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Video Teleconference Administration of the Repeatable Battery for the Assessment of Neuropsychological Status

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Abstract

Teleneuropsychology applications are growing, but a limited number of assessment tools have been studied in this context. The present investigation was designed to determine the feasibility and reliability of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) administration by comparing video teleconference (VTC) with face-to-face (FF) test conditions. Eighteen adult subjects over age 55 with and without cognitive impairment were administered Forms A and B of the RBANS in VTC and FF settings in counterbalanced fashion. Similar RBANS scores were obtained in both test conditions, with generally high correlations between administration methods. Results support the feasibility and reliability of remote administration of the RBANS via VTC.

Keywords: RBANS; Telehealth; Videoconference; Teleneuropsychology; Telemedicine

Introduction

Telemedicine refers to the use of telecommunications technology to deliver medical services to patients located in a different location than the health care provider and has been thought of as a potential solution to the unequal distribution of health care services nationwide and worldwide (Grigsby, 2002). Since the inception of telemedicine, telemental health services have gained increasing acceptance. Remote psychotherapeutic interventions have been shown to produce clinical outcomes similar to traditional face-to-face (FF) interactions (O'Reilly et al., 2007), and diagnosis via telemedicine has demonstrated comparable accuracy when compared with FF evaluation (Loh, Donaldson, Flicker, Maher, & Goldswain, 2007; Martin-Khan et al., 2012; Shores et al., 2004). Similarly, video teleconference (VTC) has been shown to be a valid medium for administering various brief neuropsychological tests (Barton, Morris, Rothlind, & Yaffe, 2011; Cullum, Weiner, Gehrmann, & Hynan, 2006; Harrell, Wilkins, Connor, & Chodosh, 2014; Hildebrand, Chow, Williams, Nelson, & Wass, 2004; Turner, Horner, VanKirk, Myrick, & Tuerk, 2012; Wong, Martin-Khan, Rowland, Varghese, & Gray, 2012).

A growing number of studies have investigated the reliability and validity of different neuropsychological assessments administered via VTC and found them to produce similar results with or without the clinical involvement of assistants at the far end (Jacobsen, Sprenger, Andersson, & Krogstad, 2003; Kirkwood, Peck, & Bennie, 2000; Loh et al., 2004). We recently reported on the result from a large ($N = 202$) investigation of VTC- versus FF-administered tests commonly used in the detection and assessment of dementia and found strong correlations and similar results across tests in both conditions regardless of presence or absence of cognitive impairment (Cullum, Hynan, Grosch, Parikh, & Weiner, 2014). As with other telemental health procedures, consumer satisfaction with teleneuropsychology has been high (Kirkwood et al., 2000; Parikh et al., 2013).

Despite the increased use of remote neuropsychological assessment, only a limited number of test instruments have been evaluated in this medium. The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998) is a brief, multidimensional battery of cognitive tests useful in a variety of populations including Alzheimer's disease (AD), mild

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cognitive impairment (MCI), and other cognitive disorders (Duff et al., 2008; Karantzoulis, Novitski, Gold, & Randolph, 2013; Randolph, Tierney, Mohr, & Chase, 1998). The RBANS is increasingly used in clinical and research settings, although its feasibility within a videoconference setting has not yet been established. Thus, we administered the RBANS Form A and Form B in both VTC and FF conditions to a group of individuals over age 55 with and without cognitive impairment in order to explore its feasibility and reliability.

Method

Participants

Eighteen subjects were recruited through the Alzheimer's Disease Center at the University of Texas Southwestern Medical Center in Dallas, TX, as part of a larger investigation. The sample included seven cognitively normal controls, six individuals with MCI, and five with a clinical diagnosis of AD. Diagnosis was made prior to participation in the study via multidisciplinary consensus using standard criteria for MCI (Petersen, 2004) and AD (McKhann et al., 2011). RBANS data were collected at a separate visit and were not used as part of the diagnostic process. The total sample consisted of 7 female and 11 male participants between 58 and 84 years of age ($M = 69.67$, standard deviation [SD] $= 7.76$) with Mini-Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975) scores ranging from 19 to 30 ($M = 26.72$, $SD = 2.89$). There were 14 Caucasians, 3 African Americans, and 1 Hispanic subject, all fluent in English and able to see and hear adequately for testing purposes. Demographic characteristics of the sample are provided in Table 1. Each participant was administered the RBANS both in the FF setting and via VTC using alternate forms of the measure (Form A and Form B), with test condition (FF vs. VTC) and test forms counterbalanced across subjects.

Materials

RBANS. The RBANS was developed as a neuropsychological screening battery to detect neurocognitive disorders (Randolph, 1998). It takes ∼30–45 min to administer, has two alternate forms, and yields five index scores (Immediate Memory, Visuospatial/Constructional, Language, Attention, and Delayed Memory) and a total score. Test–retest reliability coefficients between Forms A and B reported in the manual range from $r = .39$ for the Language index to $r = .79$ for the Total Scale score (Randolph, 1998).

Video teleconferencing. For the VTC condition, we utilized a Polycom iPower 680 series videoconferencing system that provides high-quality audio and full-motion video, in two nonadjacent rooms in the same facility. Subjects were seated at a desk and viewed the examiner on a 26-inch color LCD monitor. The examiner viewed participants on another 26-inch color monitor with picture-in-picture display linked to a mobile Polycom video camera adjusted so the examiner could view the subject and test stimuli.

Procedure

This study was approved by the University of Texas Southwestern Medical Center Institutional Review Board and each participant provided written and verbal informed consent prior to participating. Adequate audio levels were ensured by adjusting volume so that subjects were able to respond to conversation-level questions. The assistant gave each participant an introduction regarding testing procedures and explained that the examiner and test materials would appear on the TV monitor in the VTC condition. Our previous experience with teleneuropsychological testing indicated that the presence of an assistant in the remote test room was unnecessary in the vast majority of cases, as communication and instructions could be adequately provided via VTC. As such, an assistant was not present in the room with subjects during testing, but was available in the clinic setting just outside the testing room if needed. Participants were seated ∼30 inches from the screen. Visual stimuli were presented by the examiner in front of the Polycom camera in a fixed position in order to mimic as close as possible the size of the actual test items. The RBANS Form A and Form B were administered, counterbalanced across the two testing conditions, with order of administration decided a priori in

Table 1. Demographics and MMSE scores

	M	*SD*	Range
Age (years)	69.67	7.76	58–84
Education (years)	14.28	2.76	9–19
MMSE total	26.72	2.89	19–30

Note: SD = standard deviation.

alternating fashion. The following accommodations were made for the VTC condition: the examiner held up the stimulus in front of the camera for RBANS Figure Copy, Line Orientation, Picture Naming, and Coding. Blank paper and a pen were available in the testing room for the participant as was a copy of the Coding sheet from the test protocol. Test sessions were conducted the same day ~10–20 min apart. RBANS protocols were scored by the examiner in conventional fashion and double-scored by another trained psychometrist to ensure accuracy. Because the purpose of this investigation was to determine the feasibility and reliability of the RBANS administered via VTC, and because of the limited number of individuals within the diagnostic groups, subjects with and without cognitive impairment were combined for analysis. Intraclass correlations and paired-samples *t*-tests were calculated to compare RBANS index scores between test conditions across the sample as a whole. Analyses were performed using IBM SPSS Statistics 22 and analyses were considered significant at a conservative $p < .01$ level.

Results

Demographics and MMSE scores for the sample are provided in Table 1, and descriptive statistics for both test conditions along with intraclass correlation (ICC) results are provided in Table 2. All correlations were significant and ranged from $r = .59$ ($p < .01$) for the Visuospatial/ Constructional index score to $r = .90$ ($p < .001$) for the Delayed Memory index score. Paired-samples *t*-tests also revealed no significant differences between the means of the index or total scores obtained in each condition. Although small sample size precluded statistical comparison of individual subgroups, we analyzed test condition order effects to see whether those with cognitive impairment might benefit more than healthy controls from having FF testing done prior to VTC testing and found no order effects.

Discussion

Teleneuropsychology is showing promise as a way to perform assessments at a distance. A variety of neuropsychological tests have been examined using VTC, although there is a need to demonstrate the utility of additional measures in this context (e.g., see Cullum & Grosch, 2012). The present findings add to this growing body of literature, showing that RBANS scores obtained in VTC and FF conditions were highly similar, with correlations ranging from $r = .59$ to .90, with a mean of 0.80. We also found very similar mean scores across RBANS index scores between conditions, with differences ranging from 0.39 to 3 points. RBANS index scores are standard scores with a mean of 100 and a *SD* of 15, so differences of this magnitude are indeed small. In comparison, uncorrected between-forms (Form A–Form B) correlation coefficients reported in the RBANS manual (Randolph, 1998) ranged from $r = .39$ to .79 with a mean of 0.61. Thus, we found similar or higher correlations between test forms in our investigation across all index scores. This may be related to the shorter time interval between test administrations, because both test forms were administered within 10–20 min in the current study compared with a 1- to 7-day interval in the standardization sample. Nevertheless, this result not only supports the VTC administration of the RBANS but lends further support to the equivalence of Forms A and B.

Limitations of this investigation include the relatively small sample size, the short time interval between test–retest conditions, and the use of the same examiner for both test conditions, as these factors may have served to augment the observed correlations. The possibility of selection bias also cannot be ruled out, as the subjects volunteered to participate in a telehealth-based study. Additionally, participants were located in a nonadjacent room relative to the examiner in the same office suite within a secure network, and Internet connection speeds can vary over distance and by location. Further, assessments with a visuospatial component, like the RBANS Figure Copy, administered in the VTC condition require that the examiner either score the protocol while being viewed via camera, or alternatively, after it has been scanned or faxed to the examiner's site, although we found no difference

Table 2. Descriptive statistics and correlations for RBANS administered FF and VTC

Index score	Face to face		Video teleconference		ICC
	M	*SD*	*M*	*SD*	*r*
Immediate memory	97.17	27.12	96.22	24.06	.84**
Visuospatial/Constructional	94.89	20.16	92.72	23.00	.59*
Language	95.94	13.49	95.56	10.60	.75**
Attention	96.33	18.69	93.33	16.80	.81**
Delayed memory	90.83	30.37	93.28	27.06	.90**
Total scale	94.50	23.10	93.06	19.74	.88**

Notes: RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; FF = face-to-face; VTC = video teleconference; *SD* = standard deviation.
*$p < .01$; **$p < .0001$.

in scoring using either method. These pilot results nevertheless support the feasibility and reliability of RBANS administration in a VTC setting. Further research is needed to evaluate the reliability and validity of VTC-based administration of the RBANS in larger groups and other clinical populations.

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Conflict of Interest

None declared.

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