

Toward early detection of cognitive frailty in the community: tools and resources from past to next

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Background and Aims

The emerging global growing of elderly people causes an increasing number of frail, vulnerable older adults who are affected by a physiologic state of increased vulnerability to stressors that results from decreased physiologic reserves, and even dysregulation of multiple systems (Fried et al., 2004). The multidimensional and functional decline is caused by both physical and cognitive factors. Due to the increasing life expectancy, dementia is emerging as a major health problem. Research showed that the neural degeneration of dementia begins many years before clinical signs appear. An early diagnosis at the stage of pre-clinical or prodromal dementia is pivotal to optimize early approach and management of dementia for patients and caregivers. Due to the need of extensive administration in non-specialist setting, cognitive screening tools should be low-cost and easy to use. To this purpose clinicians can implement

well-known brief neuropsychological tests (1), or develop new strategies (2). Recent research showed that in addition to memory dysfunction, an early subtle language decline may heralds dementia. Neuropsychological tests often fail to reflect a person's communicative abilities. The first aim of this project is to implement brief cognitive tests as screening tools in clinical daily practice and to promote a computerized version of some of them (Clock Drawing Test). Most of them have been standardized or validated in Emilia Romagna. Moreover, we aim to find specific patterns of pathological languages, and to upgrade an easily and widely employable technique to collect ecological discourse samples in the population. The final aim of this project is to develop new validated approaches and technologies for the prevention and early diagnosis of frailty and cognitive decline.

(1) Neuropsychological tests

Mini-mental State Examination (MMSE) St by Measso et al. (1993); Magni et al. (1996)

The MMSE is a 30-point questionnaire test widely used to screen cognitive impairment but heavily influenced by age and education. The Measso validation study was conducted in a large sample of subjects aged 20-79, whereas the Magni one was administered to 1019 elderly healthy subjects aged 65-89. It is considered scarcely reliable in low educated subjects (low specificity) and in higher educated ones (low sensibility). It evaluates various functions: orientation to time and place; registration and recall; attention and calculation; language; praxis.

Duration: about 10 minutes.

Montreal Cognitive Assessment (MoCA) Nasreddine (1996); Pirani et al. (2006)

The MoCA is a short test validated in the setting of mild cognitive impairment (MCI) and subsequently adopted in numerous other settings. The validation study was administered to 94 MCI, 93 AD and 90 healthy elderly subjects. There is no standardization in Italian subjects

MoCA assesses several cognitive domains: visuospatial and executive functions; memory; attention, concentration and working memory; language and orientation to time and place.

Duration: about 10-15 minutes.

Three Objects - Three Places (3O-3P) Prestia et al. (2006)

The 3O-3P is a short, ecological test of episodic memory for the screening of Alzheimer's Disease (AD) validated by comparing the performance of a little sample of normal subjects, mild cognitive impairment (MCI) patients, AD and non-AD demented patients. The known group validity showed a specificity between 87% and 91% and a sensitivity between 92 and 100% in correctly identifying AD in age classes ranging from 50 to 65 and 66 to 80 years. However its sensitivity is very low to identify MCI.

After asking the subject to name three objects, the examiner hides them in three different places. After 5-10 minutes, the clinician asks the subject to say which objects have been hidden and exactly where.

Duration: 10 minutes.



GP assessment of Cognition (GPCog) Brodaty et al. (2002), Pirani et al. (2010)

The GPCog is a valid and efficient instrument for the screening of dementia developed for General Practitioners (GPs), specifically in primary care settings. Various studies (Brodaty et al., 2002; 2006; Lorentz et al., 2002) show it performs as well as the MMSE. Italian validation is based on a sample of 68 controls and 132 patients. It has little or no education bias and provides both cognitive testing and informant reports as sources of information in one single scale (2-stage administration)

- 1) cognitive functions assessment: registration and recall; orientation to time; visuospatial abilities; language;
- 2) interview with an informant about patient's current abilities compared to 5-10 years before (e.g. ability in remembering things, etc.)

Duration: about 5 minutes.

Clock-drawing Test (CDT) Freedman et al. (1994), Caffarra et al. (2011)

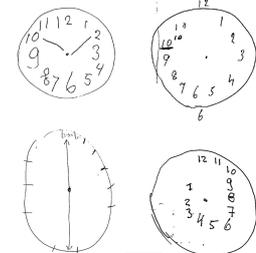
Freedman et al. (1994), Caffarra et al. (2011)

The CDT is a valid screening tool for the evaluation of cognitive decline. It requires constructive skills, but also verbal understanding, memory, spatially coded knowledge, planning and time communication ability. The Caffarra validation study was conducted on 248 subjects (aged 20-89; schooling 5-13).

The test is composed of three parts: free-drawn clock (FD), pre-drawn clock (PD), and examiner-drawn clock (ED).

Age seems to have no effect on the FD, whereas a significant effect was found for the PD and ED conditions and the total score. Gender and education had no influence on any of the scores.

Duration: 5-10 minutes.



(2) New techniques

In order to assess communicative abilities we aim to develop a new screening technique which is based on the **discourse analysis**. We intend to compare verbal productions of two different groups: the first one composed of pathological subjects (MCI; early AD; advanced AD), the other one composed of controls. Subjects productions will be recorded whilst talking about different stimuli (a picture, a working day or a personal dream). Their discourses will be carefully transcribed and submitted to a computational analysis by using natural language processing techniques, to obtain quantitative and qualitative data at any level of linguistics (morphology, syntax, lexicon).

We intend to insert the GPCog in **Millewin** (the most widespread Italian GP's software) as a leading test for detecting cognitive decline in office patients.

We aim to develop a **Tablet app** which can identify possible initial symptoms of cognitive decline through the analysis and automatic scoring of clock drawing. Subjects will produce the sketches using an appropriate smart-pen directly on the Tablet screen (Android o. s.).

If these different tools (linguistic patterns resulting from the discourse analysis, CDT and GPCog) show to be effectively predictive, they will be widely implemented in the community (e.g. GPs' involvement) as fast-screening tools, in the cheap and easy-to-use form of ICT and Tablets.



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