A Telerehabilitation Pilot Study:
Videoconferencing And 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 Québec's outlying regions. In this four 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 form 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 videoconferencing. Nevertheless, there were minor equipment malfunctions on 29% of videoconferencing sessions. Some important problems related to audio, video, and codes of behavior were identified. An extensive set of recommendations to deal with these is provided.

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 study (Nordal et al., 2001) two 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 two 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 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.

<div align="center">Method</div>

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 two 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 the proceedings and the intervention. It is based on Larsen, et al.'s (1979) Client Satisfaction Questionnaire and on an item from Lemaire, et al. (2001).

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. (2001) and Aarnio, et al. (2000).

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 (Constance-Lethbridge Rehabilitation Center - CLRC) two person wheelchair team and 2 occupational therapists from the remote site (Bayview Center).

Of the 6 participants, 1 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.

Table 1. 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

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 three times for measurement, fitting, and follow-up. All sessions were conducted using

videoconferencing, with the CLRC being the host site and the 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 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.

Prior to Session 1, occupational therapists from Bayview Center were given a 1 hour training session on wheelchair measurement. Measuring equipment was loaned to the 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 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 example, Lemaire, et al.'s (2001) 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.

Figure 1. Satisfaction of Clients with Videoconference Experience
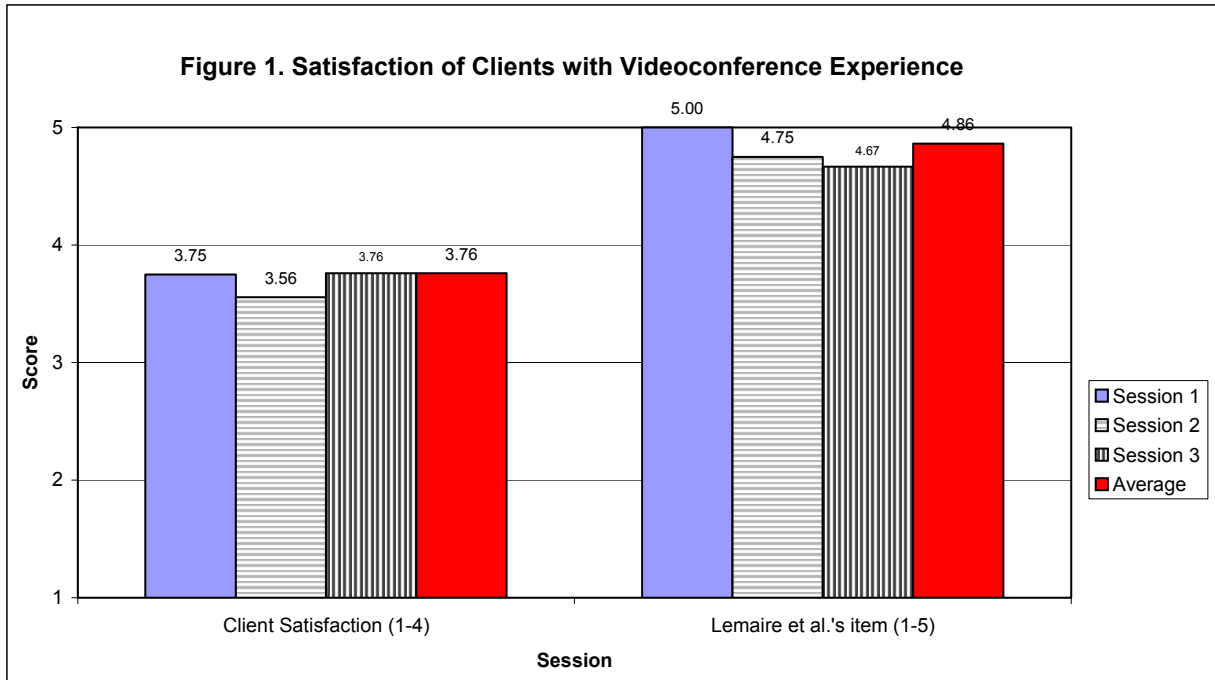
Equipment

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 ½ 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"[1]	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 [2]	4.28	4.68	4.64	4.72	4.91
Ease of assessment [2]	3.04	2.80	2.77	2.89	3.00
Confidence in assessment results [2]	3.29	2.86	2.86	2.83	3.00
Satisfaction with assessment [2]	3.78	4.02	3.91	4.17	4.36
Outcome [3]	3.92	3.11	3.10	3.17	3.55
[1] "Norms" Questions are from Lemaire, et al., 2001 and Aarnio, et al., 2000.					
[2] 5 point rating scales, with higher scores being better.					
[3] 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.

Figure 2. Satisfaction of Clinicians with Videoconference Experience: Ease of Use
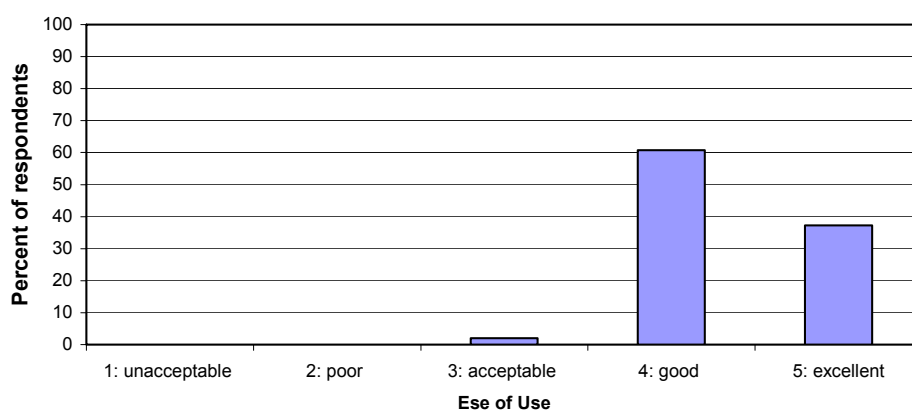
On "Ability to Understand the Remote Person," it can be seen in Figure 3 that in most instances clinicians understood almost everything said by clients and clinicians at the other location.

**Figure 3. Satisfaction of Clinicians with Videoconference Experience:
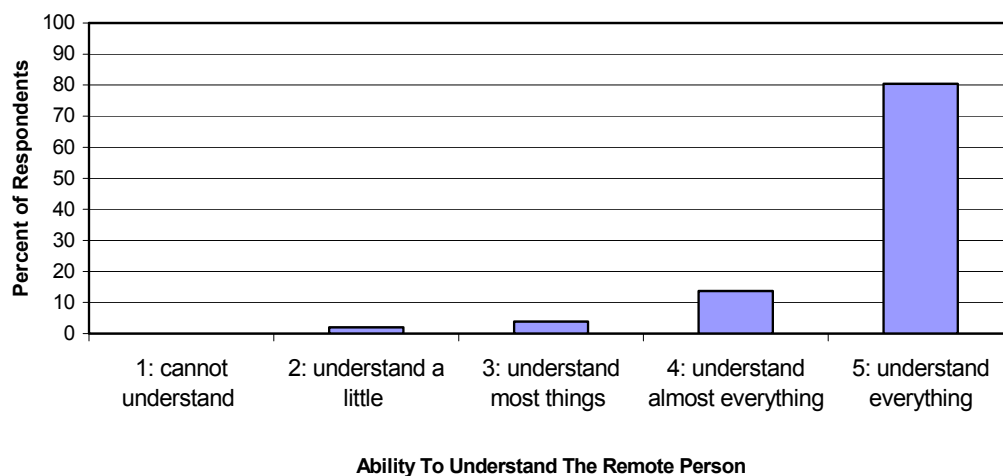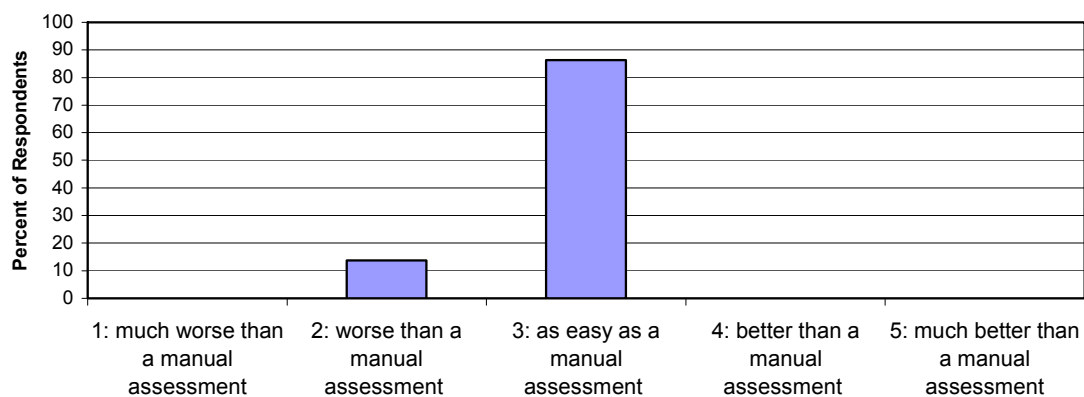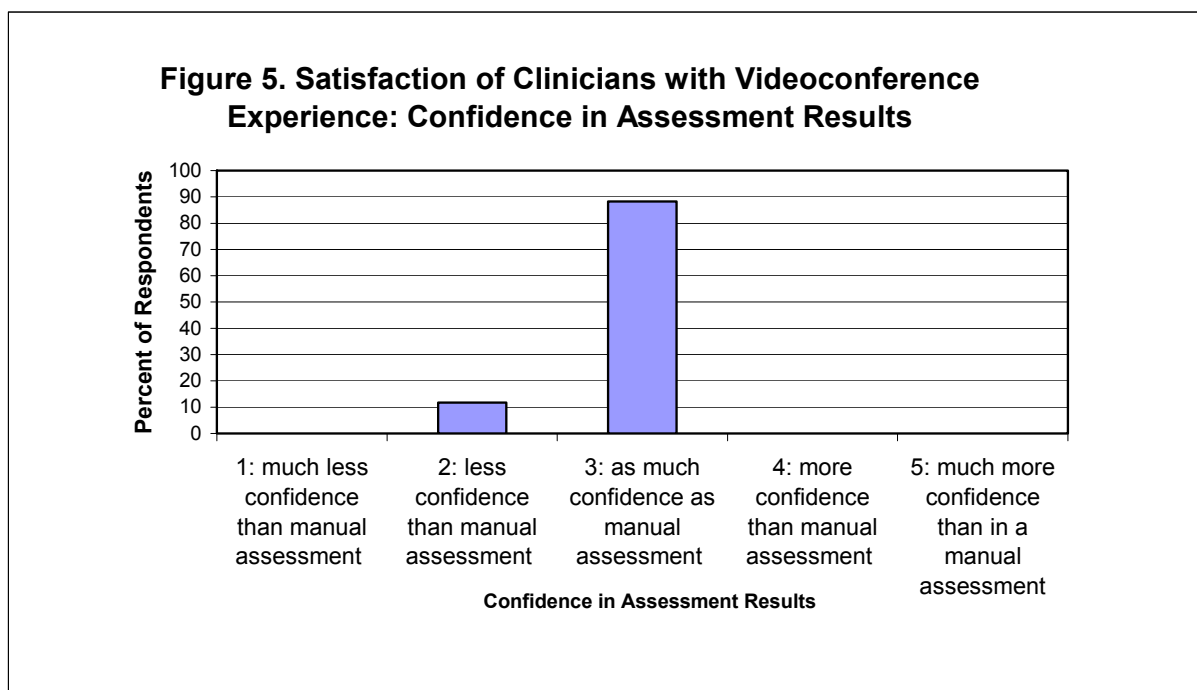Ability To Understand The Remote Person**

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

Figure 4. Ease of Assessment

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

Figure 5. Satisfaction of Clinicians with Videoconference Experience: Confidence in Assessment Results

Percent of Respondents (y-axis, 0 to 100)

Confidence in Assessment Results (x-axis)

- 1: much less confidence than manual assessment
- 2: less confidence than manual assessment
- 3: as much confidence as manual assessment
- 4: more confidence than manual assessment
- 5: much more confidence than in a manual assessment

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

Figure 6. Satisfaction of Clinicians with Videoconference Experience: Satisfaction with Assessment

Percent of Respondents (y-axis, 0 to 100)

Satisfaction with Assessmen (x-axis)

- 1: unsatisfied
- 2: poor
- 3: average
- 4: good
- 5: excellent

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.

Figure 7. Satisfaction of Clinicians with Videoconference Experience: Outcome
"The decisions were as good as they would have been in the usual way"
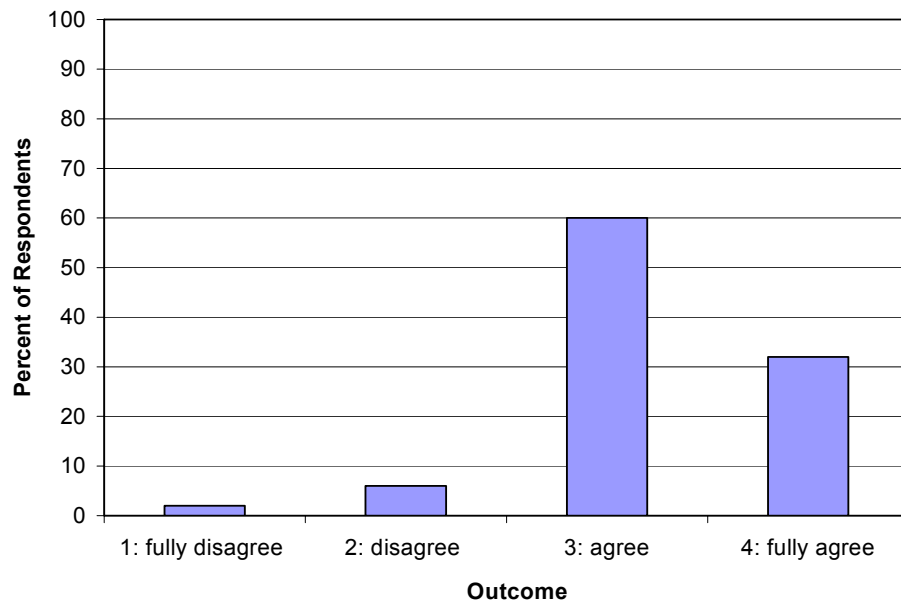
Discussion

Overall, the results of this preliminary investigation suggest that videoconferencing is a promising technique in the delivery of simple wheelchair positioning rehabilitation 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 two 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. 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 Zaylor (2000) divide these into three 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 two 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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