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## Research Paper

## Assessing Cognitive Function in Older Adults Using a Videoconference Approach

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## ABSTRACT

**Background:** The use of communication technologies is an emerging trend in healthcare and research. Despite efficient, reliable and accurate neuropsychological batteries to evaluate cognitive performance in-person, more diverse and less expensive and time consuming solutions are needed. Here we conducted a pilot study to determine the applicability of a videoconference (VC, Skype®) approach to assess cognitive function in older adults, using The Telephone Interview for Cognitive Status-Modified – Portuguese version (TICSM-PT).

**Methods:** After inclusion and exclusion criteria, 69 individuals (mean age = 74.90 ± 9.46 years), selected from registries of local health centers and assisted-living facilities, were assessed on cognitive performance using videoconference, telephone and in-person approaches.

**Findings:** The videoconference administration method yielded comparable results to the traditional application. Correlation analyses showed high associations between the testing modalities: TICSM-PT VC and TICSM-PT telephone ( $r = 0.885$ ), TICSM-PT VC and MMSE face-to-face ( $r = 0.801$ ). Using the previously validated threshold for cognitive impairment on the TICSM-PT telephone, TICSM-PT VC administration presented a sensitivity of 87.8% and a specificity of 84.6%.

**Interpretation:** Findings indicate for the range of settings where videoconference approaches can be used, and for their applicability and acceptability, providing an alternative to current cognitive assessment methods. Continued validation studies and adaptation of neuropsychological instruments is warranted.

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## 1. Introduction

Demographic ageing is a worldwide phenomenon that presents new socio-economic and health challenges, with an increasing need for proficient healthcare services to meet the needs of older adults. Most relevant, ageing is accompanied by cognitive decline; (Ciemins et al., 2009) thus, an efficient assessment process to determine cognitive status in aged individuals is of uttermost need. However, a comprehensive neuropsychological testing is a lengthy ordeal that goes well beyond several hours of physical presence in a healthcare institution.

With the broad availability and diffusion of the Internet, computer-based cognitive assessment can provide the greatly needed renewed impetus on cognitive function assessment (Wild et al., 2008). In fact, videoconferencing (VC) has been used to carry out clinical consultations of older people (Hildebrand et al., 2004). Such approach minimizes, for example, the burden of travel for seniors who live in remote/rural areas

(Shores et al., 2004). Regarding cognitive testing it can also be a cost-saving methodology and may be suited for broad screening strategies (Wild et al., 2008; Castanho et al., 2015). In fact, good agreement between face-to-face versus non face-to-face methodology has been reported (Timpano et al., 2013; Weiner et al., 2011). For example, Hildebrand and colleagues (Hildebrand et al., 2004) administered via in-person and by videoconference a battery of neuropsychological tests to 29 cognitively intact older adults; multiple cognitive measures demonstrated high degree of concordance between the two methods of evaluation. A feasibility study in older subjects with Mild Cognitive Impairment (MCI) and with mild to moderate Alzheimer's disease (AD) found correlations between 0.5 and 0.8 on a brief battery of neuropsychological instruments administered in-person and via videoconference (Cullum et al., 2006). There are also some studies on the use of videoconference to diagnose and treat cognitive disorders in the elderly, such as brain injury and other neurological disorders (Shores et al., 2004; Lott et al., 2006). In fact, work has demonstrated good correlations between various cognitive tests using other technologies compared with face-to-face interview, most often using telephone-based instruments (Castanho et al., 2015). Among these, the Telephone

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Interview for Cognitive Status (TICS; original instrument) (Brandt et al., 1988) is the most commonly used tool used by telephone for screening of cognitive status in older/elderly individuals. Still, the establishment of a practical assessment of cognition through videoconference is unexplored. On this, the most practical solution could be the addition of video to validated telephone instruments, allowing to create a social presence and bypass problems posed by telephone methods (Menon et al., 2001; Castanho et al., 2015).

Here, addressing this need, the purpose was to use a videoconference approach of the TICSM in different settings: (i) full-time community-dwellers, (ii) those resorting to assisted-living during the daytime (day care centers), and (iii) full-time residents in nursing homes with diagnosed Alzheimer's Disease. To our knowledge, there are no studies that compare three separate administration methodologies of cognitive screening in the same individual and across different settings/groups.

## 2. Materials and Methods

### 2.1. Participants

A convenience sample was selected from Braga and Paços de Ferreira (Portugal) local health centers, assisted-living day-care centers and nursing homes. After inclusion/exclusion criteria, the final sample was composed of 69 subjects (40.6% men), with ages between 57 and 95 years (mean = 74.33, SD = 9.46). Formal education level ranged between 0 and 17 years. All participants from the local health centers (n = 20) were community-dwellers and all participants from the day care centers (n = 30) attended the center on a partial basis (afternoon and/or morning period, night time at family residence). The remaining participants (n = 19) were residents in a licensed skilled nursing facility with 24-hours care. The sample characterization is summarized in Table 1 and the participant flow chart in Fig. 1. Portuguese citizens are registered in local health centers since birth and are automatically assigned a family/general practitioner. Individuals requesting assisted-living support (partial or full-time) are allocated to their local centers. On measures of literacy, (un)employment rates, positive experience/mental health, and other socio-demographic characteristics, Portugal ranks close to the OECD (Organization for Economic Co-operation and Development; [www.oecd.org/](http://www.oecd.org/)) average.

The primary exclusion criteria included inability to understand informed consent, choice to not participate or withdraw from the study, incapacity and/or inability to perform or complete each of the cognitive screening assessment sessions. Nursing home residents were previously diagnosed with early Alzheimer's disease by the psychologist of the institution or by a psychiatrist. Clinical information for all participants was obtained from medical records and through neuropsychological evaluations and/or neuroimaging exams.

The study was conducted in accordance with the Declaration of Helsinki (59th Amendment) and approval was obtained from the national and local ethics committees. Written informed consent was obtained

from all volunteer participants prior to participation and recording of the evaluations. Because patients with Alzheimer's disease may be impaired in their ability to give adequate informed consent, which may be the case even in the disease's earliest, their primary caregiver and/or surrogate decision maker also signed the informed consent.

### 2.2. Procedure

The testing set-up included two laptops, one running Microsoft® Windows 7® (i5 M450, 2.40 GHz, 4GB RAM) for participants' use, and a second running Microsoft® Windows 7® (Intel Pentium® B950, 2.1GHz, 6GB RAM) for the psychologist's use. Both laptops had built-in microphones and web cameras. The TICSM administration took place through real-time videoconference carried out with the free video-call software Skype® v6.16 on both computers. Audio, video and connection settings were adjusted in each evaluation session in order to achieve good quality of communication.

At the start of the videoconference evaluation, the psychologist gave each participant a brief introduction regarding the VC-Skype® testing procedure and explained that would only appear on a screen but that another psychologist would be readily available in person if necessary. For all assessments, the psychologist in the room was out of the participant's line of sight, and primarily assessed for the testing conditions and took note of any difficulty or (internet) connection problem. Otherwise could not intervene. For safety concerns, and well care of the study participants/patients, in the day care centers and nursing homes there was always a health professional of the institution outside the closed door. Among the individuals diagnosed with early Alzheimer's disease this is an established safety measure in order to prevent patients from leaving the room unattended. For the full-time community-dwellers testing took place at the Clinical Academic Center-Braga (2CA, Braga, Portugal); for all other participants testing took place at an adequate room of the day care center or nursing home. Each evaluation by telephone took 7 to 8 min, and by videoconference took on average 2 min longer to administer when also accounting for computer/video connection setup time. No confusion regarding who was at the other end of the telephone and videoconferencing was noted throughout the assessment for any of the participants.

To indicate for the acceptability, anxiety and ease of the participants, an informal guided discussion was previously held in a small group, for individuals of each of the settings (community, day care center and nursing home). Feedback on the quality of connection (sound and image) in order to particularly address for potential difficulties for those with hearing or visual impairment was obtained. The pilot sample was not considered/included in the study, but a similar informal discussion, which addressed the same parameters, also followed each videoconference assessment for the study participants (Table 6).

### 2.3. Instruments

Originally developed from the MMSE, the TICSM has a high validity and reliability on the screening of cognitive impairment (Welsh et al., 1993). Summarily, it consists of 13 items that assess different domains of cognitive function (orientation, learning, attention/calculation, language and delayed recall) (Castanho et al., 2014). The instrument has been validated in the Portuguese (PT) population (TICSM-PT) (Castanho et al., 2015) showing satisfactory internal consistency and convergent and divergent validity.

All participants went through the assessments in the same order: face-to-face, videoconference and telephone. The TICSM-PT via videoconference was applied 1 month after the MMSE face-to-face assessment; thereafter, after a 2-month interval from the videoconference administration, the TICSM-PT was applied by telephone. This allowed avoiding any learning effect (Mitsis et al., 2010). The MMSE ("gold standard", face-to-face administration) (Folstein et al., 1975) takes approximately 5 to 10 min to administer and has a maximum possible score of

**Table 1**  
Sample characterization.

Gender	
Male	28 (40.6%) <sup>a</sup>
Female	41 (59.4%) <sup>a</sup>
Age	74.3 (9.46), [57–95] <sup>b</sup>
Years of formal education	4 (3.29), [0–17] <sup>b</sup>
Group	
Healthy	50 (72.5%) <sup>a</sup>
AD	9 (27.5%) <sup>a</sup>
Provenience/setting	
Community	20 (29.0%) <sup>a</sup>
Day care center	30 (43.5%) <sup>a</sup>
Nursing home	19 (27.5%) <sup>a</sup>

<sup>a</sup> Data presented as n (% of total sample).

<sup>b</sup> Data presented as mean (SD), [range].

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