

# Use of a Data Transmission System for Neuropsychological Evaluation in Adult and Elderly Patients.

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**Abstract**— The use of information systems and telecommunications in medicine has been increasingly growing in recent years. Using equipment dedicated to the connection through interactive web-cam between two structures is possible to perform neuropsychological assessment at distance. In particular in the first structure, at the presence of the patient and the operator, the neuropsychological assessment is performed, and in the second, at distance, the results of tests performed by the patient on graphics tablet (Wacom Intuos 3 A3 USB Dtp pen specification) are received and it is possible a direct interaction between operator and patients for any need or clarification on some aspects. It was carried out a prior specific training for the staff of the structures according to the administration of tests and procedures for data transmission. It was possible to perform and transmit electronically the main tests for the evaluation of functional and neuropsychological dementia concerning the overall assessment, the evaluation of cognitive functions, functional assessment, the insight of disease, behavioral disorders, depression, caregiver stress. We carried out an experimental preliminary assessment on 20 patients: 10 subjects under 65 years old (average  $57\pm 5$  years) and 10 patients over 65 years old ( $71\pm 6$  years). We did not find any differences between the two groups for the use of the system, so we believe that we can easily use it, even in elderly patients, especially where there are not high specialized staff.

## I. INTRODUCTION

THE use of information systems and telecommunications in medicine has been increasingly growing in recent years and there are many examples of data, scans and images transmission between different and distant places of care (health clinics, polyclinics, hospitals, nursing homes, rehabilitation centers, home services). This application can result especially useful in setting where it is not always possible to have high professional specialization, such as facilities for elderly patients, both in

outpatient and hospital. In the field of dementia a valid experience and expertise of staff with specific training for the diagnostic and the complex therapeutic management is required and not all outpatient or residential structures in the national territory have the qualified staff, in particular staff able to perform neuropsychological assessment, by means of tests analyzing specific functional cerebral areas complicated by lesions [1]. Often highly specialized staff for the administration of tests that allow a differential diagnosis between different forms of dementia is required [2]. Whereas the most effective approach to the patient provides direct contact with the professional (doctor or psychologist), it is possible to foresee the connection between a reference centre with highly qualified staff, and one or more peripheral units, where staff trained by reference centre could take the history, in presence of the patient, and to perform one or more neuropsychological tests and send on-line the results at the referral center, which ultimately will make a competent judgment on the diagnosis, therapy or whether to perform further investigations.

Moreover geriatric medical expertise is not universally available, even in industrialized countries. This is usually a result of inadequate supply of practitioners or remoteness. In rural or remote communities, there may be insufficient caseload to warrant the full-time presence of a geriatrician. As a consequence, this important capability is often not available. Telemedicine strategies have been applied in response to similar challenges in other medical disciplines. Telemedicine has the possible advantage of being able to offer a service at marginally increased cost, depending on volume, and eliminating travel costs for the doctor and the patient, and in particular to achieve a neuropsychological assessment in non self-sufficient elderly patients. However, relatively few studies have explored the feasibility of consultation with elderly patients. In fact age-related disabilities and unfamiliarity with technology might cause problems.

For these reasons aim of our study was to evaluate the feasibility of performing neuropsychological assessment at distance in elderly patients compared to adult subjects.

## II. METHODS

Our preliminary experience is based on using equipment dedicated to the connection through interactive web-cam between two structures, the first (basic structure) where, at the presence of the patient and the operator, the neuropsychological assessment is performed, the second (referral centre), at distance, that receives the results of

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tests performed by the patient on graphics tablet (Wacom Intuos 3 A3 USB Dtp pen specification) (Fig. 1) and directly interact with the operator for any need or ask for clarification on some aspects. It was carried out a prior specific training for the staff of the structures according to the administration of tests and procedures for data transmission. It was possible to perform and transmit electronically the main tests for the evaluation of functional and neuropsychological dementia concerning the overall assessment, the evaluation of cognitive functions, functional assessment, the insight of disease, behavioral disorders, depression, caregiver stress.



Fig. 1. The Wacom Intuos 3 A3 USB Dtp pen specification system

### III. RESULTS

We carried out an experimental preliminary assessment on 20 patients: 10 subjects under 65 years old (average  $57 \pm 5$  years) and 10 patients over 65 years old ( $71 \pm 6$  years), consecutively admitted at the Alzheimer's Evaluation Operative Unit of "Federico II" University of Naples. All subjects were referred to the Alzheimer's Evaluation Operative Unit for assessment of cognitive impairment by several different centers.

All subjects were diagnosed as affected by Mild cognitive impairment by: 1. taking a history from the patient and informant to determine if there has been a change in cognition in recent months and years; 2. neuropsychological testing to determine the general cognition, defined by performance in non-memory cognitive domains; 3. assessing the activities of daily living and instrumental activity of daily living scores for functional evaluation.

The study design included a baseline neuropsychological assessment of all recruited subjects performed in a "conventional" face-to-face consultation, followed after 1 week by the technological evaluation.

The study population was divided by age in two groups: <65 years old subjects and over 65 years old patients.

By using the Student T-test for paired and unpaired data no statistically significant differences were found for any considered variable, after face-to-face and technological evaluation in each group, and between groups.

### IV. DISCUSSION AND CONCLUSION

In our study we did not find any differences between the two groups for the use of the system.

In many instances, patients may benefit from feedback regarding the evaluation in language that they can understand. Psychologists should exercise clinical judgement and take into consideration the needs and capabilities of the particular client when feedback is provided. Providing feedback, education, and support to the family are also important aspects of evaluations and enhance their value and applicability. Knowledge regarding levels of impairment, the expected course, and expected outcomes can help families to make adequate preparations. Working with families can provide them with effective and humane methods for managing persons with problematic behaviors. Appropriately counseling families regarding known genetic components and the heritability of the various disorders can address their concerns, and in many cases, allay needless fears. Healthy older adults who have had concerns about their cognitive functions can benefit from reassurance based on results of testing [3] and from suggestions as to how they may enhance their everyday cognitive function.

Some successes have been reported with assessment of cognitive function [4] and psychiatric interview [5], with clear parallels to wider geriatric practice. The use of videoconference was reported as acceptable for patients with mild dementia, but its utility is likely to decline as the patient is less able to comprehend the interview, or has significant sensory impairment. A specialist cognitive service [4] was able to show that standardized screening tools appear to perform reliably when used in videoconference to diagnose dementia, but this selected patient group required a clinician at the remote location, to enable specialist clinician assessment. Telephone assessment of cognition has also been validated in stroke follow-up [6].

Since cognitive function is an important component of comprehensive geriatric assessment, these reports provide valuable guidance, but the more impaired patients are less likely to tolerate unfamiliar technology, unless supported by skilled staff at the time, as in the nursing home experience. When there is a possibility of cognitive impairment, the capacity of the patient to cope with the technology becomes a confounding factor.

In our experience the use of a graphic tablet represented a useful and easy tool to assess neuropsychological status in patients, independently to the age, showing that also in the elderly this means could be used in the evaluation of cognitive functions, functional assessment, the insight of disease, behavioral disorders, depression, and caregiver stress.

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