

Cognitive Testing of Elderly Chinese from Selected Community Clubs in Singapore

S Sahadevan,**MRCP (UK), DGM (Lond)*, N J L Tan,***BA*, T C Tan,****FAMS, MBBS, MFOM (Lond)*,
S Tan,*****Dip Clin Psych, MSc(NZ)*

Abstract

The aim of this study was to describe the psychometric performance of cognitively normal elderly Chinese on selected psychological tests. One hundred and fifty-five community-living, cognitively intact elderly Chinese, stratified according to age and gender were administered a selected neuropsychological assessment battery which comprised the Abbreviated Mental Test (AMT), the Chinese Mini-Mental Status (CMMS), the Short Blessed Test (SBT), the Word-List Immediate Memory (WL-i), the Word-List Delayed Memory (WL-d), the Word-List Recognition Memory (WL-r), the Set Test (ST), the modified Boston Naming Test (BNT), the Constructional Praxis Test (CPT), the Block Design Test (BDT) and the Object Assembly Test (OAT).

The local median scores (ranges) of the above tests were as follows-AMT: 9 (6-10); CMMS: 25 (16-28); SBT: 2 (0-10); WL-i: 17 (8-27); WL-d: 5 (0-10); WL-r: 9 (1-10); ST: 13 (6-25); BNT: 14 (10-15); CPT: 1 (0-3); BDT: 19 (0-42); OAT: 20 (3-33). These results can assist in the clinical identification of cognitive abnormalities amongst the elderly Chinese in Singapore. Future work will attempt to adjust these overall scores for variables such as the subjects' education and age.

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Introduction

Singapore's population is undergoing a revolutionary experience in terms of its rapid and disproportionate ageing; while those in the age group of 60 years and above constituted 8.8% of the nation's population in 1990, they will, by 2030, represent 26% of the country's population.¹ There are multi-faceted consequences resulting from this remarkable transformation. From the perspective of health care matters, it is anticipated that more and more elderly patients will be encountering a hospital as the years go by; likewise what is also predicted is the increase in the number of chronic degenerative illnesses involving various organ systems of the body.

One such disorder affecting the brain is dementia, which is an age-prevalent condition, being much more common in the elderly; worldwide epidemiological studies indicate a doubling of prevalence for every 5.1 years beginning with the age group of 60 to 64 years

(which has an estimated prevalence rate of 0.7%).² The few epidemiological studies on this subject matter conducted in Singapore indicate a prevalence rate of 2% to 4% amongst those aged 65 years and above.^{3,4}

For the clinician, the recognition of this syndrome has been aided considerably by the establishment of well-defined criteria such as those of the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV)⁵ or the National Institute of Neurological and Communicative Disorders and Stroke - Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA).⁶ The NINCDS criteria also state that supporting evidence for the clinical impression of dementia is needed via psychological testing. Such testing provides objective evidence of dysfunction in various mental domains such as memory, language and visuospatial abilities, and can be a valuable adjunct to the clinical assessment.

To conclude on a psychological test that an individual's performance is below average, and thus abnormal,

* Consultant

** Research Psychologist
Department of Geriatric Medicine
Tan Tock Seng Hospital

*** Senior Lecturer
Department of Community, Occupational and Family Medicine
National University of Singapore

**** Clinical Psychologist
Private Practice

Address for Reprints: Dr S Sahadevan, Department of Geriatric Medicine, Tan Tock Seng Hospital, Moulmein Road, Singapore 308433.

implies that one is already aware of the average normative scores for that test. Test performance is influenced by a multitude of factors such as the educational status of the subject, his or her socio-economic background, cultural milieu, presence or absence of illnesses and medication being concurrently used. It is only with careful consideration of such factors that a psychologist may be able to make reasoned conclusions about abnormality or otherwise in the test scores. It also follows from this that very often it is difficult to apply the normative scores established in a population that is culturally and educationally different from our own.

In the setting of dementia, for example, the investigators of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) had published the norms from their neuropsychological assessment battery which was especially attractive for its short testing time.⁷ Those tests, as well as the normative scores however, cannot be directly applied locally as a number of items in the CERAD tests are culturally inappropriate in our context and the educational attainments of their sample of normal elderly subjects were much higher than that of the average elderly subject in Singapore. We thus need our own norms and it was decided that the optimal way to establish this was to apply selected psychological tests to a cross-section of local cognitively-intact, community-living elderly subjects.

In this paper, we describe how this community study was designed and conducted, and we also present the normative scores obtained from the selected instruments of this project.

Materials and Methods

Design

The main objective of this study was to identify cognitively-intact elderly subjects, stratified according to age, gender and prior educational attainments, and to apply selected tests in the neuropsychological assessment battery to them. In this study, the elderly have been defined as those aged 60 years and above, and they were grouped into 3 categories: (a) 60 to 64 years; (b) 65 to 74 years; and (c) 75 to 84 years. Likewise, previous educational exposure was categorised as follows: (a) 0 years of education; (b) 1 to 6 years of education; and (c) more than 6 years of education.

The master-list of community-living elderly subjects was obtained by pooling together membership records of several Senior Citizens' Clubs in the Community Centres as well as the Retirees' Club of the People's Association. The names of the subjects were subsequently stratified according to age and gender categories. In Singapore, there are Community Centres (sometimes several) in each of the 81 constituencies; 10 were randomly selected and permission was asked with regards to the conducting of the study; a total of 7 gave

approval. It was felt that members of the Senior Citizens' Clubs could represent a fairly good cross-section of the elderly in Singapore including those with less educational attainments. Because of our interest however in seeing how educational exposure influenced test results, we also approached the People's Association (a statutory board that promotes community activities) for permission to give us a list of their Retirees' Club members. It was felt that those enrolled in the Retirees' Club generally came from a higher educational background.

Given the resources and time allocated to the project, we intended to study a total of 180 elderly subjects and they were to come equally from both the Senior Citizens' Clubs and the Retirees' Club. To further standardise the study, we felt it was important that only the Chinese population be looked at so that serious cultural differences would not enter as a potential confounding factor in the eventual interpretation of the test scores. Thus, only the Chinese of the major dialect groups in Singapore (Mandarin, Hokkien, and Teochew) participated in the study; Cantonese, the fourth common dialect group amongst the Chinese locally,⁸ was excluded as the research psychologist was less fluent in that dialect. No interpreters were used in this study.

From the names in the stratified age and gender categories derived by the above-mentioned methods, subjects were randomly selected and a telephone interview was conducted for each subject with the following aims:

- (a) to explain the purpose of the call and the aims of the study;
- (b) to conduct a screening questionnaire interview over the phone that was designed to pick up features of dementia, their medications, functional status and level of alcohol consumption.

In addition to the above information, a slightly modified version of the 10-question Elderly Cognitive Assessment Questionnaire (ECAQ), a cognitive screening test already validated locally,⁹ was administered. Another separate telephone interview was conducted with the subject's principal care-giver (their children in the overwhelming majority of cases) where the informant's responses to features in the subject suggestive of dementia were looked out for. When all the entry criteria (*vide infra*) were met, the subject was asked further permission for a subsequent home visit by the research psychologist for the purpose of administering the selected tests in the neuropsychological assessment battery.

The overall participants in the study constituted about 20% of the total master-list. The 80% who did not enrol included those who did not give their consent (18.4%—hereafter referred to as non-participants), those who did

TABLE I: SAMPLE SIZE OF THE COMMUNITY STUDIED

	Senior Citizens' Clubs				Retirees' Club			
	60 to 64 years	65 to 74 years	75 to 84 years	Total	60 to 64 years	65 to 74 years	75 to 84 years	Total
Male	10	15	10	35	14	16	11	41
Female	15	15	10	40	15	15	9	39
Total	25	30	20	75	29	31	20	80

not meet the entry requirements of the study (7.4%), as well as the overwhelming majority who were non-contactable (53.8%). The final number of subjects who entered the study are shown in Table I.

Each of the 155 subjects in this final pool had a home visit. During the home visit, the aims of the study were again explained, and care was taken to ensure that adequate conditions for administering the neuro-psychological assessment battery were met (e.g. in a room with sufficient lighting and minimal distractions). The tests in the battery were administered in the same order for every subject and each session lasted a maximum of 45 minutes.

All tests and procedures were approved by Tan Tock Seng Hospital's ethics committee and were administered with the informed consent of both the subject and the principal care-giver.

Selection Criteria

It is important to delineate the entry criteria used in this study to define cognitive normality. Essentially, a two-levelled approach was taken to identify the cognitively normal elderly subject. The first level comprised the assessment of the subject, outlines of which have been mentioned above. On the ECAQ, the subject was required to obtain a score of 7 and above for entry into the study; an earlier validation work on this screening instrument had demonstrated that a score of 5 and below optimally identified dementia locally.⁹ Since a frail state of physical health (with the subject essentially home-bound and/or dependent on any one of the activities-of-daily-living) could also lead to sub-optimal cognitive performance, only those in good or moderate states of physical health were enrolled into the study. Regular intake of sedatives and significant alcohol intake (defined as more than one bottle of spirits for each drinking session and/or a frequency of more than one drinking session per week) were also regarded as exclusion criteria. Depression was similarly excluded; thus any subjects with a history of that disorder or who were on anti-depressants were not enrolled.

Apart from the subjects' assessment, the second level of approach comprised asking a principal care-giver whether the subject had any excluding features suggestive of dementia, including the criteria of memory impairment, aphasia, apraxia and agnosia described in

the DSM-IV;⁵ a past history of depression or other psychiatric conditions as well as stroke disease were also enquired for and excluded.

Throughout the above exercise of identifying the elderly who were cognitively intact, the aim was to ensure that those described as being normal in this study were reasonably so, while avoiding the characterisation of a "super-normal" group of elderly subjects (whose performance scores cannot be usefully extrapolated to the "average" patient seen in the clinical setting).

Neuropsychological Assessment Battery

The neuropsychological assessment battery consisted of two main groups of tests: (a) cognitive screening tests, which are brief instruments designed to help form a clinical impression of the probable presence or absence of dementia by assessing mental status; and (b) psychological tests, which provide additional and more detailed information for the diagnosis of dementia by assessing the pattern of impairment in the different aspects of cognition. Each of the tests were selected based on their brevity and ease of administration, with the entire battery being completed in a maximum of 45 minutes for each subject.

There were 3 cognitive screening instruments in all. The Abbreviated Mental Test (AMT)¹⁰ is a 10-item scale that assesses memory, concentration and orientation as does the 6-item Short Blessed Test (SBT).¹¹ The Chinese Mini-Mental Status (CMMS)¹² also assesses the above functions in addition to language, calculations, and visuospatial abilities.

The selection of the various neuropsychological tests also depended on their ability to assess the characteristic impairments accompanying dementia in the domains of memory, language, visuospatial abilities, and executive functioning:

a) *Word List Memory (Immediate Recall)*:⁷ Ten words were chosen from the Rey Auditory-Verbal Learning Test (AVLT)¹³ Word List A based on their appropriateness in our cultural context, with two modifications. This list is verbally presented and free recall is assessed across three trials with the words being presented in a different order for each trial. The maximum score is 30 for the three trials.

b) *Word List (Delayed Recall)*: Delayed memory for the

10 words in the Word List (Immediate Recall) test is assessed 10 minutes after the third trial on immediate memory. A maximum score of 10 can be obtained.

c) *Word List (Recognition)*: This tests recognition of the 10 words from the Word List (Immediate Recall) test which are presented together with 10 distracter words. The distracter words have either a semantic association or a phonetic similarity to the original 10 words and were selected from the corresponding Word List for testing AVL T Recognition. In order to adjust for chance, the total number of correct answers minus 10 yields the subject's score. In the event that the result is less than 0, a score of 0 is given.

d) *Set Test (Animal Category)*:¹⁴ This assesses language, verbal fluency, and executive functioning. The total number of animals named within one minute gives the score.

e) *Modified Boston Naming Test*:¹⁵ Fifteen line drawings were chosen from the original 60 drawings in the Boston Naming Test based on the level of difficulty of each item, as well as on cultural relevance with particular attention being paid to how appropriate each item would be in the translated versions. They were presented for subjects to name in a maximum of 20 seconds for each picture. A semantic clue is given upon each failure and another 20 seconds allowed for a response.

f) *Constructional Praxis*:¹⁶ Visuospatial skills are assessed with four line drawings of generic figures (a circle, intersecting rectangles, a diamond, and a cube) being presented for the subject to copy. Two trials are given for each figure and errors are scored.

g) *Block Design*: This is a performance subtest of the Wechsler Adult Intelligence Scale-Revised (WAIS-R).^{17,18} It is a construction test that measures visuospatial organisation. The subject is presented with red and white blocks and is required to use them to construct replicas of designs. Speed credits are given for latter items.

h) *Object Assembly*: This is also a performance subtest of the WAIS-R where the subject is presented with cut-up cardboard figures of familiar objects to assemble. All responses are scored for both time and accuracy.

The neuropsychological assessment battery was administered by a research psychologist who underwent training in interview techniques and procedures, as well as familiarisation with the various languages and dialects. All the test materials and the instructions were translated into Mandarin, and the other two major dialects in Singapore, namely, Hokkien and Teochew. Back-translation was also done to ensure accuracy and appropriateness in the phrasing of the items.

Items requiring adaptations included the question "What is the season?" on the Chinese Mini-Mental

Status, which was excluded since there are no seasons in Singapore. The two questions "In which town are we?" and "In which county/district are we?", also on the Chinese Mini-Mental Status, were combined to form the single question "In which estate are we?" because the latter was deemed to be a more appropriate question in Singapore. Two words, "Coffee" and "Turkey" from the Word List (Immediate Recall) Test were also modified to "Tea" and "Chicken" respectively, as their translated equivalents are more culturally appropriate. The item, "Corn", replaced the item "Asparagus" on the modified Boston Naming Test as it is a much less common food item and also has no corresponding equivalent in Mandarin or the other two dialects. For the item "Funnel" on the modified Boston Naming Test, the colloquial terms in the three dialects were accepted as correct responses, as the proper name for these items were not in the daily usage of the language. No equivalent for the item "Say the months in reverse order" on the Short Blessed Test could be found in the Chinese language; hence, this test was only administered to subjects who were tested in English.

Statistical Analysis

In this paper the mean scores on the various tests, as well as univariate tests of statistical significance were calculated using SPSS for Windows (Statistical Package for Social Sciences, Version 6.0, 1993).

Results

Subjects

The total number of subjects who were entered into the study was 155 (52% from the Retirees' Club and 48% from the Senior Citizens' Clubs) and their demographic

TABLE II: DEMOGRAPHIC CHARACTERISTICS OF SUBJECTS

	Frequency (%)
Age (years)	
60 to 64	54 (35)
65 to 74	61 (39)
75 to 84	40 (26)
Sex	
Female	79 (51)
Male	76 (49)
Education (years)	
0	33 (21)
1 to 6	59 (32)
> 6	72 (47)
Language Tested	
English	60 (39)
Mandarin	64 (41)
Hokkien	23 (15)
Teochew	8 (5)

TABLE III: EDUCATION LEVEL OF SUBJECTS BY GENDER AND AGE

	Male				Female			
	60 to 64 years	65 to 74 years	75 to 84 years	Total (%)	60 to 64 years	65 to 74 years	75 to 84 years	Total (%)
Education (years)								
0	1	0	3	4 (5.3)	11	10	8	29 (36.7)
1 to 6	7	13	9	29 (38.1)	8	9	4	21 (26.6)
>6	16	18	9	43 (56.6)	11	11	7	29 (36.7)
Total (%)	24 (31.6)	31 (40.8)	21 (27.6)	76	30 (38)	30 (38)	19 (24)	79

characteristics are shown in Table II. There was an approximately comparable number of subjects in the two younger age groups (35% aged 60 to 64 years, and 39% aged 65 to 74 years) and a slightly lower percentage in the oldest age group (26%). The percentage of female respondents was slightly higher (51%) than males. Although approximately half of the subjects had more than 6 years of education (47%), there was a higher percentage of males who fell into this category, while among the females there was a more equal spread of the educated and non-educated and the two younger age groups were generally more educated than the older age group (Table III). English and Mandarin were the two more common languages used for testing subjects (39% and 41% respectively).

The demographic characteristics of those who declined to participate in the study were as follows: the percentage of females was again higher (64%) than males; there were also more from the age group of 65 to 74 years (53%) than from the younger age group (29% aged 60 to 64 years), and the oldest age group (18% aged 75 to 84 years). The proportions of males and females and of the age group 65 to 74 years when compared to the corresponding proportions amongst the participants (Table II) were found to be statistically significant ($P < 0.05$).

Cognitive Norms

The mean and median scores as well as the ranges obtained for each of the tests in the psychological assessment battery are summarised in Table IV.

Higher scores show less cognitive impairment, except for the Short Blessed Test¹⁶ and the Constructional Praxis Test, which score errors. The sample size for the Short Blessed Test was 60 as it was administered only to the English-speaking subjects, and the sample size for both the Block Design and Object Assembly subtests from the WAIS-R¹⁷ was 152, while for all the remaining tests, the sample size was 155.

The norms from the CERAD study⁷ have also been included in Table IV where applicable. The sample size of their control group was 278 and their mean level of education was 14.2 years.

TABLE IV: NORMATIVE SCORES OF THE NEUROPSYCHOLOGICAL TESTS

Test	Community Norms	CERAD Norms
Abbreviated Mental Test [10]		
Median,	9	
Mean	8.9 (0.8)	
Range	6 to 10	
Chinese Mini-Mental Status [28]		
Median	25	
Mean	24.3 (0.2)	
Range	16 to 28	
Short Blessed Test [28]		
Median	2	
Mean	1.7 (0.3)	1.3
Range	0 to 10	0 to 13
Word List Memory (Immediate Recall) [30]		
Median	17	
Mean	17.0 (0.3)	21.1
Range	8 to 27	9 to 30
Word List (Delayed Recall) [10]		
Median	5	
Mean	5.4 (0.2)	7.2
Range	0 to 10	0 to 10
Word List (Recognition) [10]		
Median	9	
Mean	8.1 (0.1)	9.6
Range	1 to 10	5 to 10
Set Test (Animal Category)		
Median	13	
Mean	14.1 (0.3)	18.0
Range	6 to 25	7 to 38
Modified Boston Naming Test [15]		
Median	14	
Mean	13.7 (0.1)	14.6
Range	10 to 15	12 to 15
Constructional Praxis		
Median	1	
Mean	0.8 (0.1)	
Range	0 to 3	
WAIS-R Block Design [51]		
Median	19	
Mean	18.6 (0.0)	
Range	0 to 42	
WAIS-R Object Assembly [41]		
Median	20	
Mean	20.2 (0.6)	
Range	3 to 33	

Values in [] indicate maximum possible score for the test.

Values in () indicate standard error of the mean.

Discussion

When the same cognitive and psychological tests described in this report are administered to elderly patients in the clinics or wards for the purpose of assessing their mental status, the interpretation of the scores obtained becomes easier and more accurate given the normative values of these tests. One has to note however, that the entire work was confined to the Chinese; any extrapolation therefore, of the results to other races, would have to be done with great care. Ideally, similar studies on elderly Malays and Indians need to be conducted.

It is also important to gauge the representativeness of our cohort to the general elderly Chinese population of Singapore. Data from the 1990 population census showed 57% of the Chinese elderly (60 years of age and above) to be females and their distribution by age categories were as follows: 60 to 64 years-32%; 65 to 74 years-42%; 75 years and above-26%.¹⁹ The same census also showed the educational attainments of this group to be the following: no formal education-63%; 1 to 6 years of education-25%; more than 6 years of education-12%.⁸ Thus compared to the general elderly Chinese population of this country, the main difference is that our cohort of subjects was a more educated group and it will be important to keep this in mind when viewing the results of Table IV. What would be necessary as a next step is to see if the psychometric scores are indeed being influenced by demographic variables such as education and if so, to derive the appropriate variable-adjusted scores and we intend this to be the subject matter of future work.

Another limitation of this study was that our 155 subjects represented only 20% of the total number in our master-list. The statistical analysis of the differences in gender and age of our study sample against those of the non-participants had shown significance in both the gender as well as the age category of 65 to 74 years. The educational attainments of the non-participants were not available for similar comparison. Despite our intentions to age and sex-match the subjects, the observational design of our study could not totally avoid the above-mentioned differences and the possibility, therefore, of a degree of bias influencing our results cannot be totally ruled out.

As Table IV shows, compared to the norms established by the CERAD investigators⁷ the local mean test scores generally were lower ($P < 0.05$) with the exception of the Short Blessed Test¹³ which was not significantly different. However, the mean years of education of the CERAD population (14.2 years) appears higher than ours (which has a median group of 1 to 6 years of education) and this fact together with the dissimilar cultural backgrounds may explain the observed differ-

ences between local and Western norms.

Table IV also demonstrates that for a number of tests the range of scores can be rather wide and in certain instances, the lower end of this range has already reached the "floor". This phenomenon is also noticeable in the West. From the clinical point of view, what needs to be borne in mind therefore, is that isolated test scores alone cannot be used to make conclusions about the presence or absence of dementia; rather, it is vital to look at the entire psychological battery (which should be testing several domains such as memory, language and visuospatial abilities) and then combine the results from such a battery with the clinical evaluation of the doctor to arrive at the final diagnosis of cognitive impairment or otherwise.

Conclusion

We have described in this article, the design and methods of this study as well as the mean normative scores on selected cognitive screening instruments and psychological tests that were administered to the elderly Chinese in Singapore. The results pave the way for a more accurate clinical recognition of dementia in this group. In subsequent papers we intend to clarify the influence of variables such as prior educational attainments and the age of subjects on the test scores, and once sufficient number of elderly Chinese patients with mild dementia have been clinically evaluated in the hospital setting, the actual efficacy and limitations of these instruments in identifying dementia will also be determined.

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