Tele-learning for health professionals: a rapid review

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EXECUTIVE SUMMARY

The Workforce Education and Development Group was commissioned by the SAX Institute, on behalf of NSW Health, to review the use of tele-learning technologies in delivering education and training materials/programs for health professionals. For the purpose of this review the term tele-learning will be used to describe the use of audio or video-conferencing facilities for distance-based educational purposes. It excluded the use of desk-top or internet based learning.

The research focused on the education of health professionals, but also included other professionals and significant tertiary student studies, providing a broader examination of the delivery of education via videoconference.

The following research questions were addressed specifically:

- Does education using tele-learning methods result in better or equivalent learning outcomes?

- Is there evidence that some forms of tele-learning are more effective than others in achieving learning outcomes?

- Is there evidence that tele-learning supports the development and maintenance of multidisciplinary learning communities?

The literature regarding tele-learning, as defined in this study was found to be surprisingly small and often lacked scientific rigour due to the complexities of carrying out studies in this area.

There is little literature available comparing different forms of tele-learning and a gap in the literature included the development and maintenance of multidisciplinary learning communities through tele-learning.

However, the literature did indicate that tele-learning can be as effective as or equivalent to face to face learning in terms of outcomes. In addition, qualitative studies clearly established the value of tele-learning and "best practice' suggestions have been included in the analysis.

Educational methods and technology emerged as the critical success factors in terms of videoconferencing whilst participant preferences, access issues and cost were identified as other significant issues.

The report also identifies the increasing prevalence of internet-based technologies such as vodcasting, podcasting and desk-top conferencing being used in the delivery of education and the need to consider these technologies when planning any future delivery of education.

The following recommendations have been developed from the review to enable NSW Health to maximise the effectiveness of its video-conferencing based education:

1. A training program (or set of standards) should be developed for presenters/educators in videoconferencing education methods including templates for slide presentations, distribution of materials and the need for facilitators at each site

2. A training and etiquette program should be developed for participants of videoconferencing (including as a minimum an introductory component to the first live session that outlines how to get the most out of the medium)

3. Information sheets/checklists should be developed for each site which includes all relevant instructions for equipment and details for technical support

4. Each videoconferencing site should be equipped with a speakerphone as a back-up mechanism

5. A review of each sites technical capability should be undertaken, and this information made available and utilised when planning videoconferencing sessions

6. A model for optimal room set up for both multidisciplinary meetings and educational sessions should be devised and implemented at each site where feasible

7. Protocols should be established to support the use of videoconferencing for multidisciplinary team meetings

8. Where possible NSW Health should encourage alternate hosts of videoconferencing sessions to rotate the 'live' site

9. NSW Health should consider the provision of videoconferencing sessions exclusively to remote audiences

10. NSW Health should investigate internet-based education methods and how these could be integrated with and complement existing infrastructure

11. NSW Health should consider developing an evaluation framework to measure the impact of their tele-learning programs on multidisciplinary learning communities

12. NSW Health should clarify their service goals for professional development delivered via videoconference and use them to guide further planning.

List of terms

Term	Definition
asynchronous	Participants who are not physically present when a session is held are able to view or listen to the session
audio conferencing	Telecommunication equipment and technology which allows two or more locations to interact via two-way audio transmissions simultaneously
blog	A type of website, usually maintained by an individual with regular text, graphic or video entries
Camtasia	Software used to combine audio presentation with slide presentation
face-to-face/ traditional/ live	Participants are located in the same room as the presenter
interactive/ synchronous	The ability for participants at different locations to participate either via audio or visual means
Lectopia	System which automatically records the audio and visual of presentations for incorporation into other formats i.e. streaming, downloading, podcasting
multidisciplinary	Delivery of health services to a single patient by a group of health professionals with skills and qualifications in different health disciplines
podcasting	Making audio material available for viewing or downloading via the internet
streaming/ webcasting	Making visual and/or audio material available for viewing via the internet. This material can not necessarily be downloaded
tele-conferencing	Audio connection between three or more individuals using a telephone handset/speaker
tele-health	Delivery of health services to consumers via telecommunication technology
tele-learning/ tele-education	Delivery of education or training via telecommunication technology
tele-medicine	Delivery of health services to consumers via telecommunication technology
tele-medicine network/ tele-health network	The telecommunication equipment used to deliver tele-health or tele-medicine
video conferencing	Telecommunication equipment and technology, which allows two or more locations to interact simultaneously via two-way video (visual) and audio transmissions
vodcasting	Making visual and/or audio material available for viewing and downloading via the internet

1 Review methodology and search terms

Searches for relevant literature were conducted by two staff members. Both staff members reviewed each paper to ensure only relevant studies were included. Medical and educational databases, accessible through the University of Sydney, provided the basis for the search.

The review questions were refined (in collaboration with NSW health) before being translated into the following search terms; videoconference/ing, tele-learning, tele-education, , tele-medicine, tele-conference/ing, audio conference/ing, videostreaming, education, learning outcomes, multidiscipline/ary, face to face, professional development, CME, distance education, distance learning, E-learning, Online learning, Podcast/ing, Vodcast/ing, Webcasting. These terms were used to search the following databases:

- MEDLINE

- +Education

- EBM Reviews (Cochrane Database of Systematic Reviews; ACP Journal Club; Database of Abstracts of Reviews of Effects (DARE); Cochrane Central Register of Controlled Trials (CCTR));

- EMBase

- CINAHL

- PubMed

- 360°

- Summons

- Psychoinfo

- ERIC (Educational Resources Information Center)

- BEI (British Education Index)

- Google Scholar.

Extensive 'snowballing' searches using references from original articles were also conducted.

A manual search was conducted of the following journals:

- Journal of Telehealth and Telemedicine

- Telemedicine Journal and ehealth.

An internet search for other relevant reviews, reports and guidelines was conducted using the Google search engine. Additional searches for grey literature were conducted, which included databases, government reports, agency reports, reports from educational bodies such as universities and TAFE/vocational educational providers, (as detailed by NSW Health in the project proposal). Search terms used included 'video conferencing', 'tele-learning', 'education', 'multidisciplinary' and 'learning outcomes'.

122 articles were located within the search terms that were pertinent to the literature review. Of these, 47 intervention studies were identified as being relevant to this paper, comprising:

- 7 Randomised Controlled Trials
- 14 Comparison studies
- 26 Descriptive (before and after) studies.

A tabulation of these papers is included in Section 10 of this report.

Search filters

Searches combining the main categories did not generate excessive numbers of references so study type filters were not applied and results include qualitative, comparison, observation and evaluation studies, randomised controlled trials and systematic reviews.

Exclusions to the study included:

- Articles or papers published before 2000
- Papers not relevant to Australian health system
- Papers discussing implementation at lower than bachelor levels
- Any internet based education i.e. online learning/web based learning
- Articles relating to health care delivery via telemedicine
- Articles detailing technical specifications/IT equipment requirements for videoconferencing.

2   Literature analysis

Introduction

This review has found that the literature available on tele-learning is surprisingly small, and that the majority of studies are descriptive in nature, with few studies rigorously comparing tele-learning with traditional formats. These finds are consistent with the findings of others.[1-4]

In addition to there being only a relatively small number of studies available, the findings of this study and others like it indicate that caution must be taken when interpreting the results of these studies as they often lack an established evaluation framework, and it is difficult to control the many independent variables.[2,5,6,7]

However, with the above caveats in mind, the literature available does indicate that tele-learning can be an effective means of delivering education, and that there are a number of protocols which can be implemented to maximise the effectiveness of this medium.

Research question 1:
Does education using tele-learning methods result in better or equivalent learning outcomes when compared to traditional face-to-face methods?

Four randomised controlled studies and ten comparison studies were located which measured learning outcomes of tele-learning versus traditional face-to-face education. This supports the *"No Significant Difference Phenomenon"* established by Russell[8] which continues to collate evidence demonstrating no significant difference in the learning outcomes of technology based distance education compared to traditional face to face methods. The scientific rigour of these studies is not strong however, with many studies noting significant limitations and failing to control for variables such as prior knowledge, ability, instructor experience and methods, and instructor and participant familiarity with technology. Limitations included small sample sizes and non-randomised selection of participants.

Of these studies, none of the four randomised controlled trials measuring learning outcomes were based in rural or remote areas. Only three of the comparative studies detailed students participating from a remote site with the remainder of the comparative studies conducted using cohorts at the same location or between two metro locations. There was also no evidence found to indicate that any particular profession/discipline has better learning outcomes or higher levels of satisfaction than any other – studies involved nurses, medical students, pharmacists, surgeons, physicians, emergency specialists, rehabilitation providers, urologists, paediatricians, social workers, anaesthesiologists, psychiatrists and medical residents – all with similarly reported outcomes.

Randomised control studies

Two randomised controlled studies[9,10] conducted with medical students and one with community nurses[11] found no differences in knowledge acquisition or learning outcomes between participants who attended lectures in a live setting and those who participated via videoconferencing.

A fourth controlled trial[12] used a digital lecture format, similar to streaming (but using the previous years lectures via a CD ROM) to compare performances of third year medical students in an examination in which no significant difference was measured between those who attended the face to face and those who attended the distance learning format of the lecture.

Significant control issues are present in these studies with some providing for a level of variables control, for example Spickard's study[9] consisted of the same lecture being given by the same lecturer to groups of senior medical students who exhibited no statistical or educationally significant differences between demographic items, computer access and skills. Other studies however[10,11], do not specify any such variable control.

Comparison studies

Ten comparative studies[13-22] were sourced which supported the argument of equivalent learning outcomes for students in face-to-face and video conferencing settings. No comparison studies between face- to-face and any other form of tele-learning detailing differences in learning outcomes were able to be located.

Latour[13] evaluated performance and acceptance of distance (via videoconference) vs. face to face methods across two courses in the department of animal science at Purdue University, one undergraduate and one postgraduate. The study was conducted across two campuses and results showed no significant difference in exam results between the distance and live groups in both the undergraduate and postgraduate courses.

The effectiveness of delivery of a neonatal stabilisation education program by videoconference compared to face-to-face conducted by Leowen[14] was measured using a pre and post knowledge test. The course was delivered to four groups (two via videoconference and two face-to-face) of health care professionals and found no statistical differences between the groups in terms of knowledge level in the pre-test or in knowledge acquisition post-test.

Markova[15] conducted a study with 36 resident physicians located between two teaching hospitals in Detroit. The study consisted of 17 lectures delivered live and by videoconference delivered across both sites over the period of a year. Participants experience both methods and their knowledge gain was measured after each lecture with results indicating no significant difference between those participating in the live sites to those participating though the videoconferencing site.

Kidd[16] compared final course grades between two groups of undergraduate pharmacy students who participated in a clinical pharmacokinetics course either live at one campus or via videoconferencing at another. Results found no significant differences in student grades.

Using a cross over design, medical students at the University of Vermont participated in both a face-to-face and videoconferenced lecture program with exams measuring knowledge acquisition across both methods.[17] Results found no significant difference in results across both methods with students performing equally well.

Using the Self Evaluation Examination developed by the Council on Certification of Nurse Anaesthetists, Kerns[18] et al. found no significant difference between two groups of nurse anaesthesia students who completed a semester of didactic instruction via face-to-face or videoconference.

A comparison study conducted by Cronin[19] examined the feasibility of conducting assessment of neonatal resuscitation skills of Neonatal Resuscitation Program Providers via video conferencing and demonstrated that this could also be done equally effectively by video conferencing or onsite instructors.

A pilot study conducted with medical personnel in the US Affiliated Pacific Islands[20] evaluated three distance education modalities (video conferencing, audio conferencing and a recorded computer based format) in comparison to a traditional face-to-face lecture across two educational modules, diabetes/oral health and metabolic syndrome. Results of a post intervention test demonstrated no difference between distance and face-to-face participants.

Delivery of a training program for health workers in rural and remote areas of Western Australia working with at-risk young people was presented via videoconferencing over a 12 week period.[21] The same training was provided to participants based in a metropolitan area (Perth) in a face-to-face workshop. Learning outcomes measured by pre and post intervention demonstrated significant knowledge gain by both groups with similar levels of improvement between the distance and face-to-face groups. No variable controls were detailed for this study.

A study comparing the knowledge outcomes of a traditional versus videoconference delivered course on vaccine-preventable diseases conducted with health professionals across California, Indiana and Texas.[22] Results demonstrated no significant difference in the increase in knowledge for participants in the face to face and videoconference classes, in both an immediate and three month follow up which were both measured via knowledge surveys.

Research question 2:
Is there evidence that some forms of tele-learning are more effective that others in achieving learning outcomes?

Comparisons between types of tele-learning in relation to learning outcomes constitute a gap in the evidence with just two direct comparisons measuring learning outcomes between different tele-learning methods located. The first of these, a pilot study conducted with medical personnel in the US Affiliated Pacific Islands[20] was also included in the comparison studies as results compared several forms of tele-learning against each other and traditional face-to-face education. Comparisons between pre and post tests were conducted after participants attended workshops on diabetes/oral health and metabolic syndrome. Results of these tests demonstrated statistically significant increases in knowledge across all modalities but no difference between modalities.

Moridani[23] measured knowledge outcomes of an undergraduate course in pharmacogenetic therapy delivered across three sites of a university campus to three groups using on demand, asynchronous (streaming) and real-time, synchronous methods (interactive videoconferencing) in two consecutive years. Grade results from an examination completed by all participants displayed no significant difference between students across all three campuses, regardless of the technology used. Student satisfaction levels did however indicate a preference for either the live/interactive sessions or a blend of interactive and asynchronous methods.

In the only other tangibly relevant study sourced, Berner and Adams[24] found that the addition of video to an asynchronous audio presentation (delivered via CD ROM) did not result in a greater level of learning (or satisfaction) for students enrolled in a Master of Health Administration at the University of Birmingham when comparing results of post-presentation tests.

An evidence base as to optimal group size for any particular tele-education delivery method was also unable to be sourced. The need to limit number of participants in order to optimise learning

was identified by a number of studies[25,26,27] which noted that group size is also linked to technical capabilities. Larger groups were identified as potentially resulting in incorrect information being extracted, information being left unclarified and an increase in logistical problems [50, 53]. Smaller groups however were associated with positive learning environments[51] and a higher level of satisfaction as they allowed group discussion.[48]

Research question 3:
Is there evidence that tele-learning supports the development and maintenance of multidisciplinary learning communities?

Searches conducted failed to identify any studies measuring the effect of tele-learning on the development and maintenance of multidisciplinary learning communities illustrating a gap in the evidence. Literature relating to multidisciplinary activity in this area instead focused on the impact distance technology methods, such as videoconferencing, had on the conduct of multidisciplinary team meetings and the delivery of multidisciplinary care. This literature indicates that incorporating tele-learning technologies into the delivery of multidisciplinary care is feasible and can result in benefits to both clinicians and patients. Whilst participants continue to express preference for the face-to-face multidisciplinary meeting model, there is evidence of increasing acceptance of the videoconferencing model and studies detailing this are listed below.

A randomised control trial conducted with clinicians from the Macarthur Ambulatory Care Service[28] measured the effectiveness of conducting multidisciplinary team (MDT) meetings via teleconferencing and video-link (conference). Results showed that there was no difference in terms of time commitment between multidisciplinary case conferencing utilising these models. There was however, a higher level of satisfaction associated with the video-link approach. Another randomised trial measuring perceptions of group dynamics in face-to-face and videoconferenced MDT meetings was conducted with members of MDT's across a cancer centre and two district general hospitals in Scotland.[29] This trial developed a methodology to assess the technical performance and clinical effectiveness[30] with results showing multidisciplinary team members were equally supportive of MDT meetings being conducted by both methods.

A comparative study[31]conducted with clinicians across South Western Sydney Area Health reviewed the preferences of clinicians in relation to face-to-face or videoconferenced multidisciplinary meetings found that whilst MDT meetings were able to be conducted via videoconference, the face-to-face method was preferred. Recommendations resulting from this study included ensuring configuration of rooms supports a team approach as opposed to the more formal, panel-type set up. Basic training for participants in the use of technology and a centrally located camera also assist in creating more of the informal, open discussion was also recommended.

The feasibility of conducting multidisciplinary oncology rounds for remotely located surgeons via teleconference was reviewed by Gagliardi et al.[32] who found that the majority of respondents to an evaluation survey, (distributed to participants in a pilot study conducted within a cancer services network in Ontario), reported a high level of satisfaction with the videoconferencing format.

An evaluation of a tele-medicine link established between a tertiary referral centre and a remote primary care hospital to facilitate multidisciplinary oncology meetings[33] was conducted via survey with both clinicians and patients involved in the project. Results of the survey demonstrated a high level of satisfaction by both clinicians and patients in the use of videoconferencing to support the delivery of multidisciplinary care. Clinicians reported advantages in accessing peer review and support whilst patients supported the broader consultation process and in some cases, a shorter hospital stay. Recommendations from this study

included having a 'champion' in place at each end of the conference to promote the technology can assist, as can providing any information possible to specialist team members prior to the conference and integrating the conference into clinical schedules

An assessment of multidisciplinary team meetings conducted via videoconference between a specialised and regional centre for clients with traumatic brain injuries in Quebec[34] developed a framework to measure efficiency and found this mode of communication as efficient as face-to-face meetings. Technical issues were listed as a disadvantage of videoconferencing but participants noted the advantage of visual contact as opposed to the limitation of verbal via teleconference. The need for all participants to have clear, established roles and for a facilitator to be in place to ensure all members of the team are involved were nominated as key issues for effective videoconferences.

A comparison of emergency department staff evaluation of multidisciplinary team provision of care via teleconferencing and videoconferencing[35] indicated that whilst videoconferencing can assist in the delivery of clinical care by supporting the decision making process, the technology can also cause interruptions as some team members will need to leave their normal work sites to participate. Recommendation from this research included communication and leadership training for participants to enable them to work effectively in a virtual setting.

3 Teleconferencing

There is a scarcity of studies beyond 2000 relating to the use of teleconferencing for educational purposes, which likely reflects a shift from this technology to videoconferencing. A series of interviews and questionnaires conducted with a small number of public health professionals[36] indicated that whilst teleconferencing is the primary communication technique used by NSW Health staff, it is mainly used for meetings where distance is an issue or there is an urgent issue to be addressed. Participants were unreceptive to teleconferencing for educational purposes citing poor quality reception, the lack of a visual link and a generally absence of the skills required to interact without visual cues as the major reasons.[37]

To ensure this report reflects the evidence base and stays relevant to the operational context of NSW Health the remainder focuses on the factors that can improve and enhance video conferencing as an effective form of education.

4   Critical success factors

Although not directly linked to the primary research questions, the remainder of this report focuses on the factors that can improve and enhance the effectiveness of telehealth as an educational medium.

Educational methods

The literature review conducted by Greenhouse[7] highlighted the need for course content and teaching methods to be specifically developed for video conferencing. Preferred pedagogical methods identified by students and educators are discussed below with suggestions provided for best practice in developing or adapting courses for the technology.

Teaching with the technology

Lectures designed for face-to-face delivery do not necessarily translate to distance learning, interactive or otherwise[39,40] and educators need to ensure that teaching is driven by the curriculum content rather than the technology.[41]

Participants in numerous studies[42,43,44] indicated that they felt learning was optimised when the lecturer was organised, accessible, encouraged interaction and used appropriate teaching strategies and resources for the technology. Concerns of content, speaker and delivery style were identified as being more important to participants than the delivery method[45] with teachers recognising that they needed to make adjustments to their teaching methods in order to accommodate both local and remote audiences.[46]

The literature strongly argues that converting a face-to-face lecture into a videoconferencing format is not adequate. Suggested 'best practice' guidelines for educational methods in videoconferencing are as follows:

- Ensure educators have skills in using effective teaching strategies appropriate to the technology and to the class being taught

- Where educators do not have these skills provide them with the training to develop them

- Establish criteria for determining whether videoconferencing is the right choice for a particular educational content. Inappropriate content could include; psychologically sensitive or emotion based topics such as domestic violence or death, topics which require the sharing of personal/private information, topics which are heavily dependent on non-verbal cues or topics where time commitments are very short

- Educators must recognise that not all curriculums fit the delivery method

- Educators need to be able to recognise when and how conventional pedagogical approaches need to be reconsidered and when new ones need to be developed.

Interaction

In requesting a mix of undergraduate and post graduate technology students to rank the most important issues between traditional and distance education delivery, Schmidt and Gallegos[47]

recorded almost 40% of students ranking 'interaction with the instructor' as the most important and a further 33% ranking it the second most important. Clearly supporting this argument, Greenberg[47] identified interactivity as the key to successful videoconferencing.

The ability to interact with experts was nominated as having value by participants in a videoconferencing series.[26,38] In an evaluation of video conferencing for rural physicians conducted in Canada participants rated interactive discussion highly and requested increased opportunities for interactivity in future conferences.[48]

Evaluations indicated that students also enjoying the contact and input from peers[42,49] with participants in videoconferenced grand rounds reporting that they valued the sense of connection with colleagues.[50]

The personal connection and visual cues provided by videoconferencing were also identified by survey responses as being important for engaging participants[37] with the lower level of engagement able to be achieved with the audience and speaker cited as a reason why videoconferencing is less satisfying for remote participants.[45] Interaction is cited as a key strategy in videoconferencing.

Suggested 'best practice' guidelines for student engagement are as follows:

- Engaging students needs to be a primary focus for education providers when designing and delivering their sessions

- Breaking lectures up into small 10-15minute segments and ensuring sessions include a variety of activities such as paired or small group work, quizzes, case studies and Q&A presentations can assist with maintaining student's attention

- Educators should consider the options of giving one lecture to the live venue and another to distance sites or one to all with colleagues at distance venues who can then conduct Q&A at each site

- Alternating the hosting site whenever and wherever possible has also been promoted as a way to increase the sense of connection and engagement across sites as this provides remote sites the opportunity to lead the discussion and those who are normally the live audiences to have the 'remote experience'.

Technology

Respondents to a NSW Health qualitative survey[37] identified technology as both a barrier and enabler of videoconferencing citing availability of assistance, familiarity with equipment and associated training as key issues. These issues are examined below in terms of how technology equipment and training impacts the successful delivery of videoconferencing education.

Equipment

The impact of technical problems such as poor audio/video transmissions, disconnections, failure to connect, difficulty in viewing presentation skills, use of microphones in terms of hearing the lecturer and control of background noise was cited as a key issue by many studies.[1,46,48,50-55]

Reflecting the broad range of participant's demographics, and perhaps levels of expectations, responses to technical problems differed across the range of studies reviewed. For example, remote participants involved in an evaluation of grand rounds[50] indicated that they found the

videoconference valuable despite issues with technical quality whilst participants in another study[49] indicated that technical problems had resulted in them not considering using videoconferencing in the future.

Several studies identified that there were significant issues in terms of the physical layout of the room at the live site[26,38,44] which were contributing to technical issues such as sound quality at remote sites with speakers unable to be heard and background noise unable to be muted.

Following a review of reflective literature detailing authors experience in delivering videoconferencing the following 'best practice' equipment guidelines are suggested:

- Ensuring that all sites have appropriate, compatible equipment with the required technical capabilities in place and testing of this equipment is vital prior to any videoconferencing session. Testing should always be completed with enough time to address any problems that arise. Such testing needs to include the use of any audio/visual aids presenter may use so as presenters then have opportunity to modify if required

- Ideally, technical support should be available at all times and at all sites. Where in person support is not available phone numbers of support persons should be available. Back up arrangements need to be in place should equipment fail which could include options such as having speakerphones in place at each site to enable a teaching session to continue

- Investing in equipment and infrastructure is vital as high quality visual and audio capabilities optimise learning. Organisations also need to consider that additional personnel will be needed to provide training, monitor equipment and provide technical support

- Any materials should be prepared and distributed to participants prior to the videoconferencing session. Preparation and distribution of an agenda and a list of attendees also supports the smooth running of a session. Standard templates for PowerPoint presentations including font size, background colour etc assist in ensuring that presentations are visible to all participants

- The physical set up of room is important and facilitators should consider the best option in relation to both the number of participants and ensuring the receiving sites feel part of discussion. Cameras and microphones should be positioned to ensure all participants can hear and be heard and are captured on screen. Appointing a facilitator at each site can assist with these arrangements.

Training

A number of studies [26,36,42,43] identified the training of presenters and technical support for both local and remote sites as significant issues in the delivery of videoconferencing. Reliable equipment which both lecturers and students are comfortable with is needed[48] as when teachers were not comfortable the entire class suffered.[42] Inexperienced participants and their subsequent poor use of equipment can also detract from the experience.[48,56]

Study participants (teachers) facilitating a videoconference for postgraduate students in the UK[43] reported that technical training and assistance was very useful as they would have been unable to manage equipment without these. Outcomes achievable when technical equipment and skills are in place are evidenced by an evaluation of a remote interactive videoconference to enhance urology resident education[57] which was conducted between two tertiary care teaching centres. The conferences were conducted in purpose built facilities and experienced no technical difficulties. Participant levels of satisfaction were high with participants indicating

their ability to interact with the presenter was not at all hindered and could not have been better even if they were on site.

Training is clearly essential for presenters to ensure they are competent in using the technology.

Following are 'best practice' guidelines for presenter and participant videoconference training:

- Every site is different and hence presenters need to familiarise themselves with each site prior to any presentation including determining what technical support is available and how to access it

- Mechanisms and protocols for participants to communicate during and after presentation (i.e. teleconference/email/phone) should be established at the start of every session to maximise educational outcomes. Presenters are also required to speak clearly, wear appropriate clothing and maintain eye contact with all participants

- Participants also require training and, at the very least, an introductory session should be provided (within the first class) ensuring learners are comfortable with the technology. This can include acknowledging limitations and what can't be changed (i.e. minor delays in sound) whilst also establishing some protocols for how the session will run can also assist

- Specific protocols for using videoconferencing for MDT meetings is noted by several studies[31,34,35,50,56], over and above the need for participant etiquette guidelines and training in order to participate in videoconferencing. These studies noted that to bring the required sense of community, camaraderie and personal involvement to remote sites presents a major challenge and that conducting MDT meetings via videoconferencing resulted in social changes due to the lack of informality present in face to face MDT meetings. Specific techniques need to be in place to promote and facilitate discussion in MDT meetings and the placement of cameras and microphones can greatly assist in this. Having clear roles for all participants and a leader to facilitate everyone's right to speak is also important as is requiring all clinicians to be trained in communication in virtual setting when videoconferencing is used tor team work across hospitals.

5 Other significant issues

A number of other significant issues emerged from the literature which should be considered in the context of developing and delivering education via videoconferencing. These issues and their implications are as follows:

Participant preference

Participants in videoconferencing routinely reporting a high level of acceptability of this delivery model, but studies indicate that students prefer the traditional face-to-face model. Although medical students completing clerkships rotations in remote locations rated the delivery of training via videoconferencing highly, they rated the experience lower than those attending in person.[52] An investigation of videoconferenced grand rounds in Canada[56] demonstrated a significantly lower level of satisfaction for participants at remote sites compared to those at the live site. Further, a review of training activities provided by videoconferencing to health professionals in a university hospital[58] found that students reported participating more and feeling more comfortable at the local site whereas they felt they missed out on information at remote sites. Participants in several studies[1,36] reported not only a preference for face to face but also a perception that videoconferencing should only be used when face-to-face is not feasible and should complement rather than replace traditional teaching.

These findings emphasise the need to maximise the experience of the participants in a videoconference learning session to ensure their engagement and ultimate satisfaction with the medium.

Cost implications

Concerns regarding costs were raised in a number of studies[42,53] as to the purchase and use of videoconferencing equipment. In a Canadian study[51] participants were able to use the Telehealth Network at no cost but researchers noted the learning equipment cost would be $55,000 Canadian Dollars per site in addition to $27,000 for the facilitators' equipment at full commercial rate.

A number of studies[43,53] recommend that conducting a cost benefit analysis (of videoconferencing vs. face-to-face delivered education) may be worthwhile even if it doesn't result in actual savings as providing increased access at a cost that is not prohibitive may be adequate for the intervention to be deemed worthwhile.

These findings indicate that organisations need to consider whether the benefits of a videoconferencing system and associated equipment would offset the cost when deciding if this represents a good return on investment.

Access

A descriptive study conducted in Vermont and New York[43] detailing patterns of attendance at remote CME programs found that remote participants overwhelmingly indicated that access was

the primary issue and they only attended programs because they were offered via videoconferencing and meant they did not have to travel. This issue was not restricted to rural/remote participants but to any participants who were required to travel a significant distance to access the videoconference.

Access for rural health professionals was identified as important[38] with participants indicating that it provided the ability to communicate with distance audiences. Greenberg[7] identified a significant body of literature supporting the claim that video-based technologies increase access to education. Reviews of medical students able to participate in lectures via live videoconferencing included responses detailing the value of being able to be taught by lecturers that were otherwise not accessible.[44,45] The convenience of not having to travel was also reported as a benefit for facilitators.[43]

Reviews of training activities provided by videoconferencing to health professionals found that students appreciated the reduction in travel between sites and noted that videoconferencing allowed them to meet peers from remote sites[58], be exposed to future colleagues in the same discipline[46] and reduce the sense of isolation often felt by remote staff.[21,59] A review of professional development via videoconferencing in two remote mining towns in South Australia [60] further supported this conclusion noting that a level of comradeship was developed and clinicians felt less isolated as a result.

These findings indicate that access remains predominately (but not exclusively) a rural/remote issue in terms of both participating in education and connecting with colleagues.

Internet based technology

This review excluded internet based technologies in order to focus on the research questions and the optimal use of videoconferencing within the context of NSW Health. As previously stated however, the emergence of these technologies is changing the face of education delivery. Provision of live webcasts and the subsequent streaming of audio or video enabling students to view and or hear the asynchronous lectures in their own time, often in conjunction with a copy of the lecturers PowerPoint presentation, has become commonplace in tertiary institutions. Moderated online discussions (blogs), podcasts and desktop videoconferencing are also becoming increasingly prevalent. Hence any consideration of future directions in distance education methods would be remiss not to consider the integration of these technologies with non-internet based and traditional face-to-face methods. The integration of these methodologies (blended learning/Web 2) is arguably recognised as the new paradigm in education.

6 Recommendations

Ten recommendations were developed as follows:

1. A training program (or set of standards) should be developed for presenters/educators in videoconferencing education methods including templates for slide presentations, distribution of materials and the need for facilitators at each site.

2. A training and etiquette program should be developed for participants of videoconferencing (including as a minimum an introductory component to the first live session that outlines how to get the most out of the medium).

3. Information sheets/checklists should be developed for each site which include the relevant instructions for equipment and details for technical support

4. Each videoconferencing site should be equipped with a speakerphone as a back up mechanism.

5. A review of each sites technical capability should be undertaken with this information to be made available and utilised in planning of videoconferencing sessions

6. A model for optimal room set up for both multidisciplinary meetings and educational sessions should be devised and implemented at each site

7. Protocols should be established to support the use of videoconferencing for multidisciplinary team meetings

8. Where possible NSW Health should encourage alternative hosting of videoconferencing sessions

9. NSW Health should consider the provision of videoconferencing sessions exclusively to remote audiences

10. NSW Health should investigate internet-based education options and how these could integrate with existing infrastructure

11. NSW Health should consider developing an evaluation framework to measure the impact of their tele-learning programs on multidisciplinary learning communities

12. NSW Health should clarify their service goals for professional development delivered via videoconference and use them to guide further planning.

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8   Search term listing

The review questions were refined (in collaboration with NSW health) before being translated into the following search terms:

Videoconference/ing
Video + conferencing
Video + conferencing + education
Video + conferencing + learning outcomes
Video + conferencing + multidiscipline/ary
Video + conferencing + face to face
Video + conferencing + professional development
Video + conferencing + CME
Video + conferencing + distance education
Video + conferencing + distance learning

Tele learning
Tele learning + face to face
Tele learning + multidiscipline/ary
Tele learning + professional development
Tele learning + CME

Tele education
Tele education + multidiscipline/ary

Tele health
Tele health + multidiscipline/ary
Tele health + education
Tele health + professional development

Tele medicine
Tele medicine + network +education
Tele medicine + learning
Tele medicine + professional development

Tele conference/ing
Tele conference/ing + compare
Tele conference/ing + education

Audio conference/ing
Audio + distance
Audio + education

Video streaming*
Video + streaming
Video + streaming + education
Video + streaming + learning outcomes
Video + streaming + multidiscipline/ary
Video + streaming + face to face
Video + streaming + professional development
Video + streaming + CME
Video + streaming + distance education
Video + streaming + distance learning

E-learning*
Online learning*
Podcast/ing*
Vodcast/ing*
Webcasting *

*Although these terms describe internet based education models, they were included so as to not overlook any studies which either compared these studies with tele-learning or studies that had used these terms to describe non-internet based education.

9 Tabulation of relevant papers

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Allen M, Sargeant J, Mann K, Fleming M, Premi J. (2003) *Videoconferencing for practice-based small-group continuing medical education: feasibility, acceptability, effectiveness, and cost*	Descriptive study	10 participants at three remote locations were guided through four practice-based learning modules via videoconference by a trained facilitator.Data were collected using surveys, pre and post exams, interviews and observation to ascertain the learning outcomes and the quality of the learner experience	Physicians at remote locations.	Post test scores increased, demonstrating that participants had gained knowledge from the videoconference training sessions. Survey analysis indicated a positive learning experience for both participants and the facilitator, though technological difficulties affecting video and audio quality hindered some videoconference sessions. Cost was also relatively high per meeting	The study demonstrates that effective small group learning leading to knowledge gain and practice improvement is possible via teleconference, though a facilitator trained in the art of distance teaching using these technologies, and high quality equipment is paramount to the learner experience, which can be costly and require a significant outlay in assets including videoconferencing equipment
Allen M, Sargeant J, MacDougall E, O'Brien B. (2002) *Evaluation of videoconferenced grand rounds*	Descriptive study	Over 5 months, interactive grand rounds were broadcast to a medical professionals working at a remote regional hospital via videoconference. Qualitative data was collected from participants and presenters regarding the learning experience	Study involved health professionals at a regional hospital in Nova Scotia	Survey responses from participants at the remote site were positive, demonstrating they appreciated the educational opportunity despite some difficulties in the technology which led to decreased sound and video quality. Presenters indicated some difficulties in lecturing across both face to face and external sites due to their inability to see and hear all	External participants who would not otherwise have access to the educational opportunities are appreciative of the experience offered by videoconferencing, though technical difficulties can hinder the quality of the experience, particularly for interaction with presenters and other participants

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
				of the participants at the remote location. Attendees at the face to face session did not indicate any significant differences or issues caused by the broadcast and participation by remote users	
Augestad KM, Lindsetmo RO. (2009) *Overcoming distance: video-conferencing as a clinical and educational tool among surgeons*	Systematic literature review	Since 1960s, literature can be located indicating the adoption of videoconferencing technology for teaching and mentoring purposes and multidisciplinary patient management meetings	Health professionals	Literature shows that videoconferencing offers a suitable alternative to face to face teaching for clinical, skill based learning and access to expertise when geographical distance hinders opportunities for tradition learning formats	Videoconferencing has successfully been used for decades for small group teaching, improving upon teleconferencing as a learning medium due to the ability for visual communication and interaction. NSW Health can assess the experiences and lessons learned in these smaller-scale conferences to formulate best practice policy and procedure that will optimise the outcomes in larger scale telehealth group learning

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Berner ES, Adams B. (2004) *Added value of video compared to audio lectures for distance learning*	Randomised control trial	Two groups were taught using the same recorded presentation however one group saw the video of the lecture whilst the other heard only the audio. Subjective opinions of participants were collected	Health informatics students	Results of the trial did not demonstrate any added satisfaction or learning by students who saw the asynchronous, recorded video lecture than those who heard only the audio	In terms of recorded material that can be viewed after the live event, consideration must be given to the filming and recording process to maximise the efficacy and appeal of the recording; particularly post production of both visual images and sound quality can greatly enhance the recording. Lecturers should also be encouraged to pre-empt their audience and ask and answer leading/rhetorical questions to enrich the lecture
Bertsch TF, Callas PW, Rubin A, Caputo MP, Ricci MA. (2007) *Applied research: effectiveness of lectures attended via interactive video conferencing versus in-person in preparing third-year internal medicine clerkship students for Clinical Practice examinations (CPX)*	Comparative study	A group of students were taught half of the lectures for the semester in a live, face to face lecture and the other half by remote videoconference. Data was collected from results of 2 exams testing content taught in each of the formats	Medical students	Results of the exams did not indicate any demonstrable difference in learning outcomes between content taught face to face and via videoconference. Students achieved an acceptable level of knowledge and comprehension from both formats	Videoconferencing can be as effective a medium for teaching and learning as face to face teaching and provides an acceptable and accessible ongoing learning option to students who need to travel to remote locations for clinical experiences

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Bolle SR, Larsen F, Hagen O, Gilbert M. (2009) *Video conferencing versus telephone calls for team work across hospitals: a qualitative study on simulated emergencies*	Observational analysis	Videoed interactions between the emergency departments of a rural and a regional hospital during simulated critical care consulations were analysed to determine whether videoconferencing offered any benefits to telephone interactions during an emergency. Participants were also interviewed as a group regarding their experience of each technology. Data was also collected regarding impact of the technologies on the situation and the status of the patient	Inter-disciplinary specialist emergency teams across 2 Norwegian hospitals	Visual access to the emergency situation greatly assisted in interactions as superior information can be gained via both a visual and oral description of the situation when time is a key consideration, though the video equipment is less mobile and accessible than an audio-only system and can require greater levels of direct technical interaction which can impact team work and work flow	NSW Health could utilise their videoconferencing equipment in simulated clinical situations to facilitate discussion and demonstration, multidisciplinary education and peer consultation
Callas PW, Bertsch TF, Caputo MP, Flynn BS, Doheny-Farina S, Ricci MA. (2004) *Medical student evaluations of lectures attended in person or from rural sites via interactive videoconferencing*	Comparative study	Course evaluations were compared between medical students attending face to face lectures with those completed by distance students undertaking the course via interactive videoconference.	648 on campus and 255 distance medical students from the University of Vermont undertaking clinical clerkship rotations	Results indicated that whilst videoconferencing was rated as an acceptable method of education delivery when distance prohibits face to face attendance, live lectures were preferred for the ease of interaction with the instructor and other class members and due to the technical issues experienced by many participants at remote locations. Interventions such as increased font size for lecture slides have since been implemented to improve the experience for students participating remotely	NSW Health need to ensure high quality equipment and optimal broadcast conditions to minimise the impact of technical issues such as poor sound quality for remotely located participants on their learning experience and satisfaction with the delivery method

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Callas PW, Ricci MA, Caputo MP. (2000) *Improved rural provider access to continuing medical education through interactive videoconferencing*	Descriptive study	Data was collected relating to the use usage patterns of the medical education communication technology network over an 2 and a half year period. Users were required to complete a qualitative evalutaion form regarding their perceived effectiveness of the medium to deliver a high quality learning experience	Healthcare providers at 14 remote sites accessing the Fletcher Allen Health Care CME programs over a 2.5 year period	The majority of respondents felt that the overall videoconferencing experience was effective in increasing their knowledge, that presenters were well prepared and generally delivered content suitably to meet the needs of the remote participants and that it provided access to an educational opportunity they would not otherwise have accessed. Technical difficulties regarding sound and video quality, often due to poor logistical placement of microphones and cameras, and difficulties reading transmitted lecture slides decreased satisfaction. Usage data demonstrated that there was a signficant drop off in attendance of the videoconferences over the 2.5 year study period, suggesting that the novelty of attendance wore off for participants or that technical issues outweighed the educational benefits offered	For NSW Health to generate participants who regularly access education distributed via communication technologies, they must ensure they deliver a quality product that is tailored to the specific needs of remote learners in terms of presentation style and methods and effective technological equipment

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Careau E, Vincent C, Noreau L. (2008) *Assessing interprofessional teamwork in a videoconference-based telerehabilitation setting*	Observational analysis	13 videoconferences were recorded and analyses regarding group dynamics, team interaction and participant behaviours	Inter-disciplinary rehabilitation teams across 2 Canadian hospitals	Several indicators were identified from the behavioural analysis of the video-conferencing that appeared to lead to effective videoconferences. Recommendations include employing a meeting leader/chair to facilitate, having a group of less than 12 to allow for optimal communication and interaction and a conference duration of less than 60 minutes. Participants appeared to enjoy the visual access that videoconferencing provides over teleconferencing, though the video often had a poorer sound quality than experienced in teleconferences, though better microphone positioning could improve audio interactions. Visual contact was deemed important in building a collegial atmosphere between the conference sites and forstering a trusting relationship between participants	There are guidelines to optimising the efficacy and outcomes of a video-conference, both in terms of maximising the potential of the equipment through considered placement and physical conference environment, and conference structure, including involving a facilitator to lead and direct discussion and participant interactions that NSW Health can employ to provide the best possible conditions for a successful learning experience

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Chen T-H, Buenconsejo-Lum LE, Braun KL, Higa C, Maskarinec GG. (2007) *A pilot evaluation of distance education modalities for health workers in the US-Affiliated Pacific Islands*	Comparative study	The learning outcomes and acceptability of three distance modes of teaching, synchronous videoconferencing, synchronous teleconferencing and asynchronous recorded video broadcasts were compared to learning outcomes achieved in live, face to face workshops. Data was collected for comparison via pre and post tests and student feedback	Healthcare workers in the US Affiliated Pacific Islands	Evaluation of user feedback and test results show similar learning outcomes and levels of interest, acceptability and efficacy for each of the teaching modalities, particularly to remote participants who would otherwise not be able to participate in the training opportunity	NSW Health can deliver comprehensive, accessible, high quality continuing education to professionals with a significant amount of prior knowledge via a variety of teaching modalities and formats
Cook A, Salle JL, Reid J, Chow KF; Kuan J, Razvi H Farhat WA, Bagli DJ, Khoury AE. (2005) *Prospective evaluataion of remote, interactive videoconferencing to enhance urology resident education: the genitourinary teleteaching intiative*	Descriptive study	Residential trainees at sites where expertise in pediatric urology was lacking attended a series of interactive seminars presented by an expert in the area via videoconference. Feedback from participants was evaluated to determine participant satisfaction and the suitability of the medium for training purposes	Urology residents	Survey results from participants rated the videoconferenced seminars experience very highly in terms of interactivity, audio and visual quality and easy access to expert teachers, due also to the high quality, dedicated videoconferencing rooms and equipment available at the university. Participants also indicated that they did not feel the experience would have been improved if the presenter was onsite	Interactive videoconferencing can provide an equally effective learning experience as live face to face teaching. NSW Health should ensure that their presenters are prepared for the nuances of distance teaching via video link, equipment is of high quality and the topics are relevant to the participants for a successful educational experience

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Cronin C, Cheang S, Hlynka D, Adair E, Roberts S. (2008) *Videoconferencing can be used to assess neonatal resuscitation skills*	Comparative study	Some nursing students had their neonatal resuscitation competency assessments conducted at live sites whilst others were assessed by instructors via a videoconference feed. Data was collected from the instructor notes, student grades and participant feedback	Neo natal nurses	Nurses performed consistently whether their assessment was conducted live or via videoconference. Skills such as resuscitation can be effective taught and assessed via videoconference when technical considerations such as the camera angles, sound and lighting are optimised	NSW Health can provide effective, pedagogically sound education and training via videoconferencing to provide remote practitioners access to expertise and educational experiences when the financial and logisitical factors involved with having expert teachers/assessors etc is prohibitive
De Muth JE, Bruskiewitz RH. (2006) *A comparison of the acceptability and effectiveness of two methods of distance education: cd-rom and audio teleconferencing*	Comparative study	To compare the efficacy of distance teaching methodologies and modalities, 47 pharmacists participated in professional development via group teleconference whilst 33 accessed a home study CR Rom via personal computer with optional live question and answer sessions. Data was collected via pre and post tests and participant satisfaction surveys	Pharmacists completing continuing education	Though test results were similar in demonstrating learning attainment via both methods of teaching, students preferred the convenience and flexibility of the computer based CD ROM learning activities and question/answer sessions to teleconferencing, stating a higher level of satisfaction and confidence in their newly acquired knowledge. Audio quality was the main issue experienced by both groups, however access to written information and examples via the CD Rom was appreciated by learners	NSW Health may wish to consider blended educational resources, such as providing written information and examples to complement either video or teleconference to increase student understanding and comprehension of educational material
Delaney G, Jacob S, Iedema R, Winters M,	Comparative study	Videoconferencing was trialed as a format for MDC meetings to improve	Multidisciplinary health	Whilst videoconferencing improved the potential access to	Whilst this study addressed outcomes of MDC meetings

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Barton M. (2004) *Comparison of face-to-face and videoconferenced multidisciplinary clinical meetings* Australiasian Radiology 48:487–492		attendance of specialists at MDC meetings across three public hospital sites. 27 specialists were surveyed comparing their experiences following 12 weeks of face to face MDC meetings and 12 weeks of videoconferenced MDC meetings. Observational data was also recorded for anthropological analysis of participant behaviour	professionals working in breast cancer care within the public health sector	MDC meetings for specialists by removing the need to travel to the meeting site, however respondents also cited a lack of time as a reason for non-attendance at videoconferenced meetings. There was a considerable difference noticed in the social interactions between attendees of face to face than videoconferencing. It was noted that videoconferenced meetings were conducted much more formally and interactions appeared distant, which was attributed to the lack of the physical co-presence that facilitated for the animated, collegial atmosphere demonstrated at the face to face meeting. However video was deemed preferable to telephone conferencing for providing visual contact and reducing the time lag. As a result, the conduct of videoed meetings was amended to allow for a facilitator to lead discussions and for components such as seating arrangements, camera placement and quality of the video link to be addressed to heighten participation and reduce the	regarding collaborative patient management and shared care, several points regarding optimising the environment in the videoconference to promote an atmosphere of ease, acceptance and mutual respect among varying professions is applicable to the NSW Health situation. NSW Health must ensure that although videoconferencing can allow access from multiple sites, there are other practical and social issues caused of geographical distance among participants that can limit the quality of interaction, particularly in a multidisciplinary situation where there are varying levels of experience and expertise

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
				impact of the geographical distance on participants. These interventions as well as growing familiarity with communication technologies increased participant satisfaction with videoconferenced meetings at the end of the trial, however face to face was seen as the preferred interface for productive meetings that allow optimal inter-professional discussion regarding patient management	
Finley JP, Beland MJ, Boutin C, Duncan WJ, Dyck JD, Hosking MCK, Nykanen D. (2001)

A national network for the tele-education of canadian residents in pediatric cardiology | Descriptive study | Residents at 7 sites in Canada were surveyed regarding their experiences of 11 videoconferenced training and networking sessions | 93 residents in pediatric cardiology | The majority of participants indicated a high level of satisfaction with the videoconferenced sessions and felt that they achieved signifcant knowledge gains, with 60% rating them equally with face to face presentations. The opportunity to meet and network with residents and experts at other hospitals was also appreciated. Early difficulties with audio technologies were later corrected, increasing participant satisfaction with the medium as a teaching application. Presenters impressions were also positive though many expressed a desire | NSW Health can provide an effective educational experience for remotely located health professionals if the equipment is utilised effectively and presenters are provided with guidance as to best practice methods of integrating the technology into their presentations to involve participants at each of the remote sites |

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
				for guidelines regarding teaching via videoconferencing in order to improve their delivery and integration of the technology into their presentations	
Gagliardi A, Smith A, Goel V, DePetrillo D. (2003)

Feasibility study of multidisciplinary oncology rounds by videoconference for surgeons in remote locales | Descriptive study | 22 MDT members across 8 videoconferenced sites were surveyed for their level of satisfaction with videoconferenced MDT meetings discussing cancer patients | Remote oncology surgeons and other cancer MDT members | Videoconferencing successfully allowed surgeons to interact with other members of MDTs, provided satisfactory access that would not otherwise have possible to surgical expertise and advice regarding the cancer patients discussed at the meetings | Participants report a high level of satisfaction in having access via interactive videoconferencing technology to experts with skills, experience and information not locally available at their hospital. NSW Health can use their telehealth network to provide access to high level education and information for distant regional and remote health professionals who would not otherwise receive it, or would have to travel to participate |
| Haythornthwaite S. (2002)

Videoconferencing training for those working with at-risk young people in rural areas of Western Australia | Comparative study | Social workers undertaking training via videoconferencing were surveyed regarding their satisfaction with the medium and their perceived learning outcomes following the training. Responses were also compared with those collected from social workers who attended live training sessions | 32 social workers working with at-risk young people in remote and rural regions of Western Australia and | Participants in rural and remote areas receiving training via videoconferencing indicated a high level of satisfaction with the medium, with responses demonstrating that participants felt they had increased knowledge, competence and confidence after the sessions. Remotely located | If technical equipment is of high quality and is utilised effectively by teachers, NSW Health can provide a rich learning experience to remotely located practitioners that can result in practice improvements and provide an opportunity for relationship |

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
			social workers attending face to face training in metropolitan areas	participants also appreciated the social networking opportunities offered by the interactive videoconferences that reduced their sense of isolation. Resulting improvements in work practices following the training was attributed to the training sessions and similar improvements were observed at both rural and metropolitan centres, suggesting both the live and face to face sessions were equally as effective in delivering the information required by participants to implement changes in their practice	building and sharing of information that reduces participants sense of professional isolation
Kerns AS, McDonough JP, Groom JA, Kalynych NM, Hogan GT Jr (2006) *Televideo conferencing: is it as effective as 'in person' lectures for nurse anesthesia education*	Comparative study	Nursing students who were taught in on-site locations via face to face teaching were compared to students being taught via videoconferencing at remote sites. Data was collected via a self evaluation conducted at the conclusion of the course	Graduate anesthesiology nursing students	Students reported a high level of satisfaction with both methods of course delivery, with no discernable difference in learning outcomes in the self evaluation scores. Distance students felt that videoconferencing is a highly suitable method to conduct didactic, asynchronous courses, providing on-demand access to education and information for students at remote locations who would otherwise have no	NSW Health can use videoconferencing effectively, particularly for didactic teaching and information delivery to remote locations who have no other form of access to it at their local site

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
				educational contact during their remote clinical experiences	
Kidd RS, Stamatakis MK. (2006) Comparison of *students' performance in and satisfaction with a clinical pharmacokinetics course delivered live and by interactive videoconferencing*	Comparative study	38 students received live classroom teaching whilst distance students via asychronous video broadcast. Exam results and class evaluations were compared	On campus and distance learning Pharmacy students.	All students performed equally well in the examinations regardless of their method of learning. The delivery style and techniques used by the lecturer were noted by the distance students as greatly impacting upon their perception and enjoyment of the course	NSW Health can achieve success and positive learning outcomes from broadcast education and training to face to face experiences if consideration is given to factors including presenter training, relationship development and quality of equipment
Klein D, Davis P, Hickey L. (2005) *Videoconferences for rural physicians' continuing health education*	Descriptive study	593 evaluations from attendees of 29 synchronous continuing medical education videoconferences were reviewed to determine participant satisfaction with the delivery method	Physicians at various video linked sites	Despite many reported technical difficulties, evaluations overwhelmingly indicated a high level of satisfaction from participants who appreciated access to topical professional development opportunities that did not impact greatly on their time/travel etc. The interactivity of the forums that allowed small group discussion was also rated highly	Vidoeconferencing can provide a high quality, enjoyable educational experience that meets the needs of practitioners who are unable to attend live events. NSW Health can use their network to provide a similar service to remote health professionals in Australia

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Knipe D, Lee M. (2002) *The quality of teaching and learning via videoconferencing*	Descriptive study	Diaries were completed over a 10 week period by participants undertaking either on campus or remote studies in computer based learning, recording their behaviors and experiences with their particular modality of delivery and their perceptions regarding the learning outcomes of the course	29 Masters degree students undertaking a Computer Based Learning course on campus and 17 learners undertaking the same course via videoconference to remote sites	Evaluation of diary entries by participants demonstrate that students particpating in oncampus classroom activities had a higher level of interaction, cognition, learning and social and group learning opportunities, and therefore, higher levels of satisfaction with the course. Students at remote sites stated they felt they achieved lower levels of learning and were highly reliant on instructive notes, PowerPoint handouts and workbooks to supplement the lack of access to the instructor. Isolation and lack of a sense of community was reported by remote students who missed the opportunities for cooperative group activities. Results demonstrated many differences in the quality of learning and student experiences between those undertaking the course remotely to those on-campus	NSW Health should ensure courses are suitable for delivery using remote communication technologies as not all training is suitable for this method of delivery

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Kunkler I, Fielding G, Macnab M, Swann S, Brebner J, Prescott R, Maclean R, Chetty U, Bowman A, Neades G, Dixon M, Smith M, Walls A, Cairns J, Lee R, Lee A, Gardner T. (2006) *Group dynamics in telemedicine-delivered and standard multidisciplinary team meetings: results from the TELEMAM randomised trial*	Randomised trial	Breast cancer patient cases were randomly discussed at either a face to face MDT or videoconference. Data was collected regarding participant satisfaction and comparison of perceived group dynamics in each of the forums	Multidisciplinary breast cancer team across three sites in the UK	Results of the data demonstrated that similar outcomes, levels of satisfaction, atmosphere and group dynamics can be achieved in both face to face and video conferenced MDT meetings	Videoconferencing can be used effectively to create a collegial team atmosphere, similar to that achievable in a face to face interaction. NSW Health could use their telehealth network to establish efficient and effective interprofessional team building and education

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Latour MA, Collodi P. (2003) *Evaluating the performance and acceptance of teleconference instruction versus traditional teaching methods for undergraduate and graduate students*	Comparative study	Undergraduate students and graduate students received some courses via teleconference and other courses through traditional live class room based teaching methods. Data was gathered regarding student performance from exam results and regarding acceptance of the differing methods through class enrolment and drop out numbers	Undergraduate and graduate veterinary students	Students taught via live classroom methods and teleconferenced classes achieved similar results and learning outcomes in both undergraduate and graduate courses. However, there was a high drop out rate in the teleconferencing courses for undergraduates that was not reflected in the graduate course, suggesting that teleconferencing methods may be better suited to more mature students who have some prior knowledge of the course content	NSW Health should consider their audience and their needs when determining the optimal delivery format for a course. Some content may be better suited to varying methods of teaching, whilst others may demand specific forums, such as a video/visual element
Loewen L, Seshia MMK, Fraser Askin D, Cronin C, Roberts S. (2003) *Effective delivery of neonatal stabilization education using videoconferencing in Manitoba*	Comparative study	Participants were taught a neonatal stabilising course either via face to face delivery or videoconference. Pre and post test scores were compared as well as feedback from participants in each modality	Graduate neonatal nurses	Pre and post test scores for both modes of delivery, face to face and videoconferencing, were similar with both demonstrating significant gains in knowledge. Face to face participants reported a higher level of satisfaction in regards to interacting with the lecturer and the group, however all participants felt each method suitable for a postive learning experience	Videoconferencing can be used to deliver high level concepts effectively. Particular consideration should be given to optimising the group dynamic and interaction through conference facilitation and introductions of all participants so that collegial, familiar relationships can be built

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Lower T, Ladyshewskyz R, Loudl J, Moore S. (2002) *Enhancing supervision skills for rural placements through video-conferencing in Western Australia*	Descriptive study	44 participants repsonded to an evaluation survey following a one day videoconferenced training session regarding medical student supervisor training regarding the efficacy of the medium to delivery this information	Multidisciplinary clinical placement supervisors within the medical field across 3 remote sites in Western Australia	Overall, respondents indicated a positive learning experience was conveyed via the videoconference with all reporting knowledge gains that reduced the impact of geographical distance relatively cost effectively. The multidisciplinary nature of the videoconference was also well received, with participants enjoying the networking and the knowledge that many of the generic supervisory skills required for clinical supervision transcend disciplinary boundaries. Concerns were raised about technical difficulties encountered during the session such as broadcast drop out (it was suggested limiting the number of participating sites may assist in this), the length of the training session and the distance some had to travel to access the required video equipment	As demonstrated in WA, NSW Health can also effectively use their communication technology to deliver high quality, multidisciplinary training opportunities

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
MacIntosh J. (2001) *Learner concerns and teaching strategies for video-conferencing*	Descriptive study	22 registered nurses studying for baccalaureate degrees via distance education were surveyed regarding the influence of learning technologies on their learning	22 registered nurses studying for baccalaureate degrees via distance education	Respondents were generally satisfied with the distance learning technologies and techniques utilised in their course. Common issues stressed by users were the need for distance courses to be tailored to the particular modes of delivery and educators trained to teach using distance technologies in order to best engage learners. Technologies must also be of a high quality to ensure adequate delivery and an effective learning experience. Users also advocated some face to face opportunities, such as onsite visits from teachers or small group interactions to enrich their learning and to enhance their personal motivation to fully engage in the course	It is important that NSW Health ensures that the teaching strategies used by instructors fit the technologies used so that positive educational outcomes are experienced by participants
Markova T, Roth LM, Monsur J. (2005) *Synchronous distance learning as an effective and feasible method for delivering residency didactics*	Comparative study	Over 1 year, all family medical residents were taught a mixture of face to face classes and distance classes via interactive videoconferences. Learning outcomes were compared from results of pre and post tests following each class and student feedback was sort for each modality	Family medical residents at Wayne State University	There was no statistical difference in learning outcomes from face to face compared to videoconferenced distance learning, with both modalities achieving signifcant demonstrable knowledge gain in test results. Students also reported similar levels of satisfaction between the two styles of delivery, with high	NSW Health can achieve distance learning that is as acceptable an educational option for students as face to face if the technology is implemented at a high standard and the course content is suited to an asychronous, didactic teaching method

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				levels of acceptance of the distance technology equipment and the methods of implementation.	
Mitchell JG, Robinson PJ, McEvoy M, Gates J. (2001) *Telemedicine for the delivery of professional development for health, education and welfare professionals in two remote mining towns*	Descriptive study	Healthcare workers in 2 remote South Australian locations were provided with access to telemedicine delivered professional development (including videoconferencing and telephone) involving case studies over a 2 year period. Data was collected via demographic and statistical information, by interviews with participants and through observations regarding the use of the technology by the authors to anecdotally speculate on future usage and possible outcomes in the communities beyond increased knowledge	Nine interviews between health, education and welfare workers in Coober Pedy and Roxby Downs and the staff of the Child & Adolescent Mental Health Service and the Women's & Children's Hospital in Adelaide; augmented by site visits by project staff	Participants appreciated that content was specific to the needs of remote staff, that it saved on travel time and and they reported they gained knowledge through interaction via telemedicine with experts and developed a network for referral and advice. In addition, participants overwhelmingly stated that the telemedicine network allowed them to feel less isolated and more connected to other clinicians. Anecdotally, this aspect is expected to increase staff retention rates in remote areas and be used as a strategy when recruiting health care workers to these areas	If NSW Health prepares and manages targetted programs specific to the needs of very remote health workers, they can achieve a successful educational and peer networking platform that may also facilitate recruitment to these areas and assist in staff retention through the development of networks and learning communities

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Moridani M. (2007) Asynchronous video streaming vs. synchronous videoconferencing for teaching a pharmacogenetic pharmacotherapy course	Comparative study	73 students were taught using synchronised videoconferencing delivery whilst 78 students received the same lectures the following semester as asynchronous videos. Qualitative data was collected from the course evaluations submitted by students at the end of the course. The final grades awarded to students were also compared for each course	Pharma-cogenetic therapy students at 3 different campuses	There were no significant differences between the performance of students receiving the different modes of course delivery, however satisfaction levels were much lower for those completely the asynchronous video course, generally due to the lack of interaction with the lecturer and an inability to ask questions; although they did feel they had more time to read and assimilate the information than those attending the synchronous video conferenced classes. These students stated a preference for a combination of asynchronous and synchronous learning opportunities throughout the course so that students could maximise the benefits of each method	NSW Health may wish to provide access to recorded, asynchronous videos of video conferenced lectures and workshops for retrospective review by participants and learning opportunities for those who could not attend the synchronous event. Blending the delivery to provide access to a range of learning solutions appears to be preferable to participants

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Naylor C-, Madden DL, Simpson D. (2009) *The re-evaluation of the use of videoconferencing to deliver the Bug Breakfast, December 2004*	Descriptive review	A follow up evaluation of a monthly seminar series broadcast via videoconference to 11 sites across NSW to determine the impact of recommendations implemented as a result of a first evaluation conducted 2 years prior. Questions were modified slightly from the previous survey and covered technical quality and participant satisfaction. Attendees at the live site were also surveyed regarding their perceived impact of the video conference broadcast on their face to face learning experience	89 public health workers at 11 video linked sites across NSW	Survey responses demonstrated that participants continued to highly value the educational and networking opportunities offered by the video link up and there was a high level of satisfaction with both the technical delivery of the seminars and the perceived learning outcomes resulting from participation. Results of the previous evaluation in 2002 had suggested several interventions for improvements to the Bug Breakfast broadcast, including briefing speakers regarding best practice for videoconferencing presentations, a telephone technical helpdesk and a manual for optimal delivery, all of which had been well received and added to the participant and the presenter experience	

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Naylor CJ, Madden DL, Neville L, Oong DJ. (2009) *Pilot study of using a web and teleconference for the delivery of an Epi Info training session to public health units in NSW, 2005*	Descriptive study	A blended combination of web conferencing and teleconferencing was used to deliver a training session to three sites and participants were surveyed about their experience in regard to the quality of the sessions, their perceived learning outcomes and their overall satisfaction with the technologies. The facilitators were also interviewed regarding their impressions of delivering the session	12 public health workers across NSW	Whilst combining the teleconference with the web conference allowed for participant interaction, difficulties in web connection speed and continuity and teleconference audio quality, particularly at the rural sites impacted the learning experience and participant satisfaction with the forum. However with improvements to these technical aspects, most participants were enthusiastic about the access to training opportunities that communication technologies provided and would be willing to participate in further sessions. Recommendations to be implemented following the pilot included the development of facilitator guidelines about best practice methods for delivering training to remote audiences; and provision of information for participants about logistical aspects such as microphone placement and web bandwidth requirements	

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Naylor CJ, Madden DL, Oong DJ. (2009) *Report on the use of communication technology by a sample of public health professionals in NSW*	Descriptive study	12 public health professionals were interviewed regarding their use and perceptions of various communication technologies	12 NSW public health professionals	Interviewees were generally enthusiastic about integrating developing communication technologies into their daily work practice, citing videoconferencing as a preferred medium due to the personal connection allowed due to the visual element. When the task was appropriate for the use of a technology and appropriate support was provided to enable use, interviewees were satisfied with their experience. Barriers to usage and quality of the experience included limited access to the required technological infrastructure meaning that sometimes significant distances had to be travelled to access equipment; unfamiliarity with the new medium; a lack of technical knowledge and support and cost of set up and use	

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Newman C, Martin E, McGarry DE, Cashin A. (2009) *Survey of a videoconference community of professional development for rural and urban nurses*	Descriptive study	Attendants of a 2008 videoconference symposia were surveyed regarding their experiences of videoconferenced professinal development training sessions as a means for community building and knowledge sharing	56 attendees of a 2008 video-conference symposia	Despite technical difficulties, most respondents indicated that videoconferencing achieved its goal of providing accessible professional development to remotely located practitioners and enabling them to develop a sense of a community of knowledge. However, results indicate that the majority of participants felt that videoconferencing was a passive exercise where they learned but did not contribute or construct knowledge, even though interactivity was possible	NSW Health need to be aware that interaction via videoconferencing can be an intimidating concept for participants and develop methods for developing relationships within the broadcast groups to generate a sense of safety, community and sharing

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Odell EW, Francis CA, Eaton KA, Reynolds PA Mason RD (2001) *A study of videoconferencing for postgraduate continuing education in dentistry in the UK-- the teachers' view*	Descriptive study	The teachers of distance dental postgraduate education were surveyed regarding their satisfaction with videoconferencing technology as an effective medium for teaching	27 teachers at the London Dental School	The majority of teachers expressed satisfaction with utilising interactive videoconferencing technology to effectively and efficiently teach subjects to remotely located students, with 21/27 respondents stating a preference for this method over travelling in order to present face to face. Whilst the quality of equipment, especially audio, at times affected the ability of the teachers to interact with their students, causing some frustration, over time the teachers became more confident in using and trouble shooting the technolog. Results demonstrated teachers were positive regarding the use of the videoconferencing medium to provide a quality learning experience for their students	NSW Health may wish to provide training and assistance to presenters and teachers using their videoconferencing equipment in order to maximise the experience for both presenters and the audience

Author & article	Method-ological rigour	Interventions/Study rationale	Study population	Conclusions	Implications for NSW Health
Olver I, Selva-Nayagam S. (2000) *Evaluation of a telemedicine link between Darwin and Adelaide to facilitate cancer management*	Descriptive study	20 health professionals were surveyed regarding their experiences of videoconferenced MDT meetings. Data was collected regarding the participants satisfaction with the forum and the usefulness of the activity to their practice	Cancer health professionals participating in videoconferenced MDT meetings between 2 isolated Australian locations	Participants reported a positive experience from the videoconference, citing ease of access to participation in MDT meetings that would otherwise require significant travel or be time and cost prohibitive, and the benefits of interaction and consultation with other health professionals regarding their patients. Difficulties that were identified included technical problems with the equipment and the impersonal nature of the videoconference that did not allow for direct patient examination; however the benefits of access to peer consultation and limiting travel time outweighed the negative aspects	NSW Health can utilise their videoconferencing infrastructure to provide access to peer consultation, training and education for severely isolated health professionals, whose only other options for access would require significant time and cost expenses to travel to a central location

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Raffelini C. (2006) *An evaluation of the training activities provided by videoconferencing in a university hospital centre*	Descriptive study	Evaluation of the use of videoconferencing technology to provide doctoral training in medicine at a Canadian university hospital centre. Participants were surveyed regarding their satisfaction with videoconferencing as an educational medium and their perceived learning outcomes resulting from videoconferenced education as opposed to face to face	148 fourth year medical students undertaking a course being taught via videoconference for the first time	Overall, students indicated the videoconferenced course was sub standard to live face to face delivered teaching, citing difficulties to interact and develop relationships with their teacher and class mates via the video link. Students noted a difference in the quality of delivery of different presenters, feeling that some teachers intergrated the technology into their classes better than others, which greatly affected their satisfaction of the presentation. However, most students found the medium satisfactory for learning and reported a saving in time and cost from having to travel to a central location for lectures, and they enjoyed the interaction with other students at remote locations they had not previously had access to	NSW Health must focus on ensuring presenters are trained and comfortable with teaching using technical equipment so that the technology can be intergrated effectively into the presentation in order to generate a collegial 'class group' feeling to limit the impact of the social and geographical distances between particpants at remote locations

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Schmidt EK, Gallegos A. (2001) Distance learning: issues and concerns of distance learners	Descriptive study	109 students undertaking courses that were converted from face to face courses to CD Rom based distance courses were surveyed regarding their experience of the course and preferences for learning formats	109 technology students within the School of Technology at Purdue University	The computer based course was generally well accepted, though the study was conducted with technology students who are potentially more familiar with using this type of technology, the results may not apply in the same way to students of another discipline. Participants reported that they enjoyed the flexibility offered by the distance, computer based course, allowing them to fit their study around family and work commitments. indicated the lack of interaction with instructors and classmates; and the individual motivation required to undertake a course without scheduled class times as the most difficult aspects of the computer based course	NSW Health need to consider the familiarity of participants with technical equipment when planning courses and provide technical support where possible. If interactivity is not possible, other means of interaction and contact, such as telephone, email etc should be considered to allow for learner and teacher interaction

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Sclater K Alagiakrishnan K, Sclater A. (2004) *An investigation of videoconferenced geriatric medicine grand rounds in Alberta*	Descriptive study	Questionnaires given to attendees of geriatric medicine grand rounds held at the University of Alberta that were also broadcast to more than 20 videoconferenced sites were evaluated to determine participant satisfaction with the program and modes of delivery	Health professionals working in geriatric medicine	Though satisfaction levels were higher with participants who attended the live grand rounds, those who participated via video conference indicated satisfaction with the topics and the opportunity to participate, citing technical issues with audio and presenters unfamiliar with delivering to a mixed live and viewing audience as their main concerns. They also felt the sense of comraderie and personal involvement that was experienced by those at the live site was missing from the broadcast	Attendees stated that the quality of the videoconference topic/content was paramount to their decision whether to participate. NSW Health should ensure high quality content and relevant, current topics and information to attract a viewing audience. Presenters need also to be trained in delivery techniques to provide an optimal experience for those participating from remote sites

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Solomon DJ, Ferenchick GS, Laird-Fick HS, Kavanagh K. (2004) *A randomised trial comparing digital and live lecture formats*	Randomised control trial	Students were randomly selected to either attend a series of live lectures or viewed asynchronous videoed lectures. Results were evaluated from test scores of each group. Participants were also surveyed for their feedback regarding their learning experiences	Third year medical students completely a clerkship and studying at one of 6 campuses of Michigan State University	Results of the test showed equal levels of learning and cognition from both the students participating in the live lectures and those who viewed videos of the lectures. Both groups were satisfied with the medium of delivery, particularly that the asynchronous videos could be viewed at a time and location as most suitable to the students; although lack of compatability of some software caused some technical issues for those viewing the CD-Roms	Similar learning outcomes can be achieved from live, face to face teaching as asynchronous videoed lectures, particularly in that videos can be viewed multiple times at a time and speed suitable to the learner. NSW Health should consider issues such as software compatability and technical issues to ensure the distance learning experience is of the same quality as is offered to students attending the live lecture
Spickard A, Alrajeh N, Cordray D, Gigante J. (2002) *Learning about screening using an online or live lecture: does it matter?*	Randomised control trial	95 medical students were randomly taught a lecture regarding screening either face to face or by audio feed. Data was collected regarding learning outcomes of students and satisfaction with the learning experience	Senior medical students participating in a primary care clerkship	Results demonstrated equal levels of knowledge gained and participant satisfaction between students who had access to the live lecture as those who experienced the video/audio feed	NSW Health can provide a learning experience that provides similar learning outcomes and participant satisfaction levels via telehealth to those achieved in tradition, face to face educational forums

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Sptizer RF, Kives S, Ornstein M, Caccia N, Stephens D, Flood C, Allen LM. (2008) *Videoconferencing for resident teaching of subspecialty topics: the pediatric and adolescent gynecology experience at the Hospital for Sick Children*	Descriptive study	A 3 hour paediatric and adolescent gynaecology seminar was broadcast via videoconference to 8 remote sites. Participants were surveyed regarding their satisfaction with the learning experience and the results were collated and analysed. Presenters were also interviewed regarding their experience presenting to a multi site audience via videoconference	Medical residents at 9 Canadian cancer centres	The majority of participants rated the video seminar experience highly, however at some sites, problems with the videoconferencing equipment that limited the connection and interaction between the presenter and the audience and lowered participant satisfaction. Presenters expressed a desire for training in presenting to both a live and broadcast audience in order to maximise future opportunities	NSW Health need to ensure that all sites have high quality technical equipment so that all sites can participate equally in videoconferences. Presenters also need to be provided with guidance regarding how to best lecture to a blended audience
Stain SC, Mitchell M, Belue R, Mosley V, Wherry S, Adams CZ, Lomis K, Williams PC. (2005) *Objective assessment of videoconferenced lectures in a surgical clerkship*	Randomised control trial	Students were randomly assigned locations for a clerkship. Those who were more than 75 miles from the medical school received lectures via videoconference, whilst the remainder attended live lectures. Results were gathered test results from each cohort	98 third year medical students completing surgical clerkships	Results demonstrate similar examination results from students taught via telemedicine distant learning methods and those who attended face to face lectures, demonstrating that interactive videoconferencing is an effective learning medium that limits common barriers to education such as distance	The study shows that NSW Health can also provide quality educational experiences using their interactive videoconferencing network

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Strehle EM, Earle G, Bateman B, Dickson K. (2009) *Teaching medical students pediatric cardiovascular examination by telemedicine*	Descriptive study	Students who were taught paediatric cardiovascular examination via interactive videoconference were surveyed regarding their experience	77 medical students undertaking paediatric cardiology training	Students were generally satisfied with the learning experience offered via videoconferencing, however technical issues such as time lag and poor audio quality lowered some participants satisfaction with the medium. Students rated videoconferencing as suitable alternative to face to face teaching when that option is not possible, but suggested it as a complementary approach for teaching clinical skills, rather than a complete replacement to live university lectures	Depending on the content to be delivered, NSW Health may wish to consider a blended approach for educational delivery, such as including a limited number of face to face learning opportunities to add to the remote learning experience
van Boxel P, Anderson K, Regnard C. (2003) *The effectiveness of palliative care education delivered by videoconferencing compared with face-to-face delivery*	Randomised control trial	Twenty nurses were randomly provided with access to workshops, either by videoconference or live lectures for which they undertook pre and post tests for the content taught. Participants alternated between the two forums throughout the study. Data was collected quantitatively from the test results as well as qualitatively from participant surveys	Twenty community nurses undertaking palliative care training	Results demonstrated 17% and 18% of increased knowledge from live lectures and videoconferenced lectures respectively from the pre-test scores. Whilst nurses expressed a preference for face to face, particularly for emotional class discussions and due to a slight time lag that caused a distracting lack of synchronisation between lip movement and speech, there was no discernable difference in outcomes and all had a high level of satisfaction with each mode of delivery	NSW Health can conduct an effective and enjoyable educational experience via videoconference, particularly if consideration is given to practial and technical issues including camera and microphone placement and leader facilitation of group communication to enhance the quality

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Walter, Douglas A; Rosenquist, Peter B and Bawtinhimer, Gary. (2004) "Distance Learning Technologies in the Training of Psychiatry Residents: A Critical Assessment "	Descriptive study	Medical graduates participating in a continuing education seminar series via videoconference and online technologies were surveyed regarding the quality of their experience. Presenters were also surveyed regarding their experience delivery seminars using communication technologies.	19 psychiatry residents participating in a distance mode seminar series across 2 remote sites in America.	Participants were generally satisfied with their experiences participating in the remote seminars though survey results demonstrated that the satisfaction of participants with the seminars was highly dependent on the quality of the technology to which they had access. Those with higher speed connections that limited time delay issues and audio problems reported higher levels of satisfaction. Both participants and presenters noted that the level of presenter familiarity and confidence utilising communication technologies also greatly impacted on the satisfaction and learning experiences of participants.	NSW Health should investigate methods to offer the highest possible quality of transmission of distance based learning activities to remote locations to increase delivery speed and minimise time delay and disconnection issues. Presenters should also be familiarised with the technology and guided through best practice delivery methods for this type of modality to increase their confidence and improve their teaching skills using communication technologies which will enhance the learner experience.
Wang R, Mattick K, Dunne E. (2010) *Medical students perceptions of video-linked lectures and video-streaming*	Descriptive study	20 undergraduate medical students were interviewed regarding their perceptions regarding the impact of interactive videoconferenced lectures and asynchronous video recordings on their learning outcomes	20 undergraduate medical students across 4 sites in the UK	Students were generally enthusiastic about the concept of videoconferencing to provide an acceptable alternative for education to those whose geographical location prevented their physical access at face to face lectures, they appreciated the ability to stop/rewind/review recordings of lectures, and that the	NSW Health needs to continue to invest in communication technologies and the related infrastructure to ensure that the educational product they deliver to remote participants is of a high quality and results in positive learning outcomes

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				lecture content and presenter style impacted more on their satisfaction of the experience than the technology used. However the difficulties to engage with the instructor and other classmates and technical difficulties were cited as concerns about the use of communication technologies for remote delivery and many students perceived that video conferenced or broadcasted lectures would not deliver an equal quality of learning experience as a face to face lecture	
Wilson SF, Marks R, Collins N, Warner B, Frick L. (2004) *Benefits of multidisciplinary case conferencing using audiovisual compared with telephone communication: a randomized controlled trial*	Randomised control trial	50 patient cases were discussed by the MD team via teleconference and 50 patient cases were discussed via videoconference. Data was collected regarding patient outcomes and participant satisfaction	MDT comprised of medical professionals from 2 regional NSW hospitals	There was little discernable difference between the meetings in terms of length and outcomes for patients discussed, however participants reported a far greater level of satisfaction with the meetings that utilised the videoconferencing technology	As video conferencing equipment and infrastructure was successfully used to facilitate multidisciplinary meetings, NSW Health could utilise their equipment to provide multidisciplinary training opportunities

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Umble KE, Cevero RM, Yang B, Atkinson WL. (2000) *Effects of traditional classroom and distance continuing education: a theory-driven evaluation of a vaccine-preventable diseases course*	Compartive analysis	Comparison of the surveys completed by attendees of a classroom based course regarding guidelines for vaccinations for preventable diseases and respondents who undertook the same course via video broadcast was undertaken to determine the perceived impact of the delivery method on learning outcomes and participant satisfaction. Participants were also assessed 3 months following the course to determine any change in practice	196 classroom based participants and 116 distance learning participants, generally nurses, undertaking a course in vaccination practices for preventable diseases	Surveys and subsequent assessment of participant practices 3 months following the course demonstrate no signifcant difference was found between the two groups of learners in terms of increases in knowledge leading to positive changes in practice for better adherence and application to clinical guidelines. The study demonstrated that both methods of delivery were effective for educating health professionals regarding clincal practice guidelines leading to significant changes in behaviour and practice, still demonstrable 3 months following the experience	If NSW Health executes their remote teaching services well, telemedicine can provide as effective and enjoyable learning experience as face to face interactions that lead to positive learning outcomes