

A Telerehabilitation Pilot Study: Videoconferencing about Wheelchair Positioning in a Bilingual Context

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Abstract — Videoconferencing, which involves the use of a television, a video camera, and a high speed ISDN line, can provide services to remote regions in a timely way. This includes services to anglophone clients in Quebec's outlying regions. In this 4-month pilot project we obtained data based on the experiences of 6 multi-impaired anglophone older adults who underwent up to 3 sessions of simple wheelchair positioning and on the experiences of 4 clinicians (2 bilingual specialists from the host site and 2 French speaking occupational therapists from the remote site). Clients provided data for 14 discrete videoconferencing sessions. Clinicians provided 51 instances of evaluation data for the 14 sessions. Three aspects of the videoconferencing process were evaluated: (1) quality of the work carried out; (2) satisfaction with the process and outcomes as evaluated by clients; and (3) by rehabilitation clinicians. Results indicate that all clients were very highly satisfied with the services they received, and that this was true for all sessions, including their very first experience. In general, both host and remote clinicians were also pleased with the videoconferencing. Nevertheless, there were minor equipment malfunctions in 29 % of videoconferencing sessions. Some important problems related to audio, video, and codes of behaviour were identified. An extensive set of recommendations to deal with these is provided.

Key Words — Videoconferencing, wheelchair positioning, telehealth, telerehabilitation, telemedicine

Projet pilote en téléréadaptation : visioconférence sur le positionnement des fauteuils roulants dans un contexte bilingue

Résumé — La vidéoconférence, qui exige le recours à un téléviseur, à un caméscope et à une ligne RNIS à haute vitesse, peut offrir en temps utile certains services en région éloignée, notamment à des anglophones habitant loin des grands centres du Québec. Dans le cadre de ce projet pilote d'une durée de 4 mois, nous avons obtenu des données sur les expériences vécues par 6 adultes anglophones d'âge mûr, ayant de multiples déficiences, qui ont suivi jusqu'à 3 séances de positionnement simple dans leur fauteuil roulant et sur les expériences de 4 cliniciens (2 spécialistes bilingues de l'emplacement central et 2 ergothérapeutes francophones de l'emplacement éloigné). Les usagers ont fourni des données sur 14 séances intermittentes de vidéoconférence. Les cliniciens ont fourni 51 instances d'évaluation pour les 14 séances. Trois aspects du processus de visioconférence ont été évalués : 1) la qualité du travail exécuté; 2) la satisfaction des usagers quant au processus et aux résultats et (3) la satisfaction des spécialistes en réadaptation quant aux mêmes paramètres. Selon les résultats obtenus, tous les usagers étaient très satisfaits des services qu'ils avaient reçus, et ce, pour toutes les séances, y compris la toute première. En général, les cliniciens, tant de l'emplacement central que de l'emplacement éloigné, ont également été satisfaits de la visioconférence. Nous avons cependant constaté des problèmes mineurs d'équipement dans 29 % des séances de visioconférence. Nous avons aussi repéré des préoccupations majeures liées à la transmission audio, à la transmission vidéo et aux codes de comportement. Une série exhaustive de recommandations à ces sujets est fournie.

Mots clés — Téléconférence, positionnement de fauteuil roulant, télésanté, téléréadaptation, telemedicine

Introduction

There is substantial interest in the use of videoconferencing in many aspects of health care delivery in an emerging field variously referred to as telehealth, telemedicine, and telerehabilitation. In general, distance conferencing technology, most often videoconferencing, is used to provide access to specialty services for clients in remote areas that are not well served with specialists or medical care.

Videoconferencing has been evaluated in controlled investigations in a variety of health related fields, including rehabilitation. In general, controlled empirical studies suggest that videoconferencing is, in many instances, a satisfactory and cost effective means of delivering clinical services to many clients.

Although there are no generally agreed upon guidelines for most areas of telehealth application, videoconferencing is seen as appropriate only for a subset of cases, generally, for diagnoses which are common or where simple rather than complex diagnostic issues are involved. The presence of a clinician at the remote site is often seen as an advantage.

Most studies show that clinicians prefer face-to-face evaluations to videoconferencing. Nevertheless, differences between clinicians' evaluations of face-to-face and videoconferencing, while significant, tend not to be substantial. Common problems include difficulties with voice and video quality as well as technical malfunctions which appear to occur between 17 % and 40 %

of the time. Problematic voice quality seems more important than problematic video.

One important criterion for evaluating the utility of videoconferencing in diagnostic evaluations is the extent to which diagnoses made face-to-face and via videoconferencing are concordant. In one study⁵, 2 dermatologists diagnosed the same clients: one diagnosed face-to-face, the other through videoconferencing. In their study, *The demarcation between partial agreement and disagreement was drawn where the different diagnoses would imply different treatments*. Using this definition, in their study 13 % of diagnoses were discordant, although they indicate that "no serious condition was missed". What is not clear is the reliability of diagnoses between these 2 individuals if they had both done the diagnosis face-to-face or what the level of concordance would have been had it been the same dermatologist making the diagnoses in both face-to-face and videoconferencing conditions. Nevertheless, there is concern about diagnostic accuracy, even when this occurs in a relatively small proportion of cases. Videoconferencing clients tend to be as satisfied as clients receiving face-to-face evaluations. Clients tend to like videoconferencing because it is available closer to home, is less expensive, requires no extensive travel time, and provides access to premium quality care otherwise not available. Telehealth clients are generally more likely to indicate that they would opt for evaluation using videoconferencing again, although older clients may be more likely to prefer face-to-face evaluations, possibly because of difficulties hearing the remote clinician.

Method

Overview

Many anglophones need services in remote locations, and receiving services in English is often difficult. In this 4 month pilot study the feasibility of using videoconferencing for simple wheelchair positioning with anglophone clients in a French speaking setting was evaluated. The senior occupational therapist, with the assistance of a second occupational therapist at the remote site (CHSLD Bayview Center) carried out all stages of wheelchair measuring and positioning using videoconferencing with the 2 person specialist wheelchair team of the host site (Constance-Lethbridge Rehabilitation Center - CLRC). To evaluate the linguistic component, the bilingual team from Constance-Lethbridge Rehabilitation Center spoke English to clients and French to the Bayview Center occupational therapists.

Measures

CLIENT SATISFACTION QUESTIONNAIRE — BRIEF VERSION. Contains 4 items which evaluate client satisfaction with regards to the proceedings and the

intervention. It is based on Larsen et al.³ *Client Satisfaction Questionnaire* and on an item from Lemaire et al.⁴.

VIDEOCONFERENCING AND WHEELCHAIR PROJECT CLINICIAN FORM. Contains items related to administrative aspects of the videoconferencing experience (e.g., session durations, equipment failures) as well as items related to satisfaction with process and outcome. Items were adapted from Lemaire et al.⁴ and Aarnio et al.¹.

Equipment

ADCOM's Polycom ViewStation 512, a video camera with wide angle conversion lens, a 32" monitor, and the Polycom extended microphone were used. The communication port was a triple NT-1 ISDN line termination unit.

Participants

Six volunteer residents of the CHSLD Bayview Center, a chronic care residential facility participated (3 men and 3 women, mean age = 69, range = 38-91). Selection criteria were: eligible to receive the designated services and equipment according to government of Québec (RAMQ) criteria; prefer to receive services in English; "simple" rather than "complex" wheelchair positioning required; sufficient cognitive skills to provide informed consent and complete the measures. Diagnoses included a variety of neurological conditions and arthritis.

The 4 clinician participants include the host site's CLRC 2 person wheelchair team and 2 occupational therapists from the remote site (CHSLD Bayview Center).

Of the 6 participants, one required revision of a new wheelchair and 4 required a replacement wheelchair. Two clients were seen twice and 3 clients were seen 3 times. This was their first wheelchair for 2 clients. Table 1 indicates the nature of the wheelchair positioning services.

Procedure

The research protocol was approved by the CLRC Ethics Review Board. As in the case of face-to-face wheelchair positioning, participants were seen up to 3 times for measurement, fitting, and follow-up. All sessions were conducted using videoconferencing, with the CLRC being the host site and the CHSLD Bayview Center being the remote site. Videotapes were made when participants authorized this. Communication between the CLRC wheelchair team and the client took place in English. Communication with the CHSLD Bayview Center occupational therapists took place in French. Clients were informed of the rationale for this. Sessions were held approximately 2 weeks apart and the project duration was limited to 4 months. If there was any

question about the quality of the work carried out through videoconferencing provisions were made for a face-to-face visit.

TABLE 1
Nature of the wheelchair positioning services

Positioning Services	Service Received
1. Manual or power tilt	1
2. Adjustable angle of seat and backrest unit	0
3. Modular backrest	0
4. Shaped backrest	3
5. Special cushion	3
6. Pelvic seatbelt	4
7. Seatbelt tied in the back	1
8. Table	2
9. Forearm support	1
10. Headrest	3
11. Other	2

Prior to Session 1, occupational therapists from CHSLD Bayview Center were given a 1 hour training session on wheelchair measurement. Measuring equipment was loaned to the CHSLD Bayview Center. All therapists involved received a one-hour training session on how to use the videoconferencing equipment.

Clients were informed about their rights and the confidentiality of their individual responses. They were told that these would not be seen by any of the occupational therapists involved in their care. This was done both verbally and in writing.

All sessions were carried out using videoconferencing. At the end of each session clients completed the *Client Satisfaction Questionnaire – Brief Version* and placed their responses in a sealed, self addressed envelope that was returned to the senior researcher. Each clinician completed the *Videoconferencing and Wheelchair Project Clinician Form*.

Session 1 — The CLRC wheelchair team, with the assistance of the occupational therapist from CHSLD Bayview Center, obtained needed measurements to fit or modify a wheelchair (i.e., as in face-to-face evaluation).

Session 2 — Two to 3 weeks later clients typically received their wheelchair or positioning aid. At this time some adjustments to the wheelchair were made to better fit the client.

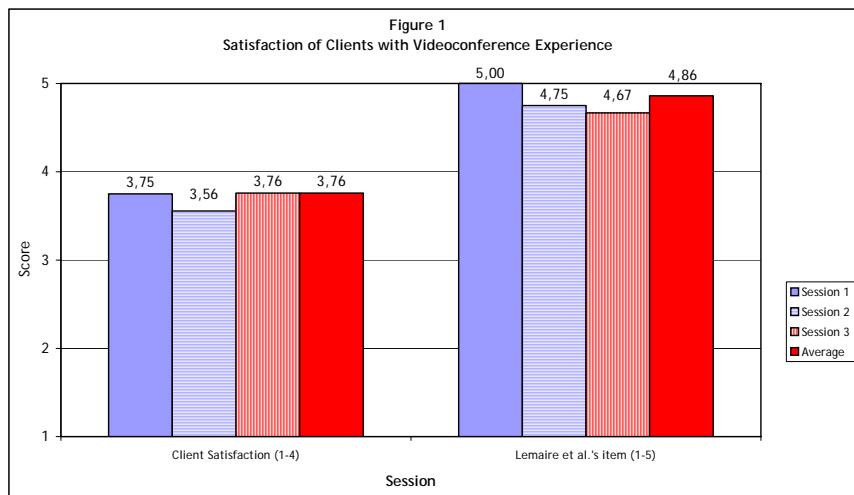
Session 3 — Where necessary, 2 to 3 weeks after clients received their new wheelchair or positioning aid they were asked how well it worked. Clinicians

conducted their standard follow-up evaluation. If there were problems, adjustments were made at this time.

Results

Clients

Figure 1 shows that clients were very highly satisfied with the services they received. For example⁴, 24 rehabilitation clients scored an average of 3,38 on the 5 point scale, compared to a mean of 4,86 (median = 5) for the present sample.



Equipment

Minor equipment malfunctions occurred on 4 of the 14 sessions. This usually involved temporarily losing the signal and having to reinitialize the system.

Solutions to problems related to audio, video, and codes of behavior were proposed and implemented during team meetings. These are detailed in the Recommendations.

Clinicians

Table 2 shows that the average length of sessions (on-line time) was approximately 1 hour (range 10 minutes to 2 hours). Clinicians spent an average of approximately half an hour "off-line" performing tasks related to the client and the evaluation session. Table 2 also provides summary scores on the *Videoconferencing and Wheelchair Project Clinician Form* for all clinicians combined. Results indicate that, in general, clinicians were generally pleased with videoconferencing and that their scores are similar to those reported by others. Breakdowns for host and remote clinicians indicate similar findings.

Table 2
Clinician Ratings: Mean Scores of all Clinicians

Item	"Norms"	Mean: all sessions	Session 1	Session 2	Session 3
On-line time (minutes)	41.65	58.49	85.50	36.11	15.45
Off-line time (minutes)	27.70	32.57	41.43	30.29	20.45
Ease of use	3.97	4.29	4.32	4.29	4.45
Ability to understand the remote person	4.28	4.68	4.64	4.72	4.91
Ease of assessment	3.04	2.80	2.77	2.89	3.00
Confidence in assessment results	3.29	2.86	2.86	2.83	3.00
Satisfaction with assessment	3.78	4.02	3.91	4.17	4.36
Outcome	3.92	3.11	3.10	3.17	3.55

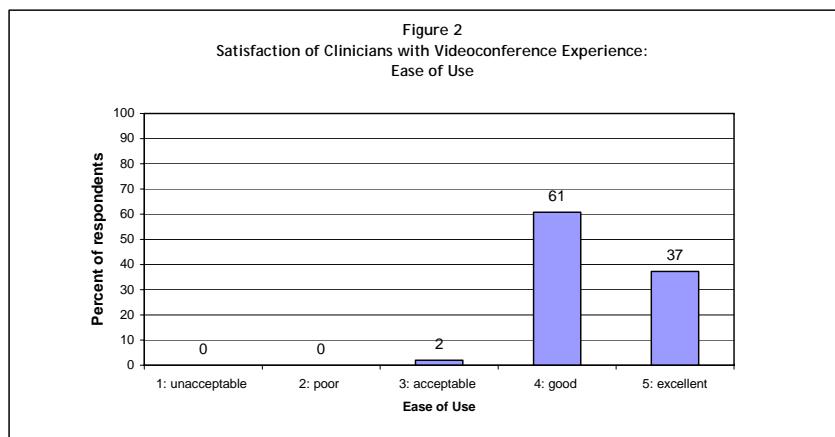
"Norms" Questions are from Lemaire⁴ and Aarnio¹

5 point rating scales, with higher scores being better

4-point rating scale, with higher scores being better

Among the 4 clinicians who were involved in the 14 videoconferencing sessions, data for 51 completed evaluations are available. It can be seen in figure 2 that on "Ease of Use" most sessions were deemed either good or excellent.

On *Ability to Understand the Remote Person*, it can be seen in figure 3 that in most instances clinicians understood almost everything said by clients and clinicians at the other location.



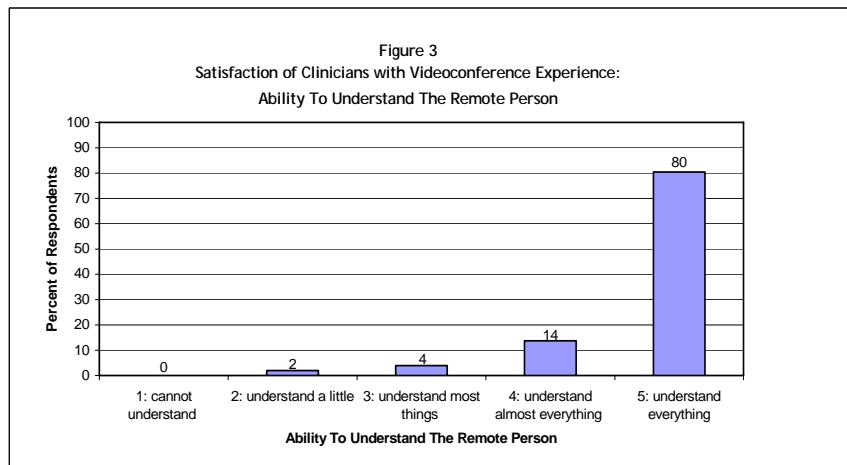
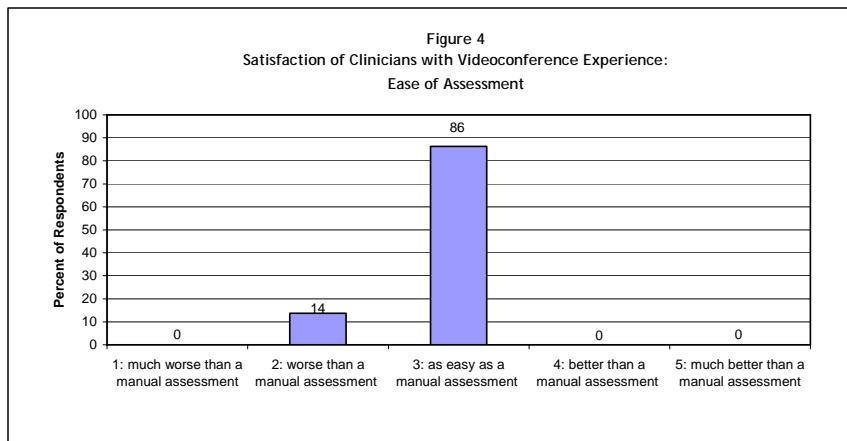
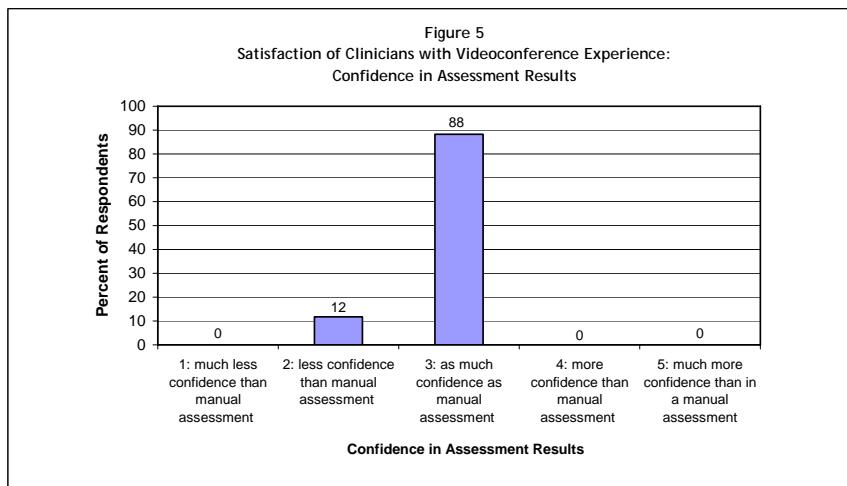


Figure 4 shows that in most cases, clinicians felt that "Ease of Assessment" using videoconferencing was equivalent to face-to-face manual assessment.



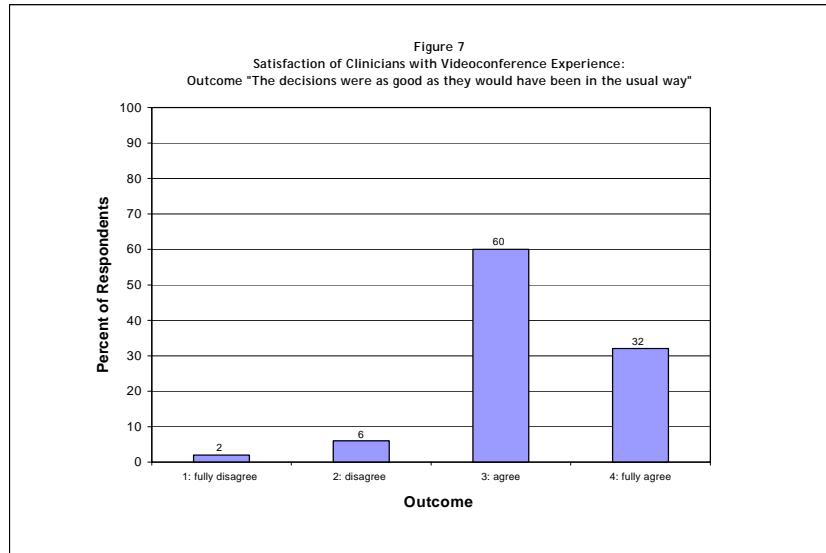
The results are similar for "Confidence in Assessment Results," as can be seen in figure 5.



When it came to *Satisfaction with Assessment* (see figure 6), in most cases the score indicated "good."



Figure 7 shows that approximately 90 % of decisions were seen to be as good as they would have been had the assessment been done in a face-to-face manner.



Discussion

The aim of this pilot study was to examine the feasibility of using videoconferencing in telerehabilitatin to deliver wheelchair positioning services to minority linguistic populations at a distance. Overall, the results of this preliminary investigation suggest that videoconferencing is a promising technique in the delivery of simple wheelchair positioning services to English

speaking clients in French speaking milieux. Clients were satisfied with the experience and both specialist and remote clinicians generally felt satisfied and comfortable with the procedures. Only 2 of the 14 sessions required a face-to-face visit by a host site mechanic.

Nevertheless, the sample was small, mainly "simple" wheelchair positioning was carried out, and the participants were carefully selected. Although scores from the present investigation were compared to results of others whenever possible, the small number of clients and clinicians is not sufficient for inferential statistical analyses. No data were collected about the comparative amount of time that would have been spent in face-to-face evaluations, nor were measurements conducted on the same clients on a face-to-face basis to assess the accuracy of evaluations. In addition, preliminary impressions suggest that sessions using videoconferencing took longer than face-to-face sessions because of the need to explain how to do things to the remote clinicians. Some concern was expressed that "complex" evaluations using videoconferencing may be problematic.

On the positive side, it is worth noting that clinicians may have become better at dialoging with clients because they had to explain the procedures very clearly. Perhaps most important, the present evaluation was conducted in a bilingual context on older adults with multiple physical and intellectual impairments. If videoconferencing was seen as successful by both clients and clinicians in such an older and impaired group, the potential of using videoconferencing for younger and more intellectually functional individuals seems truly promising.

Recommendations

Before instituting more broad-based programs, further evaluation should be carried out on a larger number of clients with a wider range of diagnoses. Comparative data from face-to-face evaluations should be obtained. Also, accuracy of evaluations should be determined by having the CLRC wheelchair team re-assess all clients whose evaluations were made using videoconferencing to determine the accuracy of measurements. In addition, an extensive cost effectiveness calculation is necessary to determine the conditions under which videoconferencing is economically justified.

It has been pointed out that the videoconferencing environment in telehealth is a new one that is experienced differently than face-to-face interactions. Thus, different rules and cues become important. Jerome and Zaylor² divide these into 3 groupings. Communication factors involve aspects such as asynchrony between video and audio, interruptions in conversation, and poor audio and delays. As noted in the results, such equipment problems were present in our investigation as well. Environmental factors involve the

fact that the televised image is 2 dimensional. This affects depth perception, a crucial concern in wheelchair positioning. Also, lighting is very important as is the distance between the interactants and the camera. Movement that is hardly noticed in face-to-face environments can be very distracting on video. Human factors include seeing only what the camera sees, lack of information about what the other side sees, and no well established codes of behavior concerning how to begin and end a videoconference health consultation.

Below is a preliminary listing of factors that need to be considered when conducting wheelchair positioning using videoconferencing with older adult clients.

Communication Factors

- The camera should be located approximately 1 meter from the ground to one side of the monitor.
- The monitor and the camera should be located approximately 2 meters from the client.
- The microphone should be located near the client. A separate microphone, to be attached to the clothing of the client, should be considered.
- Because of audio delays and occasional jerky video quality, a faster connection should be considered.

Environmental Factors

- Equipment at the remote site should be located in a room suitable for wheelchair positioning (e.g., smooth, non-carpeted floor, easy accessibility).
- The location and wiring of the equipment at the remote site needs to be flexible for different configurations.
- The room at the remote site needs to have adequate lighting and a pastel wall.
- The client in his or her wheelchair needs to be located close to the wall.
- Client clothing should include very light colors (to contrast with the black of most wheelchairs) or bright colors such as red, yellow, orange, and green. This should include the client's socks and, if possible, footwear.
- To enhance visibility, it may be necessary to cover portions of the wheelchair at the remote site. Pastel blue worked well.

Human Factors

- Because of the large number of people, formal introductions need to take place at the beginning of each session and the role of each person needs to be explained to the client.
- Clinicians should avoid speaking at the same time.

- A longer pause than in conventional speech should be considered after asking questions or when a response is expected.
- When asking the client a question, it may help to preface this by his or her name to call attention to the fact that it is the client rather than a remote clinician who is being addressed.
- It is recommended that when all other activities are completed that the client be asked something to the effect, "Mrs. X, is there anything else you would like to tell us or is there anything else you would like us to explain".
- During pauses in positioning the client, the client should be facing the television monitor.
- The client should be informed about what is happening and what the remote occupational therapists will be doing.
- The remote occupational therapist needs to be sensitive to vocalizations and nonverbal cues and gestures of the client because these may not appear on the screen of the specialist host team. The remote occupational therapist may need to prompt the host team to query the client about these (e.g., when the client mumbles or looks puzzled by a question posed by the specialist host team).
- Provision needs to be made to conduct face-to-face evaluations when this is recommended by the clinicians.

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