Telehealth use in rural and remote health practitioner education: An integrative review

PAULINE CALLEJA ; SUSAN WILKES ; MELINDA SPENCER ; STEVEN WOODBRIDGE

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REVIEW ARTICLE

Telehealth use in rural and remote health practitioner education: an integrative review

AUTHORS


Pauline Calleja[1] PhD, Head of College Nursing & Midwifery *

Susan Wilkes[2] GDip Midwifery, Nurse Educator

Melinda Spencer[3] BSc (Hons), Research Assistant

Steven Woodbridge[4] GC IntensiveCareNurs, Clinical Nurse

CORRESPONDENCE

*A/Prof Pauline Calleja p.calleja@cqu.edu.au

AFFILIATIONS

[1] School of Nursing, Midwifery & Social Sciences, CQUniversity, Cairns, Qld 4870, Australia; Retrieval Services Queensland, Kedron, Qld 4031, Australia; and School of Nursing & Midwifery, Griffith University, Nathan, Qld 4111, Australia

[2, 4] Retrieval Services Queensland, Kedron, Qld 4031, Australia

[3] School of Nursing & Midwifery, Griffith University, Nathan, Qld 4111, Australia; and Menzies Health Institute Queensland, Griffith University, Southport, Gold Coast, Qld 4222, Australia

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ETHICS APPROVAL

Nil ethics required for review study

ABSTRACT:

Introduction: For rural and remote clinicians, quality education is often difficult to access because of geographic isolation, travel, time, expense constraints and lack of an onsite educator. The aims of this integrative review were to examine what telehealth education is available to rural practitioners, evaluate the existence and characteristics of telehealth education for rural staff, evaluate

current telehealth education models, establish the quality of education provided through telehealth along with the facilitators or enablers of a successful service and develop recommendations for supporting and developing an education model for rural and remote health practitioners through telehealth.
Methods: An integrative review was conducted following the five-stage integrative review process. Searches were conducted in the electronic databases CINAHL, Medline, Nursing & Allied Health (Proquest), PubMed, Johanna Briggs Institute Evidence Based Practice (JBI EBP) and Embase.
Results: Initial searches revealed more than 7000 articles; final inclusion and exclusion criteria refined results to 60 articles to be included in this review. Included articles were original research, case studies, reviews or randomised controlled studies. Countries of origin were countries in North and Central America, the UK, Europe, and Africa, and Australia and India. One issue noted with this review was classifying rural and remote; contexts used included rural, remote, regional, isolated, peripheral, native communities and outer regional or inner regional.
Sample sizes in the studies ranged from 20 to more than 1000 participants, covering a broad range of health education topics. Delivery was mostly by a didactic approach and case presentations. Some included a mix of videoconferencing with face-to-face sessions. Overall, telehealth education was well received, with participants reporting mostly positive outcomes as signified by feeling less isolated and more supported.
One interesting result was that quality in telehealth education is poorly established as there appears to be no definitions or consensus on what constitutes quality in the delivery of telehealth education. Very few studies formally tested increase in skill or knowledge, which is usual with professional development programs that do not result in further qualifications. For those that did assess these, formal knowledge and skills assessment indicated that telehealth using videoconferencing is comparable to face-to-face training with significant benefits related to travel reduction and therefore cost. Recommendations were difficult to synthesise because of the broad issues uncovered and lack of quality in many of the studies.
Conclusion: The applications for telehealth are still evolving, with some applications having poor evidence to support use. Overall, telehealth education is well received and supported, with positives far outweighing negatives. Anything that can improve connection with a community and decrease isolation experienced by rural clinicians can only be beneficial. However, further planning and evaluation of the quality of delivery of telehealth education and addressing how education outcomes can be measured needs to be addressed in this widely growing area of telehealth.

Keywords:

education, in-service training, remote health services, rural health services, staff development, telemedicine, telehealth, videoconferencing.

FULL ARTICLE:

Introduction

Accessing education in rural and remote settings can be challenging for health practitioners. Telehealth education with videoconferencing (VC) as a main delivery mode is widely researched. Research is well established for telehealth to provide patient education and follow-up appointments, but little is known about the impact of telehealth education using VC for rural and remote health practitioners, and several recommendations note the need for further exploration[1,2].

Telehealth as defined by the International Organization for Standardization is the 'use of telecommunication techniques for the purpose of providing telemedicine, medical education, and health education over a distance'[3]. For clarity, telemedicine has a narrower focus of clinical services that are remotely delivered, with the International Organization for Standardization definition as the 'use of advanced telecommunication technologies to exchange health information and provide healthcare services across geographic, time, social and cultural barriers'[3]. VC is described as 'electronic form of communications that permits people in different locations to engage in face-to-face audio and visual communication. Also, a collection of technologies that integrate video with audio, data, or both to convey in real time over distance for meeting between dispersed sites'[3].

VC is one of the most common models of audio and visual technology used to provide telehealth and telemedicine. This article talks about telehealth predominantly and VC specifically as a form of providing health professionals from rural and remote locations an opportunity to connect with colleagues and gain support for patient care, refer patients and many other aspects that historically were a 'refer and treat' process, without connection to specialists in real time.

VC is becoming more widely used in telehealth, including to provide education to health practitioners in rural or remote settings. Quality education opportunities in rural and remote settings have traditionally been difficult to access because of geographic isolation, travel, time and expense constraints and often the lack of an onsite educator. Within telehealth, VC is promoted as a practicable alternative for educational opportunities[4-7], but like all new technology approaches, uptake has overtaken evidence for use. When establishing their own telehealth education approach, the authors found gaps in the literature related to how telehealth has been used for specific education in rural and remote settings, along with little evidence about education strategies and their modes of delivery strengths and weaknesses. Therefore, this review was undertaken to identify, evaluate and synthesise the available evidence for using telehealth for education of rural and remote healthcare providers.

The objectives of this integrative review were to: (1) determine the existence and characteristics of telehealth education in rural and remote setting; (2) evaluate current telehealth education models and resources; (3) establish the quality of education provided through telehealth along with the facilitators or enablers of a successful service; and (4) develop recommendations for supporting and developing an education model for rural and remote health practitioners through telehealth.

Methods

Research design

An integrative review was undertaken following the five-stage integrative review process described by Whittemore and Knafl[8] consisting of problem identification, literature search, data evaluation, data analysis, and presentation.

Data sources and search strategy

Searches were conducted in the electronic databases CINAHL, Medline, Nursing & Allied Health (Proquest), PubMed, Johanna Briggs Institute Evidence Based Practice (JBI EBP) and Embase, using the strategy outlined in Table 1. Studies that were published in English post-2007, to reflect current telehealth education models, were included in the review. Reference lists of included studies were then hand searched for potentially relevant articles and included in the search results.

Table 1: Search strategy applied to databases

Search number	Search terms
S1	Doctor or medical officer OR MO OR medical physician
S2	Registered nurse OR nurse OR RN
S3	Allied health OR healthcare professional OR allied health care
S4	Rural OR remote OR rural and remote OR isolated
S5	Telehealth education OR video conferencing education OR VC education
S6	(S1 OR S2 OR S3) AND S4 AND S5

Inclusion and exclusion criteria

Studies were included if they were published in a peer-reviewed journal and met the following inclusion criteria: (1) telehealth to provide targeted clinical education, training or supervision; (2) health practitioners including doctors, nurses and allied health; (3) rural or remote setting (including underserved). Studies were excluded if they (1) were written in a language other than English; (2) editorials, commentaries, news items, grey literature, could not be sourced, poorly constructed or written papers that made understanding difficult, and if their content did not meet inclusion criteria. In relation to inclusion criterion 1, targeted clinical education was related to education about clinical presentation types rather than health service process or mandatory education that is not focused on clinical practice. The authors chose to limit the inclusion of mandatory or process-driven education owing to the prescriptive nature of this type of education. The main area of interest was for patient outcomes, practice improvement, or clinician professional development.

Data extraction

One reviewer (MS) screened all records for relevance to the topic and excluded articles based on title or abstract that clearly did not meet the inclusion criteria. Two independent reviewers (PC, MS) assessed full-text articles for eligibility. Data were extracted by six reviewers (PC, MS, LT, SW, SWO, COB) and underwent consensus review until agreement was reached for final inclusion in the review.

Restrictions were not placed on study/methodology quality before information was extracted from articles and summarised into a table for review. The following data were collected from the included studies: first author, country of publication, aim, sample size, study design/methodology/intervention, relevant results/findings and recommendations, limitation/bias. This enabled a thematic summary of the studies' findings (see Table 2).

Table 2: Thematic summary of the included studies

Theme	Subtheme/details with articles
Improved practice change	Decreased opioid prescribing, patients on opioids and benzos, no. of opioid users [refs 9, 15, 28, 34, 57] Increased implementation/testing/screening of patients [refs 35, 53, 58] Reported practice change/improved clinical practice [refs 25, 32, 41, 43, 44, 53] Tested practice change [refs 15, 58, 62] Ripple effect – increased over time for clinics where education was happening [refs 16, 25] Increased referrals/accessing videoconferencing consultation [refs 15, 19, 22, 26, 57]
Improved clinician confidence	Significant increase in confidence of clinicians (general clinical confidence and confidence to treat) [refs 12, 14, 16, 19, 20, 22, 25, 30, 39, 41, 47, 57, 58]
Increased clinician knowledge	Self-reported knowledge gains [refs 10, 12, 20, 25, 31-33, 39, 41, 51, 53, 54] Tested knowledge gains [refs 9, 38, 48] Increase in certified staff [ref. 59] Application of knowledge to practice context, increased awareness of guidelines for practice [refs 9, 12, 19, 31, 41, 49] Be a resource for others after education: participants reported ripple effect of education because they would share knowledge and be a resource for colleagues after they participated in education [refs 16, 25, 41]
Improved self-efficacy	Increased self-efficacy [refs 14, 20, 25, 32, 39, 45, 53, 60]
Increased clinical competency	Tested competency [ref. 51] Self-reported clinical competency [refs 10, 12, 20, 31, 54, 65] Extends scope of practice for some clinicians by using clinical supervision and by increasing confidence to treat [ref 64]
Sense of community and interaction decreases isolation	Developed sense of community, which is important because this decreased isolation; decreasing sense of isolation important to rural and remote practitioners [refs 12, 16, 26, 27, 39, 42, 49, 55, 57, 60] Could access education/professional development [refs 11, 21, 23, 24, 42, 64, 66] Access/collaborate with MDT members [refs 12, 29, 49, 63] Access support from peers [refs 11, 24, 66] Good opportunity for debriefing [ref. 24] Decreased stress [ref. 16] Viewing recorded sessions highlight practitioner isolation [ref. 16]
Improved patient outcomes	Decreased HbA1c [ref. 56] Decreased mental health presentations to the emergency department [ref. 25] Prevention of HIV transmission between mother and baby [ref. 41] Case conference/studies contributes to improved patient outcomes and clinician confidence [refs 11, 24, 28] Clinicians reported improved health outcomes for patients [refs 11, 25, 65] Reduction of patient travel to access the care needed [refs 22, 52, 63]
Satisfaction, activity and reach equals acceptability and feasibility	Reach was reported as a measure of acceptability, and feasibility with no drop out or low attrition as a feature of this, authors described expanded reach as a positive outcome [refs 24, 39, 50, 60] Almost all studies reported high satisfaction levels with the education provided [refs 12, 18, 19, 21, 23, 24, 27, 28, 30, 32, 38, 47, 51–54, 60, 61, 65]
Successful VC education has specific characteristics	Participants reported positive features of education being: • Interactive group discussions supported more learning than non-interactive sessions [refs 23, 29, 38, 39] • Increased professional support [refs 11, 25, 47, 57] • Relevance to clinical practice [refs 24, 29, 39, 61] • Useful (more useful for doctors and nursed compared to allied health) [refs 23, 47, 48] • Having a variety of presentation topics [ref. 30] • Where interactivity was a focus, able to develop clinical reasoning [ref. 55] • Repeated education sessions increase uptake [ref. 47] • Locally generated content increased local uptake of VC education [ref. 47] • Didactic sessions and case studies of equal value [ref. 49] • An opportunity to connect with other rural and remote health practitioners (networking for support) [refs 13, 19, 45, 63, 64] • Availability of telehealth (videoconferencing) education improves recruitment/retention of young practitioners to rural and remote locations [refs 13, 67] • Motivations to attend included upgrade skills, knowledge and gain confidence in treatment provision [refs 11, 37, 49] • Clinical supervision via videoconferencing provided patient benefits (staff more confident to treat locally) [refs 22, 47] • Able to develop more reflective models of practice [ref. 19] • Can ask for future education topics to suit needs [ref. 24] Other feedback: • Education not valuable when didactic only – want more case studies and interactivity – if not interactive, face-to-face teaching is superior. Face to face rated higher than e-learning web only content, videoconferencing rated higher than e-learning (facilitators state easier to verbalise complex case study than write them) [refs 37, 55] Teachers using videoconferencing to support and teach must be: • knowledgeable [ref. 4] • approachable, personal [ref. 52] • comfortable with topic [ref. 4] • comfortable on camera [ref. 4] • comfortable with equipment and technology [refs 42, 63] • comfortable with teaching techniques [ref. 4] • able to create a confidential, comfortable and safe learning environment [ref. 52]. Educator training: • Nurse educators need support to adapt style to videoconferencing sessions [refs 4, 52] • There is a specific format needed for successful videoconferencing teaching [refs 4, 52] • Nurse educators need to be comfortable and confident in front of camera otherwise negatively impacts on user uptake and engagement [ref. 4] Users need orientation to teach and teaching style/expectations: • need to have an orientation to the technology (otherwise less likely to use in future or get best use of the teaching session) [ref. 52] Consistency: • Single point of contact for enquiries important [ref. 63] • Consistency of content important in repeated sessions [ref. 48]

VC education is acceptable and feasible for rural and remote clinicians	Videoconferencing education reported to be acceptable and feasible in most areas (except where low level of internet available) and as good as a face-to-face lecture [refs 4, 38, 48, 60] Videoconferencing education is a viable system to overcome barriers associated with accessing education in rural and remote areas. Remote and rural staff feel that videoconferencing is a good professional development option, particularly in areas where access to education was scarce and it was difficult to gain cover for leave to travel for education [refs 21, 23, 24, 27, 37, 40, 47, 48, 52, 65] Pass rates similar between videoconferencing education and face-to-face education with no difference in time taken to complete education [refs 37, 51] No difference in knowledge retention comparing videoconferencing to face to face [ref. 46] Decreased staff travel time due to geographical isolation [refs 24, 27, 37, 63, 65] Increased willingness to enrol and learn [ref. 37] Attend education more regularly [refs 19, 37] Increased flexibility to help with personnel variability and distance from education site [ref. 33] Met significant need in rural and remote practice because it gives access to information, conversations with tertiary staff, support and maintain confidence in providing care [refs 4, 22, 24, 47] Desirable to have access to continuing education that is live and interactive and accessible (videoconferencing) [refs 13, 38, 65] Shorter education time recommended (education was 5–7 hours long via videoconferencing), increased frequency and repeated sessions at different time frames [ref. 32] ECHO model is proven to be acceptable and transferrable to almost any topic area, and can be a source of rapid evidence dissemination [refs 11, 12, 33, 36, 58] Telehealth/videoconferencing teaching is superior to e-learning (online web content) due to ability to be interactive, real-time connection as learners can get clarification immediately, but needed local clinical champions to support uptake to increase implementation/intervention integrity and sustainability [refs 27, 35, 36] Where infrastructure already available, online and videoconferencing is much more cost-effective than face-to-face training (face-to-face is five times more expensive than online) [refs 22, 35, 38, 65]
Technology can support or hinder education in rural and remote communities	Technology: • Videoconferencing technology is relatively easy to use, convenient, not a lot of issues [refs 22, 32, 38, 63]. • Where technology issues were experienced, this was mitigated (as far as participant satisfaction) by the connection between facilitator and participant [ref. 19]. • Over time, facilitators become more effective in troubleshooting technology issues in real time. • Computer-based training well accepted in many environments [ref. 17]. • DVD vs videoconferencing teaching – no difference in knowledge retention. Where internet is poor, DVD is preferred. DVD also can be watched multiple times (in this case, participants could not ask questions of teacher in the videoconferencing sessions, therefore not interactive) [refs 18, 46], Technology issues: • DVD and videoconferencing but at least DVDs could be watched later [ref. 46] • Poor quality audio and video decreases satisfaction [refs 24, 37] • Overloaded hospital servers decrease ability for local infrastructure to be successfully used [ref. 24] • IT support needed to be available for rural and remote staff [ref. 42] • Connection issues [refs 24, 33, 37, 46, 49] • Must be able to be used on mobile devices [ref. 49] • With poor bandwidth, easier to hear than to see presentations [ref. 38]
Weak measures used to identify success	Unclear if self-reported confidence, knowledge and skill gains are representative of actual (tested) gains or clinical competence [ref. 65] In cohorts where testing confidence to treat across cohorts related to training received, rural and remote practitioners more confident to treat than metropolitan or regional practitioners [ref. 47] Less positive outcomes for some topic areas compared to others (more positive in pain management, opioid prescribing; not as effective in mental health or specialist pain like cancer pain management). Some felt HIV care should not be integrated into wider PCP systems – reluctance to give up ownership of management or share ownership and therefore sharing knowledge and education [refs 26, 40] Some participants unable to identify how their practice would change due to education received [ref. 21] Knowledge construction not achieved in some cases despite interactivity and educator encouragement [refs 42, 67]
Barriers to uptake include resourcing, scheduling and ease of use	Program complexity (sequencing) makes it difficult and less user friendly for participants [ref. 54] Costs: • In some areas, infrastructure is not available for reliable and fast enough internet to allow for video streaming [ref. 46] • Cost-effectiveness and sustainability often are not measured [ref. 15] • DVD is cheaper and easier in places with no internet [ref. 46] • Associated costs with providing support when needed [ref. 52] • Costs of protecting time of receiving clinician staff to access education [ref. 43] • Not all user organisations can provide infrastructure to support videoconferencing teaching [ref. 20] Scheduling: • Time of session and frequency = big impact on being able to attend [refs 16, 24, 49] • Length of time – some sessions too long to be able to commit to [refs 30, 32] • Time constraints when others are in charge of scheduling patient care into clinician time and education time is not protected [refs 41, 43, 54] • Clashes in scheduling with other events [ref. 41] • Lack of time to use resources identified in training [ref. 45]

Results

Study selection

The initial search using the search terms within the six designated databases yielded 7122 articles. To improve relevance of the search, a further screening of title and abstract only was applied to three databases – Nursing and Allied Health (Proquest), PubMed and Embase databases – as they had identified 4661, 1422 and 487 articles respectively. This screening reduced the total number to 914 articles. Duplicates were removed and then records were screened for relevance to topics. Then two reviewers (PC, MS) independently assessed 117 full-text articles for eligibility. An additional 79 studies were identified after reference list searching of all included articles and were added to the review. These studies were not identified in the initial search because of the variability of keywords that authors had attributed to their articles. A further 21 articles were excluded during data extraction and a final total of 60 articles were included in the study (Fig1).

A detailed summary of the 60 included studies is given in Supplementary table 1.

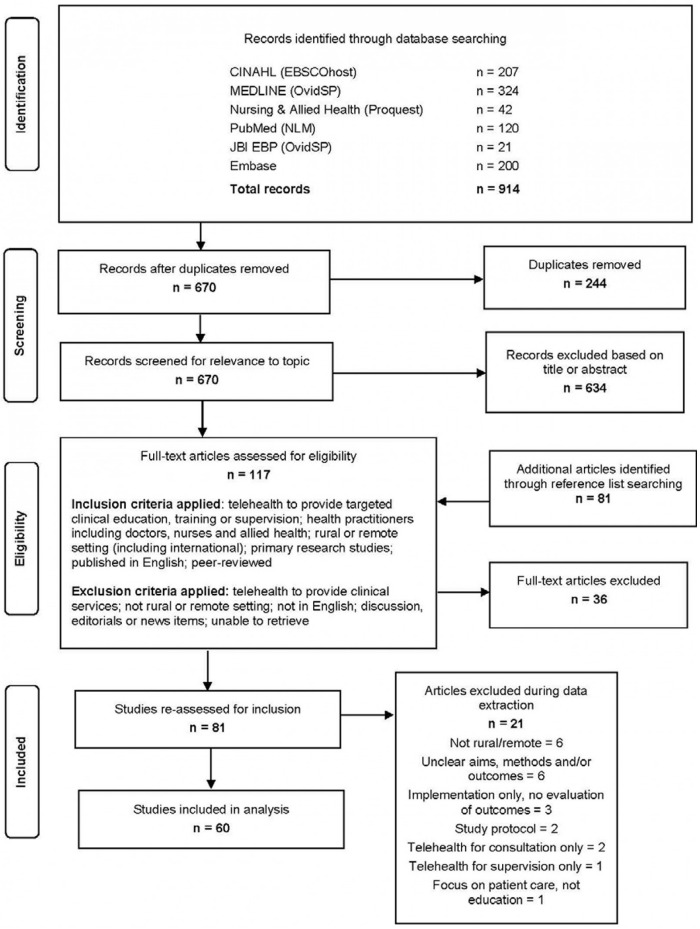

Figure 1: Modified PRISMA flow diagram of included studies.

Study characteristics

Studies were original research[8-57], conference abstracts[58-60], case studies[61-63], reviews[64,65], reviews and original research[4,66], or a randomised controlled trial[67]. (See Supplementary table 1 for details about study methodology.)

Supplementary table 1: Characteristics of the included studies

Countries of study intervention

Over half (60%) of the included studies were conducted in the USA only[9-12,14-16,20,21,23,25-27,30-32,34-36,40,41,44,45,48-51,54,56-62,67], followed by a smaller number of studies in Australia[24,29,42,43,47,52,63,64], Canada[16,19,52,53,55,65,66], the UK[37,55], the USA and Europe[33], US-affiliated Pacific Islands[17], Africa[4,13,18], Guatemala[38], India[39], Norway[22] and Madagascar[46].

Context

There was a range of contexts used to describe the healthcare setting in the included studies, including rural[15,18,19,21,23,27,28,30,32,33,38,40-46,48,50,51,55,58,60-64,68], remote[14,18,35,52,54,63,67], rural and remote[17,24,53,56,64,66], rural and underserved[10-12,31,39,49,57,59,67], underserved[9,25,33,36], rural, remote or underserved[16], isolated[13], regional[29], rural and regional[63], peripheral[37], remote military army and navy medical facilities[32,34], native communities[20,45] and US-affiliated Pacific Islands[17]. More specifically, one study[47] used outer regional, inner regional, remote and very remote locations. One study[21] classified 'rural' as defined by the Health Resources and Services Administration Shortage Designation Branch, US Government.

Population

Populations were divided into two specific groups, including the healthcare professional cohort who was receiving the education and the patient population the clinical topic was focused on. For example, studies focusing on the type of healthcare professional targeted included primary healthcare practitioners only[11,16,25,36,53,58,61,68], nurses only[38,51,52,68], physiotherapists[55], and psychiatrists and psychiatrist trainees[27]. Some studies targeted the clinical topic to a particular patient cohort, including veterans[14,15,26,40,42,54,56], Indigenous groups[20,21,28,32,45], current military personnel[33,34] and those in prison environments[12,59]. Within these studies, the majority (12 of the 16 studies) targeted multiple health practitioner disciplines servicing those particular patient populations.

Sample size

Of the included studies, participant numbers ranged from fewer than 20 participants[18,39,55,56,58,62,66], 21–50 participants[9-11,13,14,16,20,26,30,37,38,40,41,43,45,46,51,52,67], 51–100 participants[17,38,42,49,54,61], 101–500 participants[15,19,21,23-29,33,35,47,48,53,59,68], 500–999 participants[31,36,50], and one study with more than 1000 participants[32]. The smallest number of participants was 1[62], and the largest number of participants was 1079[32]. In four studies, the sample size of participants was not specified; however, the number of clinics and patients treated was provided instead[12,22,34,63]. In one study, the sample size of participants, number of clinics and patients treated was not given[60].

Interventions

Forty-nine studies applied a single combined intervention. This usually included didactic VC, along with case study discussions and/or interactive questions[9-16,18-24,26,27,29-41,44,45,47,49-54,56-63,67,68]. One study applied a combination of e-mentoring and group-based case study discussions[55]. Two studies compared two individual interventions – VC and DVD[46] and VC versus standard lecture[48]. One cross-sectional study compared two intervention arms – educational sessions with case study discussions against two control groups; another study compared four intervention arms – VC, audioconferencing and 'live' lecture including interactive questioning, and recorded presentation slides (inability to ask questions)[17].

Topics covered by telehealth education

Pain[9,14,16,26,28,31-34,50,54,61,67] was the most frequent health topic delivered by telehealth interventions, followed by psychiatry, mental and behavioural health[18,19,25,27,39,42,50,53,61], hepatitis C virus[10-12,15,45,48,50,65], addiction or substance abuse[9,16,32,36,39,50,53], diabetes[10,17,20,37,54,56], oncology/cancer care[18,22,23,28,52], paediatrics[29,38,55,59,63], HIV[35,40,41,50,57], unclear/unknown[13,42,65,66], opioid prescribing[9,16,34], variety of topics[21,64], palliative care[47,60], perioperative[51,52], oral health[17], metabolic syndrome[17], dementia[24], multiple sclerosis[30], antenatal/child health[38], medicine[44], sleep[44], liver disease[49], cardiology[54], physiotherapy[55], asthma[59], dermatology[62], midwifery[68] and antiretroviral therapy[68].

Current telehealth education models and resources

Within current telehealth education modules and resources, there were 10 themes identified: (1) improved practice change; (2) improved clinician confidence; (3) increased clinician knowledge; (4) improved self-efficacy; (5) increased clinical competency; (6) sense of community and interaction decreases isolation; (7) improved patient outcomes; (8) satisfaction, activity and reach equals acceptability and feasibility; (9) VC education is acceptable and feasible for rural and remote clinicians; and (10) weak measures used to identify success (see Table 2 for a summary of themes and subthemes).

Most VC education provided used a combination of didactic and case presentations[10,11,14,16,18,20,23,25,26,28-32,36-41,43-45,47,49-51,53,54,57,59,60,62,67], while others used a combination of VC and face-to-face interactions[19,35,62]. The sessions varied in length, often from 30 minutes to 1 hour[28,31,36,38,56], and up to 2 hours duration[9,10,12,46,53,60]. The frequency of sessions delivered varied from twice weekly[34], weekly[14,22,30,31,53,57,61,67], to monthly[23,28,45,47]. A discrete education model was identified in the literature called Project ECHO (Extension for Community Healthcare Outcomes). Project ECHO accounted for over half of the retrieved literature (33/60 or 55%), with only three of these occurring outside of the USA. The most common topic for Project ECHO was pain (n=9) followed by chronic disease management not specified (n=5), then mental health (n=4). The usual model for Project ECHO was a short didactic lecture (15–30 min) followed by two or three de-identified patient case studies with peer-led review of case presentations, and management recommendations all via telehealth or VC, with a focus on creating a community of practice to narrow the health disparity gaps. Project ECHO's focus is to support clinicians to access collaborative learning in a knowledge-sharing network model[69,70]. Most studies reported on followed closely to the Project ECHO model, with only some variations in frequency and duration of sessions, and all were focused on case study presentation. One study had added in a two-day onsite training session before using the usual Project ECHO model[20]. One study also had their didactic session pre-recorded, and the debriefing as a live session.

Telehealth sessions were regarded as being as beneficial as face-to-face sessions[38,68], while the technology was often challenging to some participants[13,24]. Educators' knowledge on how best to use telehealth or their technical ability also affected (either positively or negatively) the delivery and provision of education using this technology, and therefore the development of those providing education in this way should be ensured to improve delivery and outcomes[17,37,42,44,48,52,54].

Most of the education provided was delivered by specialists in the area or by multidisciplined teams[10,12,18,19,22-25,29,30,32,33,35-38,50,51,56,62,63] and this appeared to have a positive effect by increasing and promoting the development of professional networks[11,23,25,43,45,47,63]. Use of telehealth modalities for education also had other beneficial outcomes, such as feelings of decreased isolation for participants[16,27,39,45,49,57,60] as well as an increase in the availability and access to education opportunities[13,20,63,64].

Participants who had undertaken telehealth education also had increased levels of self-efficacy and felt that they were able to better apply what was learned to clinical practice[9,23,26,28,31,43,60]. There appeared to be an increased sense of support being provided[20,22] by using a telehealth education model, as well as increases in the levels of confidence of education recipients[10,19,20,22,23,25,30,39,47,57]. Recipients also reported that they gained knowledge as a result of attending telehealth education sessions[9,10,23,25,31,41,48,54,64] and satisfaction levels with education provided using this technology were high[17,19,23,24,28,53,60].

Quality of education provided through telehealth along with the facilitators of a successful service

Related to quality of education provided and facilitators of a successful service, there were three themes identified: (1) successful VC education has specific characteristics; (2) technology can support or hinder education in rural and remote communities; and (3) barriers to uptake include resourcing, scheduling and ease of use (see Table 2 for themes and subthemes).

Quality is not well established as far as agreed measures of what quality is. Satisfaction, level of self-reported confidence, knowledge gains, self-efficacy and engagement are all presented as elements of good education. Very few studies formally tested increase in skill or knowledge as is usual with professional development programs that do not result in further qualifications. For those that do (perioperative nurses, asthma educators and diabetes educators), formal knowledge and skills assessment indicates VC is comparable to face-to-face training with significant benefits related to travel reduction and therefore cost. Most of the Project ECHO publications that described clinical supervision relate education to patient outcomes such as measurable change in practice. Reach, extension of services through topic areas and new clinical environments, was presented as proof of acceptability. Although Sevean et al[52] and Chipps et al[4] touch on teaching styles, teacher comfort, expertise and ability to adapt to VC teaching, what enables or is deemed as successful education approaches is not presented in detail. Other studies relate advice on length of and time of day of the sessions both affect the ability of participants to attend. Related to this is

ensuring repetition of sessions to allow local uptake, and advocating the use of local champions to support local uptake, which all relate to success along with technology quality, ease of use and access to support.

The quality of education provided through telehealth has so far not been mentioned or addressed in the literature included in this study. Most studies report using case-based presentations and didactic teaching as a chosen method of delivery, but don't refer to the quality of material that was presented[2,4,10,12,14,16,17,20,21,23-32,34,36,38-41,43,44,47-49,53-57,59-63,67].

Some studies[14,25,34] mentioned the use of evidence-based or best practice guidelines in their sessions. While these studies stated that clinicians self-reported increased confidence and knowledge, no formal testing was done to substantiate this. Other studies highlighted clinicians' feelings of increased knowledge or comfort, but no testing or quantifiable measures were demonstrated or tested to prove these perceptions[9,16,19,20,28,38-40,47,48,57]. Knowledge scores improved in testing post VC education, showing improved learning; however, limitations are noted as to whether this increased knowledge is transferred into clinical practice[9,38,48].

There appear to be no definitions or agreed consensus as to what constitutes quality when using telehealth to deliver education. Feedback from participants indicated presenter approachability/connection[19] and presenter comfort with equipment/technology[4] were issues that affected engagement. Educators felt that there was a need to alter or adapt teaching format or style[37,42,52], but the details of what should be altered or how were not clearly presented.

Specific recommendations were difficult to synthesise as the focus of education strategies used was extremely broad. This was complicated by limited evaluation of education strategies used and perhaps this is an indication that we are still in the phase of proliferation of publications that describe rather than evaluate a new intervention/approach. The few papers that do evaluate quality or outcomes of using a telehealth strategy for education may be the start of the professional conversation of questioning how to use a new approach like VC for telehealth education, most effectively for health professional education in rural and remote settings.

The 13 themes and subthemes distilled from the selected are presented in detail in Table 2. These included the following (theme names in italics).

Improved practice change, which focused on the changed practices of the clinicians as a result of engaging in the education provided. This was closely linked to patient outcomes as a result, and to *improved clinician confidence* and *increased clinician knowledge and improved self-efficacy.*

Increased clinical competency related to tested clinical competence, whether this was tested or self-reported, and in some cases extended the scope of practice of the clinician.

Sense of community and interaction decreases isolation related to being able to collaborate with peers, access support and as a result feel more connected and reduced stress related to being a healthcare practitioner in an isolated environment.

Improved patient outcomes related to measurable patient clinical outcomes and being able to access health care in a rural or remote environment for a broader scope of care.

Satisfaction, activity and reach equals acceptability and feasibility was closely related to *weak measures used to identify success*; however, this would benefit from more robust outcomes-based research.

Successful VC education has specific characteristics focused on relevance of the education to the target audience, being interactive in nature, providing a mixture of educational approaches, and tailorable to what is needed locally. Specific educator skills and characteristics also made up a large portion of this theme; for example, being knowledgeable, approachable, comfortable with equipment, being able to create a confidential, safe and comfortable learning environment. Training for educators also features aspects such as being able to adapt teaching style to VC sessions, using a specific format, technological skills, and accessibility for questions and consistency of session information presented across multiple groups.

VC education is acceptable and feasible for rural and remote clinicians related to reported satisfaction of participants, being able to attend education, decreased time and money required to access education, and the additional benefits of having VC education frequently versus face-to-face education sporadically.

Technology can support or hinder education in rural and remote communities is related to how much support and infrastructure is available to troubleshoot issues, quality of original set-up of easy-to-use systems. Barriers related to poor audio quality and video capability, overloaded servers that were not set up for the increased traffic, and ability to access on mobile devices.

Barriers to uptake including resourcing, scheduling and ease of use included complexity for end users to complete the education, availability of times that sessions are scheduled, infrastructure of equipment and training for clinicians to use the equipment, being released from clinical work to attend education, session length (some are too long to be able to work with clinical needs locally), lack of time to use resources that are identified in the education, being able to attend sessions when scheduled (therefore if they are recorded, or run multiple times) and scheduling clashes.

Discussion

Telehealth continues to grow into novel application areas faster than evidence exists to support uptake. Using telehealth for education delivery is clearly well established in the literature, but less well measured. This gap is particularly noticeable in this review, specifically in relation to the third objective – establish the quality of education provided through telehealth along with the facilitators or enablers of a successful service. The authors are unable to make specific recommendations about the quality of education that should serve as a guide for future educators and researchers when they are designing telehealth education approaches and evaluation of their services. VC was the most used strategy in the telehealth suite of education; however, it was used variably and perhaps not to its full potential. For example, assessment of clinical skills after the attendance of education could be undertaken by videoconference, enhancing support for rural and remote nurses and midwives in their endeavour to maintain clinical currency. This has been

demonstrated in specific care areas such as the use of tele-ICU to support rural nurses caring for critically ill patients, providing teaching, assistance and further education in real time[5].

This study found improving practice change was a theme related to telehealth education provided to health professionals in rural and remote areas. However, the measures supporting this outcome were not rigorous. Future research related to quality measures of tangible outcomes is needed. This is not specific to VC education; measuring practice change as a result of education provided is more complex and needs careful planning to be able to creditably achieve clear outcomes because often training is not the only answer[68]. While patient education can be measured directly by observing behaviour change and asking their intention to change behaviour, this is more complex to do with clinician education outcomes. There are many more factors involved in measuring outcomes of clinician education in addition to increased knowledge, intention to change practice and observed practice change. This would be an interesting and valid area of research to develop more effective approaches to measuring education outcomes within the health professional cohort.

In one integrative and thematic synthesis[71] that investigated education and professional opportunities in rural and remote environments when using telehealth programs, engagement and participation was found to be further enhanced by the personalisation to the program, contributing value and meaning. This is closely linked to several of the current themes. For example, social isolation was reduced, and networking opportunities provided with the interactive learning were found to be most effective as an education technique for influencing patient outcomes[71]. Regardless of geographical location, the use of telehealth to provide education to health professionals in rural and remote areas is seen as feasible, cost-effective and beneficial[69,72]. While this may not have clear economic measures outlined in the studies included in this review, the unequivocal potential for economic savings simply due to decreased travel is clear; and this becomes more attractive the more geographically distant clinicians work from their preferred education sources. An interesting example of this was a study on shared care models trialled in the Kimberley region of Western Australia, where telehealth provided patients with specialist care and health professionals with education sessions. This significantly reduced time normally taken to travel to specialised care for patients and education for staff[73].

One of the most widely applied models for telehealth education for clinical staff is the ECHO model. The ECHO model has been used worldwide, incorporating the use of telehealth to impact a lack of resources in rural and remote areas, applying case-based education to manage intricacy and the sharing of best practices[69,70]. The ECHO model applies four principles: use technology to influence limited resources, impart evidence-based practices, individual patient-based education, and an internet database to monitor outcomes[69,70,74,75]. Of all the education models reported on in the literature, the ECHO model had the most replicable approach, although this may only be because other education models have not been presented in a way that makes them easy to replicate and implement in different environments. Project ECHO presents a scalable, low-stakes, relatively low resource-intensive approach (apart from the telehealth infrastructure) to providing education to health professionals that does not require specific educational skills or resources on behalf of the presenters. Didactic presentations are short and therefore should not take a lot of resources to develop, and case study presentations are chosen from recent practice, thereby improving relevance. There was little discussion in articles about the disadvantages of implementing Project ECHO; however, it is likely that while having a specific structure can assist scalability, it can also be a barrier and lack flexibility. Additionally, as it is peer led, there is little training about 'how' to undertake education for your peers that would help support and sustain this model. Staff also undertake this model most often in their own time, which can have financial implications.

To support retention, the World Health Organization[72] advocates for continuing education together with professional development programs to be made available for rural and remote health professionals from their home locations. It has been identified that VC is a viable, cost-effective means of providing education to rural and remote staff[69,70]. However, VC education is not without its challenges, including internet connection issues in remote areas and the ability of staff to work equipment[1,6,18,76].

There are no hard measures for success; however, success has been indicated by the overall accomplishment of the reportative qualitative feedback and the proliferation of different programs using telehealth. There needs to be higher level evaluation research planned and undertaken to provide further evidence of the effectiveness of telehealth education and its impacts on patient care.

Another interesting finding was the wide variety in clinical education topic areas covered by the included studies. Pain was the most prevalent topic area. It could be argued that since pain is a common reason for seeking health care[77] and managing pain effectively is complex, there is a significant need for clinicians to access education about pain management. An alternative reasoning is that perhaps those who provide pain education have had to provide professional development to others via alternative approaches for a long time, and therefore have better established services in this regard.

Recommendations for supporting and developing an education model for rural and remote health practitioners through telehealth

Positive factors for the use of telehealth include the ability to have real-time interaction and active participation, facilitating questions, receiving clarification and discussing care presentations[23,38,42]. This has been demonstrated in studies undertaken with the ECHO model, with participants indicating they had increased knowledge, liked group discussions and felt a reduction in professional isolation; however, the impact on patient outcomes warrants further exploration[9,19,20,25,28,39-41,47,65]. Duplantie et al[66] discuss the use of the Delphi study involving 12 participants and how education via VC could impact positively on recruitment and retention, providing the ability to work in collaboration to help recruit and retain staff.

Program evaluation and curriculum development, training for educators and staff accessing VC education would need further consideration for program success. This includes development of educators to enable content transfer to participants, and being able to adapt to the needs of participants, format and style for program success[18,29,44,52,54,60,62].

The identification of participant barriers for education via VC needs to be explored, including education provided, time and length of sessions, internet availability, equipment instruction and facility-level barriers[24,26,32,37,43,45]. Further measures beyond participant satisfaction need to be considered for evaluation of program success, including practice change and impact on patient outcomes[9,19,20,25,28,40,41,44,47,65,66].

In future studies, recommendations to improve the quality of studies reporting on using VC to deliver education in rural and remote environments include:

1. Use multiple success factors to test for within the study, including education model, teaching approaches, skills of facilitators, technology components and infrastructure, to publish a set of principles, skills and abilities. These measures should also consider the following aspects.

2. Report or measure the alignment of education aims with results being reported:

- Should satisfaction of participants be the only measure of success?
- Does reach equals acceptability or is it reported as a measure because that is all that is available to the researchers?
- What is the feasibility related to local infrastructure and resourcing (which will vary and may not be transferrable)?
- What does good teaching in a VC format look like and why do participants and teachers feel this way?
- In relation to interactive education, is all interactivity equal? Does the interactivity serve application or key educational goals?
- Are there specific teaching approaches that influence learning and retention of learning within the VC format?
- What level of participant input makes a program successful? What are the measures of success? Why have these measures been chosen? How do they align with educational goals?
- What measures make most sense for the level of education that best fits the aim of education (eg access to education vs practice change will have very different measures)?
- What level of training or what training is needed for educators/facilitators to adapt to teaching via VC? What resources are developed, and can these be made more widely available?
- ECHO is a model that has been widely adopted by practitioners for practitioners and clinical supervision. Are there other versions/models that can be replicated (recommend Delphi study to gain consensus of acceptable model components)?

Limitations

The limitations in this study include variations in what defines a rural or remote area and the variety of settings where studies were undertaken. Another issue was the quality of the studies included. Outcome measures were generally weak, and therefore recommendations cannot be made on this basis; however, if all studies were excluded for this reason, there would be very few to include in this study, and the authors feel that this is a finding in itself. The nature of the emerging work in this area means there is some way to go in improving the research design of education program evaluations in telehealth use for health practitioner education in rural and remote areas.

Conclusion

Telehealth education, and in particular VC, is seen as a viable, cost-effective means of providing education to rural and remote staff[78,79]. With technological advances, a variety of education resources can be made available, impacting on knowledge and skills in the rural and remote arena, and assessment of knowledge and skills can be assessed by VC methods.

However, VC education is not without its challenges in rural and remote areas, including poor internet connection and the clinicians' ability to operate equipment[1,6,76]. It is highlighted that equipment familiarity is essential when using VC for education, and Chipps et al[2] discusses the importance of well-defined guidelines and operating instructions with videoconference use to alleviate concerns of participants and educators.

Notwithstanding the methodological limitations of the studies, there appears to be adequate evidence for VC education to have an impact on cultivating knowledge for rural and remote nurses and midwives. The paucity of high-quality research warrants further investigation focusing on scrupulously planned studies. Larger studies evaluating effectiveness of videoconference educational interventions pertaining to the impact on knowledge and skills is needed to quantify the scholastic gains.

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