Chapter 3.2.2

TELECONFERENCING IN
RURAL AND REMOTE MEDICAL EDUCATION

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Introduction

Educational methods that counter the barriers created by the distances implicit in rural and remote sites support both the learning of the professionals themselves as well as contribute to the efforts to deal with rural health workforce shortages. The development and effective use of distance education approaches is key to enabling these personnel to maintain and improve their qualifications without excessive travel and time away from the community and the patients.

Recent improvements in technology – including sophisticated teleconferencing systems – have provided one set of practical solutions to bridging this gap. As this is relevant for undergraduate medical students as well as qualified clinicians undertaking professional development, both the higher education sector and other training providers are affected.

Throughout this chapter we use 'teleconferencing' to include terms such as videoconferencing and webconferencing. Technological developments have made video communication easily available through smartphones, tablets and personal computers as well as auditoriums or meeting rooms purposely designed with multiple high definition (HD) large screen displays, which create the illusion that participants are in the same room. The usability of teleconferencing systems is, in part, always dependent on technical capabilities.

This chapter discusses the use of these systems in diverse medical education activities, specifically technical and educational considerations in rural and remote settings. We provide an overview of the potential of teleconferencing systems for educational purposes in rural and remote settings – and employ a case study of TelePresence, a high definition teleconferencing system, to illustrate application in a rural setting in Victoria, Australia.

Context of technology-based distance education

Teleconferencing systems can be defined as real time interaction in which participants at one or more locations communicate via an interactive audio-video communication system employing electronic devices (1). This allows for engagement between sites without having to meet physically, a key feature being the opportunity for interaction, critical for constructivist approaches to learning where knowledge and meaning are created through dialogue (2). Teleconferencing systems can be used for teaching, consultation and diagnosis.

Studies have shown the effectiveness and efficiency of learning and teaching using teleconferencing systems (3,4) which are reported as being an appropriate alternative (5) or, in some cases, as equivalent to 'in-person' teaching sessions (6,7). It has also been shown that improved access when using teleconferencing systems increases participant attendance(8).

There are many different approaches to the delivery of distance education, some of the commonly used ones being listed in Box 1.

The Australian College of Rural and Remote Medicine uses a learning management system (LMS) system to connect members in supporting a range of educational activities (9). This enables participants to upload presentations (e.g. PowerPoint) and discuss their contents in real time. The success of the process is, in part, dependent on thorough orientation to the system. Prior to use, participants are asked to check the specifications of their own computer and, once logged in, are guided through the basic functions in an interactive process. The advent of faster and more accessible internet, as well as improvements and reduction in costs of smartphones and tablets, has resulted in a rapidly changing landscape of educational methods.

Box 1:
Commonly used systems for synchronous
and asynchronous distance learning

Synchronous learning	Asynchronous learning
- Teleconferencing - Videoconferencing - Webconferencing - Educational television - Instructional television - Direct-broadcast satellite (DBS) - Internet radio - Live streaming - Telephone - Web-based VoIP - On-line meeting software (like Adobe Connect) - Learning management system (LMS)	- Mail correspondence - Message board forums - E-mail - Video and audio recordings - Print materials - Voicemail - Fax - LMS

Currently, teleconferencing systems appear to be the most widely used and researched method of delivery in distance medical education in Australia. Most studies report the effectiveness of teleconferencing systems, including the benefits of reduced travel times (10, 11) (Box 2). Through providing an opportunity to offer teaching to a wider audience using reduced resources (12), teleconferencing systems overcome the barrier of geographic distance and can provide effective education that would not have otherwise been possible (7).

The effective use of teleconferencing systems is dependent on the availability of specific infrastructure - as they require adequate equipment including video and audio recording and projection, reliable high bandwidth internet connection, and appropriate software. Furthermore, it is necessary for there to be an understanding of the use of the system and how to troubleshoot if things go wrong. Together these can represent significant challenges and costs, depending on the chosen system.

Box 2:
Benefits and challenges of
teleconferencing and videoconferencing systems
in supporting teaching and learning

Benefits	Challenges
• Access anywhere • Access anytime • Interactivity for teachers and learners • Embedded/accessible through diverse hardware (e.g. smart phones, laptops etc) • Time saving (especially for reduced travel) • Access to otherwise unavailable resources • Teleconferencing systems can support skills-based teaching and learning by demonstration and/or feedback on performance	• Broadband capability • Non-user friendly interfaces • Surrounding physical space may need optimisation • Orientation to functionality required

When considering any teleconferencing system, it is important to define its educational purpose. In addition presentation resources may need to be adjusted from their original format to suit the system.

Audio quality is critical and includes volume, clarity and timing - and there needs to be a high-resolution image if skills demonstrations are included in the learning activities.

Technical considerations

Most systems are designed for meetings rather than education, so some have a fixed camera position without pan, tilt or zoom capacity. As the way in which participants appear on the screen is important for communication, teleconferencing systems are best used to *capture static situations* e.g. meeting rooms with participants seated behind desk/a table at both or all of the teleconferencing sites. When sessions require *high levels of interactivity* – like the need to stand and explain or show something – then the camera angle can become an issue. Where there is a fixed camera position without pan, tilt or zoom capacity, it is important to acknowledge who is in the room out of the camera view so that participants on either end know who is present and to ensure a safe learning environment.

Most teleconferencing systems have the functionality to share images and workspace, to interpret and discuss X-rays or ECGs, or to be able to interact with presentations, which can be highly beneficial where educational sessions require more than only verbal interaction. Alternative options are possible where systems do have this feature, however, or where the ability to edit and interact is limited.

If the visual quality of the teleconferencing system is in *high definition,* even the facial expressions of the participants are easy to read and the understanding of participants at the distant site is clearer. This clarity also aids the general understanding if audio quality is compromised. It is believed that the possibility of a 'picture-in-picture' mode[1] would be beneficial for everyone involved. If participants cannot see themselves or are unsure of their position on the screen, their interaction with the camera is affected.

Choosing a high definition system will often require a dedicated internet connection. However, as the volume of data increases substantially with the increased quality of the image. This may make the system vulnerable as a drop in up- or down-stream data may lead to a lost connection. This is a particular issue in rural and remote areas where internet connections are not always as fast or reliable as in urban areas.

Educational considerations

Overall, teleconferencing is considered beneficial for learning and teaching. Educational activities comprising varying levels of knowledge, attitudes and skills for learners with different levels of experience have proved feasible with teleconferencing.

Stand-alone high definition teleconferencing systems are suited to the varied nature of one-to-one and small group activities since this renders an image allowing detailed instruction and skill-based learning activities and/or supervision.

When teaching technical skills using teleconferencing, all instructions are delivered verbally, sometimes using visual demonstrations. This may be challenging for the teachers and learners since teleconferencing cannot include the physical guidance which can be offered with hand movements, handling instruments or other personal support when being taught in the same space.

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[1]   Picture-in-picture mode is where one picture is displayed on the full screen at the same time as another is displayed in an inset window on the same screen. The sound is usually from the main picture only.

Case study: Cisco TelePresence to support acquisition of knowledge, attitudes and skills

Our case study, based in rural Victoria, evaluated the use of the high density teleconferencing system CISCO TelePresence model CTS-500. The study was conducted over two years with 59 participants in 18 medical education activities, specifically focusing on facilitators and hindrances (13).

Mixed methods were used to evaluate the use of the technology including participant questionnaires, interviews and structured observations. Numerical data of qualitative ratings were entered into SPSS17.0 and descriptive statistics were computed. De-identified interview transcriptions and free text observations of the activity were analysed thematically.

All participants rated each activity higher than the aspirational mean of 4.5/6. The value of teaching had a mean rating of 4.5/6 (SD=1.6) and learning 4.9/6 (SD=1.9). Participants were most satisfied with the visual quality (mean 5.5/6, SD=0.7) and least satisfied with the physical space (mean 4.6, SD=1.3).

Overall, TelePresence was considered beneficial for learning and teaching, providing an appropriate alternative for direct teaching. Educational activities with varying levels of knowledge, attitudes and skills and across learners with different levels of experience proved feasible with TelePresence, and it created educational opportunities that otherwise would not be available to participants - specialist teachers and simulated patients. The system should not be seen as a replacement for direct teaching methods, however.

The superior audio-visual quality of the system and resulting intimacy was convenient and the ease of use facilitated teaching and learning. The presentation, image display function and audio quality had mixed responses. The fixed camera and poorly arranged physical environment were limitations. While the system is best suited for small group activities and clinical skills-based activities are viable, the latter may be improved by the inclusion of a mobile camera.

It is recommended that technical support be available during set-up and use, a picture-in-picture mode be included and integration of office suite software be improved to provide a joint workspace for display of presentations, images, editing or annotation of documents and file sharing.

According to the literature and our study, it is essential that educational activities that are other-than discussion-based and require some sort of demonstration or observation of skills or behaviour need a higher quality image. This is also the case when teleconferencing systems are used for patient consultations as the higher quality image will facilitate the ability to read the patient's non-verbal cues and facial expressions as well as to assess their condition, e.g. a rash.

Practice pearls

- Remote and rural health institutions use teleconferencing systems to overcome the barriers of distance for activities such as teaching, consultation and diagnosis.
- These teleconferencing systems are shown to be beneficial for teaching and learning, especially small group activities.
- Educational activities that require demonstration or observation of skills or behaviour may need higher quality images than those available on standard systems.
- TelePresence is a high definition teleconferencing system suitable for teaching some clinical skills.
- High definition systems may require dedicated internet connection as the amount of data moved is increased substantially with increased quality of image.
- These systems are typically designed with a fixed camera which can be a barrier in some educational sessions.
- Orientation for teachers and participants is important for effective use of any teleconferencing system.
- Although highly valued, teleconferencing systems are not a substitute for all on-site supervised hands-on training.

Conclusion

We have advocated the use of teleconferencing systems for educational activities in rural and remote areas to increase access to expert teachers and others without the need and cost of travel. Based on our case study and the literature, the use of high density teleconferencing systems is beneficial for teaching and learning, and has shown to increase the benefits of small group discussion and teaching as well as skills-based activities. However, these educational activities demand practice and commitment by the teacher/facilitator. This makes orientation to the system for the teachers and participants essential to optimise learning. Teleconferencing systems are a useful adjunct to hands-on experience but are not a substitute for all on-site supervised hands-on training in the development of competency.

Disclosure

The authors do not endorse or support any particular teleconferencing system. It is important to choose the system specifications according to need and demands for its use.

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Further reading

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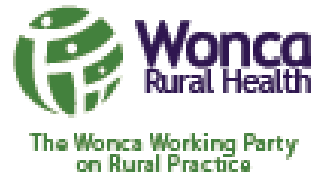
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