear and to see the face of remote consultants resulted in patients having more confidence in the consultation [32]. Interestingly, the quality of the video and audio was also found to impact the content of video calls between hospice teams, patients, and their families, where higher-quality images were associated with more time spent on general informal talk, psychosocial issues, and caregiver education [35].

b) System design and usability

ICT systems were commonly met with resistance when they were not felt to be user-friendly, or when the costs of operating the system in terms of time commitment outweighed the benefits. For example, Nicolini [36] noted that at an organizational level, if the amount of work to incorporate an innovation exceeds the perceived benefits, or if it conflicts with other aspects of practice, there will be a significant reduction in the level of use of the system. For these reasons, Nicolini stresses the need for close collaboration between designers and users, stating that the outcome of this process is paramount to the successful uptake of the innovation [36]. Wilson, Stevenson, and Cregan [31] reviewed four hospital-based broadband telehealth projects, and found that systems designed with a user-centric process that aimed to preserve team-based work practices provided a high level of both usability (requiring little mental effort) and task focus, as the system design was aimed directly to meet the needs of the team [31]. Similarly, a user-centred telecenter technology application was designed to be customizable, reflecting the semantics and workflow of each specific team's collaborative process, and there was no requirement for IT staff to operate or maintain the application [15].

On the subject of systems design, Murray, Burns, May, Finch, O'Donnell, Wallace, and Mair [34] used Normalization Process Theory (NPT) in their study of the difficulties in e-health implementation. Important factors to consider when implementing telemedicine included NPT concepts, such as interactional workability (the impact that a new technology has on interactions, particularly the interactions between health professionals and patients, i.e., consultations) and relational integration (the impact of the new technology on relations between different groups of professionals, and the degree to which it promotes trust, accountability, and responsibility in interprofessional relationships). ICT systems design that takes both

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concepts (interactional workability and relational integration) into consideration will more likely facilitate a collaborative and efficient telemedicine program. Moreover, technologies that are not understood by their users to have a positive impact on both consultations and interprofessional relationships are harder to embed and sustain in routine practice [34].

c) IT support team

Findings support the need for telemedicine teams to see the addition of less traditional roles, which are crucial to the successful implementation and maintenance of interprofessional communication through ICTs. For instance, Day and Kerr [22] and Kuziemsky et al. [25] state the importance of having an IT support team in place to troubleshoot technological issues. The support team's role has been found to be vital to a smooth operating program, and involves tasks such as being on call during tele-health clinics, training health professionals to use the IT equipment, and ensuring that the equipment is always in working order [22]. An available support team for troubleshooting is, therefore, another important element for any collaborative team that is communicating primarily with other team members and with patients through ICTs.

Establishing good rapport and communication patterns

Establishing good rapport and communication patterns within interprofessional teams, including with patients, is important for any working relationship, but this is felt to be especially true in the telemedicine setting. In order to facilitate collaboration between individuals who are communicating through ICTs, studies have shown the importance of having an initial face-to-face meeting, adhering to camera etiquette, and making special efforts to build relationships and foster trust.

a) Initial face-to-face meeting

Many studies outlined the importance of building patient-provider relationships by establishing good communication and verifying mutual understandings [17,37,38]. Study participants commonly held the belief that at least one introductory meeting should occur face-to-face so patients and health professionals could build a rapport that could then be followed up with telemedicine appointments. For example, Hiratsuka, Delafield, Starks, Amborse, and Mau [37] found that the first visit should occur face-to-face in order to help build an effective relationship, and so the care provider could perform a hands-on thorough clinical examination. Furthermore, LeRouge, Garfield, and Collins [17] found that telemedicine encounters were more appropriate after first strengthening a relationship by meeting face-to-face, because weak ties between patients and providers resulted in less than optimal outcomes. Before telemedicine implementation, palliative care professionals also anticipated that an initial face-to-face meeting would be necessary for the success of the teleconsultation program [38].

b) Adhering to camera etiquette

Standards for and attention to camera etiquette facilitated collaboration when com-

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municating through ICTs. Stafford, Myers, Young, Foster, and Huber [39] outline camera etiquette standards, including limiting the amount of time that the e-health intensive care unit, or eICU, cameras are on in the patient's room (to decrease the perception by the bedside team members that they were being watched); ringing a bell in the room when the camera was activated; and having eTeam members introduce themselves and state the purpose of activating the camera, as well as announce when they were about to deactivate the camera. These efforts toward improving communication patterns and camera etiquette proved successful for collaborative communication between the eTeam and bedside team [39]. Another study outlined several tasks that must be carried out in successful collaboration through remote telemedicine consultations, one of which was patient, consultant, and primary care practitioner knowledge of who is listening and/or watching telemedicine encounters [32]. In a study examining the effect on clinical cooperation when videoconferencing is introduced into patients' homes, Clemensen, Larsen, Kirkevold, and Ejskjaer [40] found that attending to both verbal and non-verbal communication to avoid misunderstandings during telemedicine interactions was crucial.

ICT communication training was another commonly named facilitator in the telemedicine setting [20,32,39,40]. In fact, Stafford et al. [39] deemed communication the number one skill in their eICU study, and outlined the importance of eTeam training in collaborative communication skills. Collaborative communication training included ongoing monitoring and practice, as well as taking ownership to ensure all communications are "professional, non-judgmental, and non-offensive" to bedside staff. Watts and Monk [32] make the point that consultation is "mainly about talking," requiring adaptation to lags, speaking more slowly and with longer pauses between speakers, choosing the right words for the audience, and having participants informed of what will happen next in teleconsultations. Consultants must also establish what the baseline levels of knowledge, competence, and confidence are among remote participants and communicate appropriately [32].

c) Relationship building and trust

Making the effort to build relationships when communicating through ICTs has proved to be extremely helpful in facilitating a collaborative atmosphere. As an example, pre- and post- implementation efforts to build relationships between tele-ICU and ICU staff were identified as important factors related to staff acceptance of telemedicine in an ICU program, including formal introductions, permission to ask questions, and knowledge of team members' experience and expertise [20]. Similarly, good relationships between providers, along with clinician demand for telehealth services, were among several important contributors for achieving clinical acceptance of telehealth services in a model of telehealth service sustainability [42].

A study on interpersonal interactions in telemedicine by Bulik [41] suggested several factors that are important in patient-provider relationships for telemedicine encounters. Such factors included the special attention providers need to pay to verbal interactions, such as maintaining small talk as they would in a face-to-face meeting. Non-verbal factors were also reported to be important, such as camera

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placement, close-ups, the feeling of bonding created by providers, and provider posture [41]. Another suggestion to improve the interpersonal interaction in telemedicine meetings was focusing on relational acts. For example, it was important to think out loud and explain what was happening or what was being done off camera [41]. Lastly, active listening by providers was reported to be more important in telemedecine than in traditional face-to-face interactions, in order to create a good patient-provider relationship [41].

The capacity to more easily share information and transmit knowledge between health professionals who communicate through ICTs also fosters collaboration. Esterle and Mathieu-Fritz [23] studied the impact on the professional work practices of a care organization using a teleconsultation system, and found new social relationships that had not existed formerly between health professionals contributed to the sharing and transmission of knowledge between practitioners. In a case study, multiple users in an e-health initiative were able to view the same image at different locations, which promoted interprofessional relationships and trust by improving the quality of clinical conversations and working relations [34]. In another study examining paramedic-physician collaboration in 3-D telepresence technology, paramedics believed this technology would allow physicians to view their capabilities, thereby increasing both trust and respect, as well as enhancing the expectation that physicians would be more willing to approve orders [33]. Similarly, the improved sharing of visual data and visual communication between emergency teams using videoconferencing in Norway led to virtual team building, and teams were more confident in advice given or received when compared with telephone interactions [27].

LeRouge et al. [17] illustrate the importance of having strong relationships between telemedicine providers in their case study, which determined the position of telemedicine along a service spectrum [43]. By examining linkages among actors, they found that telemedicine requires a new kind of service relationship, which they labelled as an "advanced encounter." One relationship examined was that between the healthcare provider and what they term the "local presenter" (the individual who, for the purposes of their study, operated equipment, introduced patients, and acted as the physician's arms and eyes locally). In this analysis, they determined that for a telemedicine interaction to be successful, the link between telemedicine healthcare providers and the presenter must be a synergistic and symmetric team, thus embodying a "single medical care provider" for the patient [17]. From this, it is clear that attempts to create good working relationships between colleagues, especially between healthcare providers and local presenters, is vital to a successful collaborative telemedicine program.

Along with good professional working relationships, a patient's trust in her healthcare provider is also necessary for telemedicine programs where health professionals collaborate with their patients. Trust in providers was needed for successful medical videoconferencing exams, and was partly founded in confidence in the provider's expertise and a provider's understanding of the patient's condition [17]. Confidence in provider expertise was also seen as important in another study, where patients felt assured when their provider showed she had access to and had reviewed their med-

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ical records, and when an introduction and brief overview of provider credentials were given to patients [17]. Furthermore, nurses, remote team members, and case managers who took time to debrief with patients in "care huddles" after telehealth visits were perceived as being more coordinated and transparent, with patients being more trusting of their expertise [28]. Therefore, actions on behalf of health professionals that increase confidence in provider expertise, as well as conducting debriefing sessions with patients, foster trust and, therefore, a collaborative relationship with patients receiving care from a distance.

Patient-centredness

Interprofessional collaboration, as defined by the Canadian Interprofessional Health Collaborative National Interprofessional Competency Framework, includes patient-centred care as one of the competency domains [16]. As outlined below, communicating through ICTs has been shown to create a more patient-centred focus, therefore allowing for more interprofessional collaboration with patients, who are seen as vital and central team members. Communicating through ICTs facilitates collaboration with patients by building triangular relationships, allowing for the presence of a second clinical eye, maximizing supports, and creating continuity of care.

a) Triangular relationships

Telemedicine programs have been found to result in changes in the relationship between patients and their providers, and in many studies ultimately improve patient-centred care by allowing patients to take part in discussions and play a larger role in their care. "Triangular" relationships are created when communicating through ICTs by allowing the simultaneous presence of two health professionals (for example, a primary care physician and a specialist consultant) who are collaborating with one patient. This is in contrast with traditional face-to-face care, which typically involves a patient visiting one health professional at a time—first a primary caregiver and then, through a referral, a specialist. Triangular relationships are more patient-centred as they allow all parties, including patients, to be more involved in care discussions that are more holistic. This new type of relationship when communicating through ICTs therefore promotes collaboration, both between health professionals and between health professionals and their patients. This was demonstrated in several studies, where teleconsultations with the patient present led to the creation of a new triangular relationship, for example one between a geriatrician, a specialist, and a patient [23,32,40,44].

An additional study by Andersen, Bjorn, Kensing, and Moll [44] revealed that a telemonitoring system with a two-way communication tool, myRecord, gave healthcare providers information in the context of telemonitoring data, symptoms, and medications, and permitted dictated replies. This tool increased the patient's role in the delivery of care by allowing two-way communication, and resulted in a more collaborative diagnosis [44]. Similarly, pre-implementation, palliative care providers expected that patients in a teleconsultation program would become more pivotal in their own trajectory of care due to increased capacity for participation in discussions

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and decisions [38]. A study by Clemensen et al. [40] aimed to describe how clinical cooperation is affected when video consultations are introduced into patients' homes. They described videoconferencing as a new way of working, based on immediate inter-individual cooperation and teamwork, where participants' competencies combined led to a more holistic treatment as well as a more active patient role [40]. Simultaneous communication between all interprofessional team participants through videoconferencing also resulted in a "witnessing" situation that was thought to potentially enhance the quality of patient treatment—patients in this program were no longer required to act as messengers between their healthcare providers [40]. Day and Kerr [22] likewise found that telemedicine supported shared care and an opportunity for more full participation among team members.

b) Presence of a second clinical eye

Communication through ICTs also allows for observations by peripheral participants who would typically not be present in face-to-face encounters, and for their contribution to and collaboration with primary participants. In this way, the presence of a second clinical eye during telemedicine appointments is a facilitator of interprofessional collaboration, as it creates opportunities for dialogue and teamwork where there was none. To illustrate, a study of simulated critical care videoconference scenarios showed that specialists acted as a second clinical eye, noticing responses to treatment and making clinical observations that were not detected by the remote team [27]. Another study identified many benefits to collaboration when using telehealth, including access to a second opinion and outcomes such as improved continuity of care, increased available information, facilitation of communication, and decreased isolation for those located in rural or underserviced areas [51]. Addressees such as patients and nurses (described as more peripheral participants during consultations), who overhear speakers or primary participants, such as specialists and general practitioners, in telemedicine conversations, enhanced the quality of treatment and reduced the need for patients to play messenger between their health providers [32,40]. Furthermore, a facilitator of staff acceptance in a tele-ICU program was the perception that monitoring can be helpful, as it provides a second eye that oversees a patient's care and investigation results [20].

c) Supports maximized

Telemedicine programs, through videoconferencing in particular, allows for patients to remain in their community and therefore gives greater access to family and community resources during telemedicine appointments, maximizing their support system. For example, video telehealth visits were said to maximize patient supports as the visits allowed access to the patient's family, home environment, and usual care providers and therefore normalized the experience [29]. Video telehealth visits also allowed for the presence of a familiar telehealth nurse during appointments to provide support and act as the patient's advocate [29,45].

In a mental health telemedicine demonstration project, Cornish, Church, Callanan, Bethune, Robbins, and Miller [46] found increases in cross-disciplinary

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connections and referrals among health professionals, and more community-based collaboration with police, clergy, and youth workers. Others found videoconferencing allowed the participation of diverse peripheral team members, family members, as well as ongoing remote access to specialists—who all play a critical role in patient care [21,28]. Introduction and opportunity for inclusion of family members during memory clinic appointments has been found to increase family and client satisfaction with videoconference care delivery [47]. Patients' next-of-kin reported more influence in the content of care in videoconference care coordination meetings [48].

A study by Sevean, Dampier, Spadoni, Strickland, and Pilatzke [29] found that videoconference appointments actually enhanced communication with nurses and other healthcare providers. Community members thought a remote telemental health program may encourage openness by making patients feel more comfortable and more willing to disclose [49]. Palliative care providers expected in the pre-implementation phase that teleconsults might have a healing effect on their own due to increased digital attention and contact with patients [38]. Some specialists in emergency room videoconference simulations felt more psychological involvement and commitment to the patient when compared with telephone interactions [27]. The above findings demonstrate that communicating with patients through ICTs can lead to enhanced patient-centred care by maximizing the support system, and therefore facilitating collaboration between patients and their interprofessional teams.

d) Continuity of care

Several studies cited the importance of having continuity of care, and how this is made more feasible in telemedicine initiatives. Continuity of care that is made possible by ICT and telemedicine systems allows for interprofessional teams to work closely as a unit with the same patient over an extended period of time. It therefore acts as a facilitator of interprofessional collaboration. Many state that continuity of care is in fact essential for the success of telemedicine programs, and is one of their greatest advantages. For example, Lundvoll, Nilsen, and Andreassen [50] found that in non-acute medical work, the use of videoconferences was facilitated when the same practitioners were involved in several phases of the treatment trajectory or wanted to be involved in planning over the patient trajectory, thus facilitating coordination, continuity, and knowledge sharing. Hiratsuka et al. [37] similarly pointed out that patients should see the same provider on subsequent telemedicine visits to have continuity in their care [37]. Factors contributing to success in a telehealth case study by Moehr, Schaafsma, Anglin, Pantazi, Grimm, and Anglin [21], included the involvement of established teams with previously known patients, who communicated in regularly scheduled visits or in sessions scheduled well in advance.

Willingness to adapt to and accept the technology

In order to achieve interprofessional collaboration when communicating through ICTs, participants in telemedicine initiatives must first have a willingness to adapt their current work processes and perceive that there is a relative advantage to start using ICTs in their work. Because communication through ICTs cannot happen

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without willingness and acceptance on behalf of the participants, these factors have been reported as important first steps in facilitating interprofessional collaboration.

a) Willingness to adapt work processes

Health professionals' attitudes and perceptions regarding their professional role have been shown to play a significant part in the effectiveness of collaboration through telemedicine programs. As an example, Day and Kerr [22] made the point that sometimes roles will have to change with the implementation of telemedicine, and that the acceptance of this is critical in order to be successful. Campbell, Harris, and Hodge [19] found similar results, stating that a health professional's attitude on "turf," (p. 421) or their perception of whether or not the telemedicine was a threat to her livelihood or professional autonomy, was a significant factor in receptivity to technological change. Role flexibility was required to ensure services ran smoothly in new telemedicine programs studied by MacFarlane, Clerkin, and Murphy [52]. This involved professionals taking on responsibility for new tasks and duties, including administrative duties and more frequent communication with other providers [52]. Specialists in a teleconsultation program learned how and when to delegate routine clinical acts to their geriatrician colleagues who were located beside patients [23].

b) Perceived relative advantage

In order to buy in to a new telemedicine program, researchers have also found that users have to perceive a relative advantage or a functional need for the technology in their professional role before they invest time and money in making such a change [19,53]. For example, in one study staff acceptance of a tele-ICU program was partly facilitated by a perceived need, or the staff's perceptions of whether the tele-ICU would be beneficial [20]. Factors influencing acceptance were experienced benefits of assistance with rural and off-hours care, as well as perceived usefulness based on positive experiences [20]. Similarly, Söderholm and Sonnenwald [53] wrote about what they call relative advantage, or the degree to which a new innovation surpasses current practices in one's role, including enhancing job performance, perceived usefulness, and expectations of the outcome of using a technology. Furthermore, the successful adoption of programs requires that the new technology be compatible with existing values, needs, and practices or it will be met with resistance [53]. Lastly, Söderholm and Sonnenwald [53] describe the observability of the technology's effectiveness and usefulness (the degree to which the results of an innovation are easily seen and understood), stating that users must have a clear understanding of collaboration technology and how it will impact their professional role before they will adopt it.

Key individuals providing leadership and administrative support

There are several important persons that can facilitate interprofessional collaboration in telemedicine programs: a telemedicine champion and leader with social influence; stakeholders and end-users who take ownership in creating a successful program; and lastly, a telemedicine administrative coordinator.

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a) Champion

Several studies found that there should be individuals in place as leaders or champions of telemedicine programs [24,25]. Physician "champions" were found to be potential facilitators for the initiation of successful telemedicine programs [53]. Söderholm and Sonnenwald [53] also spoke about a concept called social influence—the degree to which an individual perceives that important people believe they should use the new system. Wade, Eliott, and Hiller [42] determined that although champions are important for successful initiation, clinician acceptance is also necessary for the continuation of telehealth services.

b) Ownership

Ownership was found to be another predictor of success. For example, programs that were the most successful were those with participants who were professionally and emotionally invested in the technology [19]. For example, stakeholders and administrators who acknowledge the benefits of a telemedicine program, use it in their practices, are involved in the implementation stages, and teach colleagues about the technology will be more invested in creating an effective program and will therefore be more likely to succeed than someone who is not as invested [19]. Similarly, Gagnon, Duplantie, Fortin, and Landry [51] found that, among conditions for successful implementation of telehealth networks, clinicians' or end users' participation in decision-making was critical.

c) Coordinator

After researching various telemedicine initiatives, many urge the need for a telemedicine coordinator. Day and Kerr [22] advise having a coordinator with an administrative role as well as providing clinical and telehealth support, ensuring the telehealth appointments run smoothly. Others also outlined the need for local coordinators, strong leadership support, and additional organizational supports [17,20]. For example, a nurse care manager who coordinated care at a community site provided essential assistance to patients navigating the telecollaborative system and assigned tasks to other providers and patients [28]. Cornish et al. [46] further suggest that the ability to enhance local collaboration from a distance will be limited unless there is an effort to also coordinate the involvement of local community leadership. Lastly, early in the implementation process, the role of a motivated and determined clinical administrator was found to be critical [53].

To conclude and review the many facilitators listed above, there were six major areas identified that act as facilitators to collaboration when communicating through ICTs. The first, training and planning, includes facilitators such as ICT training, determining patient suitability, reorganizing the system, and setting out ground rules, roles, and responsibilities. Second, ICT system supports are required as high-quality technology, planning around design and usability, and having an IT support team facilitate this type of interaction. Third, establishing good rapport and communication patterns was also important, including holding an initial face-to-face meeting, adhering to camera etiquette, and making efforts to build relationships and increase

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trust. Fourth, patient-centredness can be achieved through ICT communication as it promotes facilitators such as triangular relationships, the presence of a second clinical eye, maximizing supports, and allowing for continuity of care. Fifth, having a willingness to adapt to and accept the technology through adapting work processes and perceiving a relative advantage when using ICTs facilitates collaboration. Lastly, key individuals who provide leadership and administrative support were another important facilitator, particularly having a champion of the program, having participants take ownership, and implementing a designated telemedicine coordinator. The above is summarized in Table 1.

Barriers to interprofessional collaboration

Themes identified through the literature that were felt to be barriers to interprofessional collaboration when communicating through ICTs included:

7. Technical issues;
8. Coordination and organizational challenges; and
9. Problematic relationships.

Technical issues

Naturally, any technical issues encountered when communicating through ICTs can act as a potential barrier to collaboration for interprofessional teams and their patients. Although advances in technology since the introduction of telemedicine in the 1990s has eliminated many problems that were detrimental to collaborating through ICTs in the past, problems such as poor media quality, perceptual difficulties, and privacy and safety concerns still remain.

a) Poor media quality

Although image resolution and media quality have improved greatly over the last few decades, poor ICT quality is still a reality and was commonly found to act as a barrier to the long-term success of telemedicine programs and interprofessional collaboration. As an example, after a tele-ICU program had been in place for several weeks, glitches with technology was cited as one of the barriers to staff acceptance, where nurses experienced problems with microphones and other equipment when communicating with other team members [20]. In addition to problems with equipment, poor sound quality [24] and poor image quality [37] were also identified as barriers to interprofessional communication and collaboration. Careau et al. [24] found that image resolution and quality could determine whether the interaction would be positive or not. Interprofessional team communication could therefore easily be hindered by inadequate image or sound quality in videoconference technology, as visual and auditory stimuli are clearly a necessity for effective communication between team members when using telemedicine delivery programs [24]. For this reason, Careau et al. [24] found poor audiovisual quality to be the most commonly mentioned disadvantage of using telemedicine technologies, such as videoconferencing. Others also stressed the importance of small social phenomena that become blurred or diminished in videoconferencing, such as small expressions

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or movements that are unnoticed due to it being a virtual meeting [22,54]. May, Gask, Atkinson, Ellis, Mair, and Esmail [54] and Day and Kerr [22] further talk about the changes in body language seen in those using telemedicine, and how some users felt constrained by the camera frame and were uncomfortable with the lack of physical contact.

Perceptual difficulties were cited as a concern and potential barrier to collaborating with patients over ICTs. A study by Agha, Roter, and Schapira [55] found more requests for repetition from patients during telemedicine consults, suggesting perceptual difficulties, and a third of patients participating in telerehabilitation sessions for dysphagia also had perceptual difficulties due to audio and video quality [56]. In fact, patients with schizophrenia reported difficulty hearing telepsychiatrists and incorporated videoconferencing into delusions [57]. Johansson, Lindberg, and Soderberg [45] found that a larger picture would help simulate face-to-face interactions, and that failure to properly place the camera would sometimes require patients to be in awkward positions.

b) Privacy and safety concerns

Some studies brought up the issue of privacy and safety in telemedicine. Programs will predictably face implementation challenges and collaboration will be less than optimal if participants have concerns over privacy and safety when communicating with patients. For this reason, failing to address these concerns acts as a potential barrier to collaboration. To illustrate, a Canadian study of an emergency room trauma telehealth program revealed that one reason for the declining frequency of telehealth consults was concern over privacy and being overheard [21]. Other health professionals had concerns over being monitored, describing the tele-ICU system as a sort of "Big Brother" watching the bedside [20]. Privacy and security concerns were raised by incarcerated youth participating in telepsychiatry appointments [58] as well as First Nations participants in telemental health programs, who stated that they feared for the safety of patients who could essentially feel alone during a crisis if they could only access professionals via videoconferencing [49]. Patients' feelings of security were also found to decrease when too many health professionals and staff were present in the videoconference room [45].

Coordination and organizational challenges

Coordination and organizational challenges were also found to be potential barriers to interprofessional collaboration in telemedicine settings, including: fragmented work processes; ambiguous responsibilities and resistance to shifting roles; time investment and increased workload; coordination demands; staff retention and recruitment; and medicolegal concerns.

a) Fragmented work processes

Several studies outlined aspects of work processes in telemedicine that may lead to poorer interprofessional teamwork. As is illustrated by the examples below, some of the most common factors that were found to fragment work processes and thus

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impact interprofessional collaboration included: lack of feedback; leaving out information; disruptions in teamwork; continuing to work within established communication structures; gaps in knowledge of when and how to use ICTs; a mismatch in technological scripts; and the use of ICTs creating more rigid communication patterns. For example, the lack of a complete feedback loop in project structure and the lack of opportunities to correct misinterpretation of feedback were cited as concerns for ophthalmologists and optometrists involved in a telecare service in the Netherlands [59]. Another study demonstrated that telephone consults were felt to fragment the clinical process and leave out important information [60]. Similarly, in a study of team cooperation by Bolle et al. [27], latency in transmission during simulated videoconferenced critical care scenarios was found to disrupt clinical presence and teamwork.

Use of a tele-ICU program as a support during off-hour shifts was found to be minimal in one study because residents reported proceeding through their chain of command and working within established communication structures, opting to keep their collocated team involved rather than contacting and collaborating with the tele-ICU program [20]. Moreover, the extra communication when co-managing a critical situation with a virtual team was perceived as a hindrance that disrupted work systems and communication [20].

Another potential barrier to team functioning related to fragmented work processes is the mismatch of technological scripts, as described in a study by Nicolini [36] that examined the effect of telemedicine on existing medical practices. He notes that telemedicine requires remedial work by health professionals, as the use of an electronic patient record (EPR) led to a more structured, detached, question-and-answer interactional order. Nurses using EPRs were required to search for the appropriate screen to input data, which interrupted the flow of conversation with patients who had to wait in silence [36].

b) Ambiguous responsibilities and resistance to shifting roles

Ambiguous roles and responsibilities in telemedicine were common barriers to successful collaborative programs [20,28,38,61,62]. For instance, pre-implementation barriers to staff acceptance of a tele-ICU program included unclear organization of patient care and tele-ICU clinical practice, as well as lack of protocol policies and procedures [20]. Incompatibility of the ER-trauma service with traditional referral patterns was identified as another obstacle, as there was uncertainty about professional responsibilities and who should invoke a consult [21]. Another study demonstrated that general practitioners and specialists appeared to have different expectations for the role of primary care physicians in telemedicine appointments. While specialists expected more interactions from general practitioners, general practitioners chose to take a less active and vocal role and acted as their patients' advocates, mostly observing interactions between patients and specialists and only commenting when required [61]. Patients were also aware of the confusion due to ambiguous responsibilities among their providers, and some perceived the occasional experiences of decreased continuity and problems in care coordination as trade-offs for the

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improved access that came with telehealth collaborative care programs [28]. In another study, despite pre-implementation negotiation and the definition of roles and responsibilities, patients still occasionally experienced delayed care due to role ambiguity among providers, with confusion among providers as to who should respond to urgent care [28].

Another barrier affecting team functioning occurred when health professionals continued working within the pre-existing medical hierarchy and demonstrated opposition to shifting roles and responsibilities. The existing hierarchy in one study was felt to be to holding back interprofessional participation in telemedicine care because some health professionals failed to shift models of clinical practice and had difficulties negotiating new roles and responsibilities [30]. Opposition to shifting roles and responsibilities by health professionals in a tele-ICU initiative was found to be a post-implementation barrier to the program's acceptance and success [20]. Changing interactions among emergency room physicians, staff, and stroke neurologists during acute stroke telemedicine encounters made it difficult to engage some primary care physicians and generalist physicians [63]. Furthermore, rural primary care providers perceived telemedicine to be an intrusion by a tertiary care centre into rural practices and viewed it as a threat to their livelihood, sense of competency, and autonomy [19]. Some health professionals participating in palliative care teleconsultations were concerned about consultants "loss of control" (p. 11) over a patient's care and disrupting the established chain of care [38]. The above examples illustrate that ambiguous roles and resistance to shifting roles can act as barriers to interprofessional collaboration among teams that are adapting to communicating through ICTs.

c) Time investment and increased workload

Communication through telemedicine in some cases was viewed as having a negative impact on health professionals' available time. Negative perceptions and, at times, the reality of time investment and increases in workload for health professionals has been found to pose challenges to the establishment and sustainability of telemedicine programs. Health professionals are less likely to incorporate technologies into routine practice if they believe it will constrain their valuable time, and therefore perceptions of substantial time investment or an unacceptable increase in workload act as barriers to interprofessional collaboration for those communicating through ICTs. For example, previewing records and frequent telemedicine consultations outside of initial consults or crises were found to strain telepsychiatrists' time [58]. A potential barrier to the adoption of 3-D telepresence medical consult technology was whether or not physicians would have enough time and availability to take a telemedicine call [53]. Health professionals who were previously not involved in the booking process perceived the new primary and secondary telehealth care appointment booking system to have a negative effect on interactional workability, consuming too much of a patient's consultation time [34]. Some telemedicine providers perceived that, compared with face-to-face interactions, they had less control of their time [41]. In a Swedish study examining the pre-implementation views of health professionals on video consultations, nurses expressed

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concerns about the time required for scheduling and worried that organizing and performing videoconferences would require too much of their time [18]. Johansson, Lindberg, and Soderberg [18] also found that patients perceived it would be faster to meet face-to-face if a diagnosis could not be made via videoconferencing. And lastly, a telecare service set up with the intention of reducing workloads of ophthalmologists by detecting patients with glaucoma using digital images that were further assessed by trained technicians in hospital, failed to become part of everyday clinical routines when participants were dissatisfied with both the quality of the pictures and perceived an increase in their workload [59].

d) Coordination demands

A barrier to collaboration that was identified involves the effort required for the coordination of telemedicine programs. Extra coordination and scheduling for establishing meeting times and agendas between internal and external team members was found to be a barrier in a study by Kuziemsky et al. [25] that examined how best to support interprofessional palliative care e-teams. Similarly, poorly designed and cumbersome means of scheduling and utilizing telemedicine technology was cited as an element that may have hindered telemedicine program effectiveness [62]. In fact, this study found that 60 percent of communication content was related to telemedicine coordination issues [62]. Barriers to telecare integration in a community-based chronic disease management program included a lack of coordination across social and primary care boundaries, a lack of dialogue between primary and secondary systems that led to difficulties in shifting balance from secondary to primary care, and difficulty establishing and maintaining agendas across health and social care boundaries [64]. Complications in another study arose with the ad hoc use of telemedicine equipment in trauma settings, where physicians were unfamiliar with the equipment when needed in emergency situations due to lack of coordination and planning [21]. Lastly, a lack of common terminology about telemedicine was found to contribute to confusions in an organizational analysis of an early telemedicine program, and the perception that decision-making was done by almost everyone but the referring physician was found to be another significant organizational communication deficit [62].

e) Staff retention and recruitment

Staff retention and recruitment was a concern in several telemedicine studies, with constant disruption and staff turnover acting as a barrier to forming cohesive interprofessional collaborative teams. As one example, a rural mental health telemedicine demonstration project experienced problems with high staff turnover, with 18 of the 34 participants leaving their positions before the project was completed [46]. Additionally, an integrated strategy to improve access to stroke care that utilizes telehealth experienced similar problems and was unable to hire, retain, and maintain skilled remote administrators and healthcare practitioners [63]. And although paramedics could potentially have more access to physicians in emergency situations using 3-D telepresence medical consult technology, there was concern that current

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numbers were insufficient and that additional staff would be required in order to have a successful and timely collaboration [33].

f) Medicolegal concerns

Medical law, or medicolegal, concerns among participants in telemedicine initiatives represent a further barrier to collaboration, as such concerns have been found to inhibit or constrain teams from fully participating in ICT communication initiatives. A visioning study of 3-D telepresence technology for medical consultation (3DMC) by Söderholm and Sonnenwald [53] mentioned several issues related to legal responsibility, liability, and authority with respect to patient care (p. 1820). Because 3DMC uses digital network technology, sessions can be easily recorded, archived, and incorporated into a patient's electronic record, which raises concerns regarding the potential for malpractice lawsuits. Furthermore, a qualitative study examining tensions in inter-doctor telephone consultations revealed that callers and consultants had concerns about being held medically legally responsible when they held shared responsibility for patients [60]. In addition to concerns over being held legally responsible, participants voiced concern over the redistribution of professional work in a tele-triage initiative that resulted in doctors' tasks being delegated to nurses. This was often not acknowledged legally or economically and so participants did not receive compensation for the new tasks they were required to carry out [36].

Problematic relationships

Lastly, in addition to technical issues and coordination and organizational challenges, problematic relationships have the ability to hinder collaboration. Therefore, tension and mistrust in professional relationships, as well as threats to the patient-provider therapeutic relationship in teams communicating through ICTs, can be a major barrier to successful collaboration.

a) Tension and mistrust in professional relationships

Communication through ICTs has been found to cause tension and mistrust in professional relationships, due to factors related to the nature of telemedicine itself or the way a telemedicine program was implemented. For example, concerns from telemedicine participants, which are further described below, include: problematic team dynamics and lack of team relationship development; mistrust of those monitoring through ICTs; lack of personal contact; rejection of perceived needless monitoring and increased interactions; experiences of verbal abuse and rudeness over ICTs; and ICTs creating a more formal, closed didactic form of communication between health professionals.

A telehealth service studied by Moehr [65] cancelled one of the clinical application domains (ER trauma sessions) after six months for several reasons, one of which was problematic team dynamics related to the introduction of the project. Post-implementation barriers to staff acceptance in a tele-ICU program also included a lack of team relationship development, as well as mistrust of those monitoring from a distance [20]. In a case study of three e-health innovations, the new booking sys-

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tem was said to have a negative impact as it disrupted the usual personal contact and long-established referral method between the referring doctor and specialist, altering interprofessional relationships [34]. Some health professionals rejected the increased personal interactions of telemedicine, stating that consultants who were monitoring in tele-ICU programs were perhaps more apt to needlessly chime in and give advice [20].

One study that examined tensions in telephone conversations presented cases of verbal abuse and rudeness over the phone, and showed that key sources of tension during telephone consults included discursive features, such as pace, accent, organization, tone, rambling, or being cut off [60]. Differing context of calls (between primary care provider callers and specialist consultants receiving calls) was another source of tension, as a caller's questions were felt to be urgent, however, the consultants viewed the calls as one of many competing priorities and were at times unwilling to take them [60]. Primary care provider callers therefore perceived that the telephone interactions were more convenient for consultants than for themselves, as consultants had the liberty of responding when they felt they had time to so do [60]. Consultants were also unsure if they could trust the subjective assessments of others when not on site with patients [60]. Furthermore, strategies by one group to deal with sources of tension actually exacerbated tension for the other. For example, consultants preferred objective lab values to assess patients rather than a relatively more subjective clinical exam by a colleague, but callers perceived that they were being talked down to when asked for lab values. Callers thought that consultants, who used additional questioning when speaking with a caller in order to understand her skill level, were unnecessarily slowing down the process. Consultants also tended to give more conservative advice over the phone than in an in-person consult, which was perceived by callers as exaggerating the severity of clinical situations. When consultants asked to see patients in their clinic, callers felt they were taking over the patient's care [60].

In an anthropological analysis by Delaney, Jacob, Iedema, Winters, and Barton [66], videoconferencing was perceived as a more formal, less spontaneous, and more closed didactic form of communication in comparison with face-to-face meetings among multidisciplinary breast cancer medical staff. There was less equality among participants that were characterized by the same specialty than among those from different specialties. However, Delaney et al. [66] go on to suggest that many of these barriers could be altered by a more conducive meeting set-up, with attention to things like camera and participant placement.

b) Threats to therapeutic relationship

Collaborating and establishing a bond with patients through ICTs was challenging in several studies, and many researchers and telemedicine participants voiced concerns over threats to the therapeutic relationship when patients are not meeting face-to-face with their care providers. Altered therapeutic relationships, therefore, challenge collaboration and connection between health professionals and their patients when they communicate through ICTs. For example, a telepsychiatry study examining therapeutic relationships by May et al. [54] found resistance to new technology from mental

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health professionals as telecommunications systems threatened deeply embedded professional constructs about the nature and practice of therapeutic relationships. In a study of telehealth for chronic disease management, the absence of face-to-face and hands-on interaction was a concern to patients, as they feared the loss of a personal connection. Providers in this case, however, were primarily concerned with missing information or findings when performing a remote physical exam [37]. Altered clinical interactions when delivering healthcare through ICTs could restrict both interprofessional collaboration and effective patient care. One instance of altered clinical interactions in telemedicine is not showing an overall view of patients before zooming in on specific findings during video consultations, which could lead to clinical misinterpretation and disruptions to interprofessional collaboration. For example, failing to show the general location of a diabetic foot ulcer before showing a close-up would limit one's understanding of the full clinical picture, and may therefore hinder interprofessional collaboration and patient care [40]. Some expressed concerns about telemental health appropriateness and cultural compatibility, believing it was more difficult to build trust without face-to-face contact [49], and incarcerated youth further expressed dissatisfaction with staff presence during telepyschiatry appointments [58]. Lastly, Nicolini [36] argues that telemedicine redesigns relationships between larger urban centres and the remote peripheries, reinforcing the role of the centre in patient management and threatening local community resources. In this way, communicating through ICTs modifies the typical face-to-face therapeutic relationship, which may act as a barrier to successful collaboration between patients in the community and their distant healthcare providers.

One study showed telemedicine visits were more physician-centred than face-to-face sessions, with physicians controlling the dialogue and speaking more frequently, and patients taking a more passive role [55]. Others found similar results, where specialists dominated telemedicine consults, patient-centred responses were rare, patients were the least active participants, and there was limited group discussion—with most discussions occurring between specialists and primary care providers [67]. The above findings show that some aspects of telemedicine can threaten the therapeutic relationship and therefore can be seen as barriers to collaborating with patients through ICTs.

In summary, there were many barriers to interprofessional collaboration in this non-traditional setting. As stated above, the first major barrier was related to technical issues, including poor media quality, perceptual difficulties, and concern over privacy and safety when communicating through ICTs. The second barrier related to coordination and organizational challenges, including concerns over fragmented work processes, ambiguous responsibilities, resistance to shifting roles, time investment, increased workload, coordination demands, staff retention/ recruitment, and medicolegal concerns. Lastly, problematic relationships when communicating through ICTs caused by tension and mistrust between professionals as well as threats to the therapeutic relationship can also act as a barrier to collaboration. The above findings are summarized in Table 1.

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Discussion

The accessibility and rapid advancement of mobile technologies has produced new possibilities in chronic disease management and offers innovative opportunities to improve care delivery by providing patients with access to interprofessional patient-centred care across multiple sites. Undoubtedly, the potential benefits telemedicine has to offer are enormous, including the ability to provide clinical information to a specialist to detect and treat clinical changes and control disease progression; monitor and transmit information from a patient to a central facility for review by clinicians; allow for collaborative practice between interdisciplinary teams; support health promotion and prevention interventions; and promote patient engagement in maintaining his or her own health. It is, therefore, critical to understand what is essential for programs to be successful and reap the benefits that ICTs afford. Existing literature has mainly focused on the software design requirements, clinical outcomes, cost-analysis, and general factors for successful implementation of telemedicine programs (e.g., staff acceptance and usage). This study addresses a gap in the literature by examining the factors that act as facilitators and barriers to health professionals collaborating effectively with their patients and each other—as interprofessional collaboration is arguably one of the most important components in the delivery of patient-centred care.

A number of facilitators to collaboration through the use of telemedicine technology were identified, including having access to training opportunities, and effective planning in both the pre-implementation and implementation phases. For example, this included training in ICT operations, determining appropriate patient suitability for the telemedicine program, reorganizing the current system where necessary, and establishing ground rules, roles, and responsibilities for communicating through ICTs. Another facilitator was ICT system support, which included designing a high-quality technology system that is user-friendly and having a designated IT support team in place. Establishing good rapport and communication patterns were also identified as crucial. They can be achieved by having an initial face-to-face meeting, adhering to camera etiquette, and making efforts to build team relationships and trust. Patient-centredness in telemedicine was found to further facilitate collaboration, as the creation of triangular relationships, the maximization of supports, allowing for continuity of care, and having the presence of a second clinical eye all encourage patient participation and collaboration between health professionals and their patients. A willingness to adapt to and accept the technology, including a willingness to adapt current work processes and to perceive the relative advantage of using ICTs, was also found to be necessary for collaboration and the successful uptake of telemedicine programs. Lastly, key individuals or champions who provide leadership and take ownership, as well as designated telemedicine administrative support coordinators, facilitate interprofessional collaboration by ensuring program buy-in and sustainability.

While several facilitators were identified, there were a number of barriers to interprofessional collaboration when communicating through the use of telemedicine technology. For example, technical issues in this setting were identified as barriers to

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collaboration, including poor media quality, perceptual difficulties, and privacy and safety concerns. Additionally, coordination and organizational challenges were found to act as inhibitors to interprofessional collaboration. For instance, telemedicine programs face challenges related to collaboration, such as fragmented work processes; ambiguous responsibilities and resistance to shifting roles; time investment and increased workload; coordination demands; difficulties with staff retention and recruitment; and medicolegal concerns. Finally, problematic relationships were also found to restrict collaboration through ICTs, as there may be tension and mistrust in professional relationships, as well as threats to the therapeutic relationship between health professionals and their patients.

Based on our findings from this review, we have developed recommendations on how to facilitate interprofessional collaboration, support organizational alacrity, and encourage technology adoption in telemedicine programs that can be used by key stakeholders involved in such programs, including patients, clinicians, health system leaders, and policymakers (Table 2). Recommendations come from the modifiable facilitators and barriers identified in Table 1.

Table 2. Recommendations on how to support interprofessional collaboration when communicating through ICTs

Recommendations
✓ Develop high quality technology systems, designed with end-user input
✓ Reorganize current system where necessary
✓ Offer ICT training for health professionals and patients
✓ Determine patient suitability
✓ Set out ground rules, roles, and responsibilities
✓ Outline and adhere to camera etiquette
✓ Address privacy and medicolegal concerns upfront
✓ Hold initial face-to-face meeting
✓ Make efforts to build relationships and trust
✓ Create IT support team available for troubleshooting
✓ Create role for administrative support and telemedicine coordinator
✓ Identify key individuals or champions to provide collaborative leadership

While there is relatively little research specific to the topic in question, this literature review found similar results to other reviews in the field. Note that, although the following reviews included keywords such as "telemedicine," "facilitators," and "barriers" in their titles and abstracts, none of the reviews identified below directly examine the specific topic in relation to interprofessional collaboration. However, many reviews that examined telemedicine programs had findings similar to our own. For example, facilitators for using health information technologies that were identified in a review by Finkelstein, Knight, Marinopoulos, Gibbons, Berger, Aboumatar, Wilson, Lau, Sharma, and Bass [7] support the findings of this review, as they included the following facilitators for effective telemedicine implementation: satisfaction with ease of use, perceived usefulness, efficiency of use, availability of support, comfort in use, and

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training. Likewise, necessary technical conditions named by Jarvis-Selinger, Chan, Payne, Plohman, and Ho [8] included: basic technical requirements, monitoring camera placement and setup, and establishing ongoing technical support. In the same review they reveal key lessons for organizational readiness and adoption, which closely resemble the facilitators listed above in Table 1 and involve: establishing comprehensive change management and a user training program; developing organizational protocols for system use; protecting patient confidentiality; supporting interprofessional collaboration and professional development; and facilitating quality of service [8]. A review by Obstfelder, Engeseth, and Wynn [12] outlined characteristics of successful telemedicine programs, such as: clearly stating local service delivery problems; identifying benefits of telemedicine and perceiving it as a solution to political and medical issues; collaboration between promoters and users; and addressing issues regarding organizational and technological arrangements. Additional important issues to consider that were not found through our literature review, but were named by others in the context of telemedicine service delivery, include establishing technical compatibility between telemedicine sites, understanding program costs and remuneration issues, and considering the future operation of the telemedicine service [7,8,12]. The above findings correlate well with our own, and largely fall under one of the facilitator themes identified through our literature review.

We also found many similarities that support our results when comparing our findings regarding barriers in telemedicine with those of other reviews. For example, one review listed barriers impacting telemedicine implementation and ICT usage, including: poor interface usability; insufficient basic formal training in clinical use; concerns about potential new work; problems with work flow; problems related to confidentiality and privacy; depersonalization; incompatibility with healthcare systems; and concerns about reimbursement [7]. In Young, Chan, and Cram's [13] review, they summarized existing research on the barriers to telehealth program acceptance, which included many results that resemble the barriers we identified, including: resentment fostered by monitoring and scrutiny; increased interruptions; increased workload; conflicting recommendations between on- and off-site physicians; and technical malfunctions. The literature review by Ward, Stevens, Brentnall, and Briddon [14] on the attitudes of healthcare staff to ICTs also had results similar to our own. For example, factors affecting attitudes toward ICTs included social system aspects of management (such as power, education, and training) and the design of IT systems [14]. Stumpf, Zalunardo, and Chen [68] state in their essay that non-technology barriers to telemedicine implementation included: inadequate leadership; lack of physician buy-in; immediate and widespread implementation breakdown; unavailability of technical expertise or support; and staff resistance to changing habits. The findings regarding barriers in telemedicine listed above support the results of this review, as they generally fall under one of the three barrier themes (technical issues, coordination and organizational challenges, and problematic relationships). Further barriers in telemedicine that were outlined by other reviews include issues such as: problems with access due to older age, low income, education, and cognitive impairments; low computer literacy in patients

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and clinicians; problems related to funding; user-specific attributes such as age, gender, professional groups, and previous experience; and lastly, end-user resistance to evaluation protocol, such as satisfaction surveys [7,14,68]. Although they may not necessarily directly affect interprofessional collaboration, these additional barriers should also be considered when implementing telemedicine programs and communicating through ICTs. Lastly, our research is in concordance with two policies from the American Telemedicine Association: Practice Guidelines for Video-Based Online Mental Health Services [69], and Practice Guidelines for Videoconferencing-Based Telemental Health [70], which contain guidelines for the practice of telemental health, and recommend addressing the following: standard operating procedures, protocols, clinical specifications, technical specifications, and administrative issues.

Future research studies of telemedicine programs are needed with a focus on how interprofessional teams collaborate when not co-located to further understand this type of healthcare delivery and its implications on teamwork and patient care. The review of systematic reviews conducted by Ekeland, Bowes, and Flottorp [6] outlines the importance of formative research aimed at collaboration, as well as the engagement of stakeholders—including patients—to ensure capacity for the improvement of services in natural settings.

A limitation to this review is that many of the studies included used qualitative methods and for the most part only involved interviews with health professionals. The findings are, therefore, somewhat subjective and they exclude the opinions of other important individuals involved in telemedicine programs, such as patients, telemedicine software designers, and administrators. Additionally, this review did not include an assessment of risk of bias or the quality of the included studies. Furthermore, this is a narrative review and not a systematic review, and may consequently not be entirely comprehensive.

Conclusion

Despite ICTs being widely used in healthcare, relatively little research has shown how this affects interprofessional collaboration when health professionals and patients are communicating in telemedicine settings. This review adds to the literature by identifying the barriers and facilitators to interprofessional collaboration when communicating through ICTs. A number of facilitators were identified, such as: training and planning; ICT system supports; establishing good rapport and communication patterns; patient-centredness; willingness to adapt to and accept the technology; and key individuals providing leadership and administrative support. In contrast, technical issues, coordination and organizational challenges, and problematic relationships were found to be barriers to interprofessional collaboration in telemedicine. Recommendations on how to facilitate interprofessional collaboration in the delivery of care through telemedicine programs have been compiled for key stakeholders of telemedicine initiatives to consider. These findings provide a foundation from which researchers can further explore and discuss ICT communication and interprofessional collaborative efforts in healthcare. Future research is

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needed to advance our understanding of how communicating through ICTs impacts healthcare, and importantly its effects on interprofessional collaboration between health professionals and patients.

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