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An urban community-based study of cognitive function among non-demented elderly population in India

[1]Shyamal Kumar DAS, [2]Tapas Kumar BANERJEE, [2]Chandra Shekhar MUKHERJEE, [1]Paramita BOSE, [1]Atanu BISWAS, [5]Avijit HAZRA, [1]Aparna DUTT, [1]Sujata DAS, [3]Arijit CHAUDHURI, [4]Deepak Kashinath RAUT, [1]Trishit ROY

[1]Bangur Institute of Neurology, [2] National Neurosciences Centre, [3] Indian Statistical Institutes, [4] All India Institute of Public Health and Hygiene, [5] Departments of Pharmacology, IPGMER, Kolkata, India.

Abstract

This study provides normative data on the cognitive function of randomly selected, non-demented and non-depressed 745 healthy urban subjects ranging from 50 to 95 years of age with a standardized cognitive test battery (Kolkata Cognitive Screening Battery) in the city of Kolkata, India. Results showed better test scores among subjects with higher educational level. Age related cognitive decline was observed unevenly across cognitive parameters. Women had lower mean scores on all the parameters except fruits naming and the three domains of memory tests. Results showed comparable test scores by urbanites on most cognitive parameters except animal naming and visuo-constructional ability as compared to illiterate rural population. This population-derived normative data will help to separate the cognitively impaired from the unimpaired group in the urban populations of India as well as neighboring countries of South East Asia after proper validation in respective vernacular language.

INTRODUCTION

A wide range of cognitive screening instruments is currently available to evaluate various aspects of cognition in an individual. The Mini Mental State Examination (MMSE)[1] is a widely-accepted and quick to administer brief screening test for cognitive dysfunction. It has been modified and translated into different languages, such as Chinese, Finnish[2], Korean[3], Japanese[4], Spanish[5], Yoruba[6], Cree[7] and Hindi.[8] However, MMSE when applied alone has low sensitivity and is insufficient for the detection of early dementia.[9] More comprehensive test batteries such as the Consortium to Establish a Registry for Alzheimer's disease (CERAD)[10], Cambridge Examination of Mental Disorders of the Elderly (CAMDEX)[11] and the Structured Interview for Diagnosis of dementia of Alzheimer-Type, multi-infarct dementia and dementia of other etiology (SIDAM)[12] have been developed and applied in various settings, generally in the developed world, to obtain more elaborate analyses of cognitive function.

The scores obtained from cognitive tests have been shown to vary in different target populations with regard to age, educational attainment and socio-cultural issues.[13] Modifications of existing cognitive test batteries are particularly necessary in a country like India which has an enormous ethnic, linguistic and cultural diversity and widely varying educational levels among its population. A comprehensive Hindi cognitive screening test battery based on CERAD and Hindi Mental State Examination (HMSE)[8] has been developed for the Hindi-speaking semi-literate and illiterate population of rural northern India. However, there is no such test battery for the urban population, estimated over 300 million in India.[14]

We decided to obtain a normative data from a healthy urban population above the age of 50 years residing in the city of Kolkata (previously called "Calcutta") and the ultimate purpose is to utilize this data to distinguish cognitively impaired from the unimpaired group in the urban community.

METHODS

Study area

The study was conducted within the municipal area of the city of Kolkata. The city has a heterogeneous population, where the predominant

Address for Correspondence: Dr. Shyamal Kumar Das, Professor of Neurology, Bangur Institute of Neurology, Kolkata. Q No- 74, Minto Park Govt. Housing estate, 247/1, A.J.C Bose Road, Kolkata-700027. Phone: 033-2223-2235 extn. 199(Office), 033-2223-0003 (R), Email: das_sk70@hotmail.com

ethnic group speaks Bengali. The next major linguistic group is Hindi, though some from this community are also very fluent in Bengali. The population within the municipal city limits is 4.58 million. The overall literacy level is 81%.[14]

Study design

According to urban frame survey, the National Sample Survey Organization (NSSO) under the Government of India has divided the Kolkata municipal area into 5200 blocks with the objective of listing down the number of households and population in each block every year. Using a table of random numbers, we decided to select the required numbers of blocks to capture a representative population of about 50,000. We planned to visit 50% of the households randomly in each block. The approximate number of households in each block was about 150 and the average family size was approximately 4.5. A door-to-door survey was conducted between February 2003 and April 2004 by a field team and we screened 52,377 individuals from a randomly selected cohort of 11,819 households, chosen from a total of 166 blocks. The mean number of households visited per block was 71. Out of the screened population, 9,602 (18.3 %) persons were identified as being 50 years old or more. Since the Indian population is younger than the developed world (72% below 50 years old)[14] and dementing illnesses had been reported in patients as early as 50 years old; [15] and the general perception of the people was that they grew old after 50, we decided to define our elderly population as equivalent to 50 years old and above. It was planned *a priori* that for logistical reasons the survey would be restricted to a sample size of 10% of our older population (>50 years old). So, 960 subjects were randomly approached for an interview.

Inclusion and exclusion criteria

Subjects aged •50 years and residents of Kolkata city were included in this study. The subjects with the following disorders were excluded: (i) Dementia according to DSM IV criteria; (ii) History of significant hearing or visual impairment, and unable to participate in an interview in a meaningful manner; (iii) History of memory impairment observed by the family members, not matched with DSM IV criteria[16]; (iv) Family history of dementing illnesses; (v) History of neurological disorders (stroke, Parkinson's disease, active epilepsy) or psychiatric illnesses (schizophrenia, mental retardation, depression and mania) and significant substance abuse. Individuals who were living alone were also excluded because the history and complaints could not be corroborated with another person.

Data collection

Four field investigators who had at least a bachelor degree with experience in epidemiological investigations were selected for the survey. They were trained extensively during the initial 3 months to make them capable of identifying subjects with neurological disorders and to familiarize them with the thorough operations of the instruction manual of the cognitive test battery. Initially all the participants underwent brief screening and examination by the neurologist before being included in the study. The healthy participants were subjected to a structured interview in their residents which included demographic information such as age, sex, literacy level and the number of years in school, occupation held during their working life and mental state examination. The cognitive test battery was then administered by the field investigators under the direct supervision of the neuropsychologist. Geriatric Depression Scale (GDS)[17], which was already validated for internal consistency, was also applied to establish the presence of hitherto undetected depression. Information was corroborated with at least one close family member, usually the spouse, children, or a reliable informant closely associated with the test subject. Subsequently all information recorded in the proforma were verified by a team consisting of two senior neurologists and one senior psychiatrist who checked the completeness of the information entry and if there was any deficiency, further contact was made with the participants. They also determined initially the sensitivity and specificity of the cognitive battery, which was found to be 80.3% and 90%.

Kolkata Cognitive Screening Battery

Our cognitive screening test battery consisted of category-based verbal fluency tests (fruits and animals), a 15 item version of the object naming test, mental state examination, calculation tests, visuo-constructional ability which included drawing the circle, diamond, overlapping rectangles, box and a set of memory tests which consisted of immediate memory, delayed and recognition of a 10 item wordlist. This test battery has already been used and validated by Ganguli

and her colleagues in a rural Ballabgarh population in north India.[18] In addition, GDS[17] was also applied to establish the presence of hitherto undetected depression. Given that our study was conducted on an urban population, our cognitive test battery differed from Ganguli's in one particular domain, which was the information related to places according to existing local norms. We replaced questions on post office, district, village and block with questions on locality (road name), city, state and country. This partially modified Hindi cognitive screening battery was translated into Bengali and again back translated to Hindi by independent bilingual professional translators in order to ensure the integrity of the translation. The GDS was also translated into Bengali and again back translated into Hindi. The translated test battery was named the Kolkata Cognitive Screening Battery (Appendix).

Field-testing was done to evaluate intra-rater and inter-rater reliability. The inter-rater reliability was determined by applying the cognitive test and GDS on 24 randomly selected subjects by four field investigators. They recorded the test findings individually under the direct supervision of the project neuropsychologist who scored their result. The neuropsychologist independently applied the test on the same subjects and the neurologist scored the result. Similarly intra-rater reliability was determined by applying the test to a group of 50 normal subjects. Each subject was tested twice at one-month interval. Both the test results were analyzed statistically. The final battery was pilot tested on 50 randomly selected participants.

Statistical analysis

For intrarater and inter-rater variation, we used Spearman Rank coefficient of correlation. For the purpose of analysis of our main data, subjects were divided into sixteen subgroups by age and education and two subgroups by gender. The age groups were 50-59 years, 60-69 years, 70-79 years and 80 years and above. Where age could not be determined properly, it was established by correlation with sentinel events and significant life events with the help of the family wherever necessary. Based on the number of years of prevalent pattern of formal education in India, each subject was categorized into four education groups- 0 education (illiterate), 1 to 5 years of school (primary education), 6 to 12 years of school (high school), 13 and above years of education (graduation and above). The first group (illiterate or nil education) was defined as those who were unable to read and write any written message in any language and the other three groups are defined by years of formal education. There were some subjects who had not received any formal education but knew the alphabets and were able to read and write simple sentences; these were included in the primary education group. Cognitive parameters were compared between the two genders by Mann-Whitney *U* test. An analysis of variance (Kruskal Wallis test) was used to analyze differences among the four educational groups and four age groups. A value of $p < 0.05$ was considered to be statistically significant for all analyses. The data was analysed using Statistica version 6.0.

Cut-off scores

For screening a large population, operational cut-off points are essential to differentiate between the cognitively impaired and the unimpaired groups.[13] We chose the lowest 10th percentile score as the cut-off point for identifying the significantly impaired tenth of the population. In GDS, score ranges from 0-30. The higher scores indicate undetected depression. We chose the highest 90th percentile as the operational cut-off point (i.e. 21) for identifying participants with masked depression.

RESULTS

The inter-rater reliability measures for each of the tests were excellent and ranged from 0.85 to 1.00. Intra-rater reliability, except object naming, was also shown to range from 0.76 to 0.98, consistent with excellent correlation. In the object naming test, the intra-rater reliability was 0.25 because of the learning effect of a few illiterate participants who did well in second testing as compared to the first testing.

Of the 960 subjects, the proportion of age ranges were: 50-59 years (31.2%), 60-69 years (31.9%), 70-79 years (25%), 80 years and more (12.0%). The age range of the general population (N=9,602) were: 50-59 years (43.5%), 60-69 years (32.7%), 70-79 years (17.3%), 80 years and more (6.7%). Of the 960 potential subjects, 82 refused the test, 53 were unwilling or unable to complete the test to any meaningful level and 11 had a major hearing or visual impairment noted during evaluation. A further 32 subjects had clinically significant neurologic and psychiatric diseases. The were: stroke (18), epilepsy after stroke (5), Parkinson's disease with memory impairment (2), depression (3), schizophrenia

(2), mental retardation (2). These subjects were excluded from the study. The records were verified by the review team. Seven hundred eighty two subjects completed the entire cognitive test battery including the GDS. Based on the cut off score of GDS, a further 37 individuals were excluded. The normative data presented here are taken from the remaining 745 non-demented and non-depressed individuals.

Since the population was mixed and constituted predominantly of Bengali and Hindi speakers, the participants were categorized in two groups. Distributions of the studied groups by age, education, genders are presented in Table 1. The mean age of the Bengali speaking and Hindi speaking groups did not show any statistically significant difference. However the Hindi speaking group had significantly lower educational levels than Bengali speaking group. The proportion of Hindi speaking group in the study was smaller (13.6%) as compared to the Hindi speaking population of Kolkata (18%).[14]

The number of men and women in our study were roughly equal. The participating women had a significantly lower mean age and educational level (Table 1). The overall distribution of the test scores with mean values (± SD), median, quartile range and both 10th and 90th percentile scores were presented in the normative data table (Table 2). Women also had significantly lower mean scores on all the parameters except fruits naming and the three domains of memory tests (Table 3).

The Hindi speaking group had significantly lower scores in all parameters except object naming and the three domains of memory test as compared to the Bengali speaking group (Table 4).

In each educational group (Table 5), we found significant differences in almost all parameters except in the domains of immediate and delayed memory. However the differences were not significant between the illiterate versus the primary school group and between the primary school versus the high schools group.

Table 6 shows the comparison of the test results among the four age groups. Tests of verbal fluency, mental state examination, three domains of memory tests and visuo-constructional ability show uneven decrement with age. Significant differences in overall test scores were mainly observed when comparing the relatively younger (50-59 age) with those of elderly subjects above the age of 70 years. Object naming and calculation did not show significant alteration with age.

The interaction of age and education on the different test parameters is presented in Table 7, showing statistically significant differences in all the tests except immediate/delayed memory and recognition test.

DISCUSSION

In India there is only one validated cognitive screening test developed on a rural illiterate Hindi speaking population in Ballabgarh, North India.[18] In view of the heterogeneity of our urban population consisting of multiethnic and multilingual subjects at different literacy level, it is essential to prepare a normative data of cognitive screening tests for the elderly urban population. Population derived normative data are essential to separate the cognitively impaired from the unimpaired group.

Cut-off points for different parameters in our study had been based on percentile scoring. The score could be determined either using scores of two standard deviations below mean or the lowest 10th percentile scores. If we accept the two standard deviations below the mean, the scores will be very low and thus many affected persons will be considered as normal. Hence, we considered lowest 10th percentile score as the cut-off point for identifying the significantly impaired tenth of the population.

For GDS score, conventional cut-off point score of 11 had been reported in western population. However this GDS scale had been validated among elderly Indian rural population and very high scores had been observed. A cut off score of 22 at 90th percentile level had been accepted in rural India and it indicated the 10 percent of the study population had severe depression.[19] We have also accepted a score of 21, which is 90th percentile score in our study population for identifying the participants with masked depression from the non-depressed or less depressed subjects. The exact cause is unexplained, but perhaps the elderly Indian population had a higher level of contentment or peacefulness at the perceptional level.[19]

The data of the two predominant linguistic groups constituting the majority of city's population had been analyzed as a whole and separately. Our Hindi speaking groups were small in numbers and they showed significantly lower scores in all parameters except the memory domain and in object naming, though the absolute differences between the mean scores were small (Table 4). They had significantly lower literacy

Table 1: **Distribution of study population by gender, language (mother tongue), education and age**

	n	Mean age in years (±SD)	Mean years of education (±SD)
Overall participants	745	66.8 (±10.0)	7.7 (±5.5)
Men	367	67.7 (±10.2)*	9.0 (±4.4)**
Women	378	65.9 (±9.6)	5.6 (±4.8)
Bengali speaking	644	67.0 (±10.1)	2.8 (±1.0)***
Hindi speaking	101	65.3 (±9.1)	2.0 (±1.0)
Education groups			
0	150	67.0 (±9.3)	0 (0)
1-5	94	67.7 (±9.6)	3.7 (±1.2)
6-12	344	67.5 (±10.1)	9.3 (±1.7)
13+	157	64.1 (±10.3)	13.5 (±0.8)
Age groups			
50-59	161	53.5 (±0.5)	8.7 (±4.9)
60-69	272	63.5 (±2.7)	7.1 (±4.9)
70-79	208	73.0 (±2.9)	6.6 (±4.7)
80+	104	83.2 (±2.9)	7.0 (±5.0)

Education denotes years of formal education; *****Women were significantly younger than men ($p < 0.05$); **Women had significantly less education than men ($p<0.01$; ***Hindi speaking group had significantly less education than Bengali speaking group ($p<0.01$) (2-tailed unpaired t test); ANOVA showed significant difference of mean age ($p<0.01$) between 4 education groups.

Table 2: **Overall distribution of test scores in non-demented subjects (N=745)**

Parameters		**Max. score**	**n**	**Range**	**Mean score (±SD)**	**Median (Quartile range)**	**10th percentile score**	**90th percentile score**
Verbal Fluency	Fruits naming		739	0-31	12.1 (±4.7)	11 (7)	7	18
	Animals naming		739	0-29	11.8 (±4.5)	11 (5)	7	18
	Total		739	0-57	23.3 (±8.6)	23 (12)	14	35
Object Naming		15	743	11-15	14.7 (±0.6)	15 (1)	14	15
Mental State Examination		30	745	13-30	28.7 (±2.1)	30 (3)	26	30
Calculation		5	738	0-5	4.5 (±1.2)	5 (0)	3	5
Memory (Immediate-recall)		30	730	7-26	16.8 (±3.8)	17 (5)	12	21
Memory delayed		10	730	0-10	5.0 (±1.8)	5 (2)	3	7
Memory Recognition		20	730	0-20	18.7 (±2.1)	20 (2)	16	20
Visuo-constructional ability		13	694	0-13	9.6 (±3.3)	10 (5)	5	13

Table 3: Test scores separated by gender and their comparison by Mann-Whiney *U* test

Parameters Verbal fluency	Gender	n	Mean score (±SD)	10th percentile score	90th percentile score	*p*-value
Fruits naming	Men Women	363 376	12.3 (±4.7) 11.9 (±4.8)	7 6	19 18	NS
Animals naming	Men Women	363 376	12.4 (±5.0) 11.3 (±4)	7 7	19 16	<0.01
Total	Men Women	363 376	24.7 (±9.0) 23.2 (±8.1)	14 13	36 34	0.04
Object Naming	Men Women	366 377	14.8 (±0.4) 14.5 (±0.8)	14 13	15 15	<0.01
Mental State Examination	Men Women	366 378	29.3 (±1.6) 28.2 (±2.5)	27 25	30 30	<0.01
Calculation	Men Women	364 374	4.8 (±0.7) 4.2 (±1.5)	4 1	5 5	<0.01
Memory (Immediate recall)	Men Women	361 369	16.9 (±3.8) 16.7 (±3.8)	12 12	21 21	NS
Memory delayed	Men Women	361 369	4.9 (±1.8) 5.1 (±1.8)	2 3	7 7	NS
Memory recognition	Men Women	361 369	18.7 (±2.0) 18.7 (±2.1)	16 16	20 20	NS
Visuo-constructional ability	Men Women	344 350	10.6 (±2.5) 8.6 (±3.6)	7 3	13 13	<0.01

NS = not significant

Table 4: Test scores and the comparison of the two language groups (Bengali and Hindi speaking)

Parameters	Bengali speaking subjects		Hindi speaking subjects		*p* value
Verbal fluency	**n**	**Mean score(±SD)**	**n**	**Mean score(±SD)**	
Fruits naming	641	12.5 (±4.7)	98	9.4 (±4.1)	<0.01
Animal naming	641	12.1 (±4.6)	98	10.1 (±4.1)	<0.01
Total	641	24.6 (±8.5)	98	19.5 (±7.7)	<0.01
Object Naming	643	14.7 (±0.6)	100	14.6 (±0.6)	NS
Mental State Examination	644	28.9 (±2.0)	101	27.7 (±2.6)	<0.01
Calculation	637	4.6 (±1.1)	101	4.0 (±1.6)	<0.01
Memory (Immediate-recall)	631	16.8 (±3.8)	99	16.7 (±3.7)	NS
Memory delayed	631	5.0 (±1.9)	99	5.2 (±1.7)	NS
Memory Recognition	631	18.7 (±2.1)	99	18.9 (±1.5)	NS
Visuo-constructional ability	604	9.8 (±3.2)	90	8.5 (±3.7)	<0.01

NS = not significant

Table 5: Summary of statistical analysis between four educations group by Mann Whitney U test

Parameters	Illiterate vs 1-5 years	Illiterate vs 6-12 years	Illiterate vs 13+ years	1-5 vs 6-12 years	1-5 vs 13+ years	6-12 vs 13+ years
Verbal Fluency Fruits naming	P<0.01	P<0.01	P<0.01	NS	P<0.01	P<0.01
Animals naming	P<0.01	P<0.01	P<0.01	NS	P<0.01	P<0.01
Total	P<0.01	P<0.01	P<0.01	NS	P<0.01	P<0.01
Object Naming	NS	P<0.01	P<0.01	P<0.01	P<0.01	NS
Mental State Examination	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	NS
Calculation	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	NS
Memory (Immediate-recall)	NS	P=0.05	P<0.01	NS	P<0.01	P<0.01
Memory delayed	NS	NS	P=0.02	NS	P=0.01	P=0.04
Memory Recognition	NS	NS	P=0.04	NS	NS	NS
Visuo-constructional ability	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01

NS = not significant

Table 6: Summary of statistical analysis between four age groups by Mann Whitney U test

Parameters	50-59 vs 60-69	50-59 vs 70-79	50-59 vs 80+	60-69 vs 70-79	60-69 vs 80+	70-79 vs 80+
Verbal Fluency Fruits naming	NS	P<0.01	P<0.01	P<0.01	P<0.01	NS
Animals naming	NS	P<0.01	P<0.01	NS	NS	NS
Total	P=0.02	P<0.01	P<0.01	P=0.01	P=0.04	NS
Object Naming	NS	P<0.01	NS	NS	NS	NS
Mental State Examination	NS	P=0.05	P=0.03	NS	NS	NS
Calculation	NS	NS	NS	NS	NS	NS
Memory (Immediate-recall)	P<0.01	P<0.01	P<0.01	NS	P=0.04	P=0.04
Memory delayed	P<0.01	P<0.01	P<0.01	NS	P=0.04	NS
Memory Recognition	P=0.04	NS	P<0.01	NS	P=0.05	P=0.02
Visuo-constructional ability	NS	P<0.01	P=0.01	NS	NS	P=0.01

NS = not significant

Table 7: Comparison between 4 education groups in each age level by Kruskal-Wallis One Way Analysis Of Variance

Parameter	Comparison in 50-59 (*p* value)	Comparison in 60-69 (*p* value)	Comparison in 70-79 (*p* value)	Comparison in 80+ (*p* value)
Verbal Fluency Fruits naming	P<0.01	P<0.01	P<0.01	P<0.01
Animals naming	P<0.01	P<0.01	P<0.01	P<0.01
Total	P<0.01	P<0.01	P<0.01	P<0.01
Object Naming	P=0.02	P=0.02	P<0.01	P<0.01
Mental State Examination	P<0.01	P<0.01	P<0.01	P<0.01
Calculation	P<0.01	P<0.01	P<0.01	P<0.01
Memory (Immediate recall)	0.01	P<0.01	NS	P<0.01
Memory Delayed	NS	P<0.01	NS	NS
Memory Recognition	NS	NS	P=0.05	NS
Visuo-constructional ability	P<0.01	P<0.01	P<0.01	P<0.01

NS = not significant

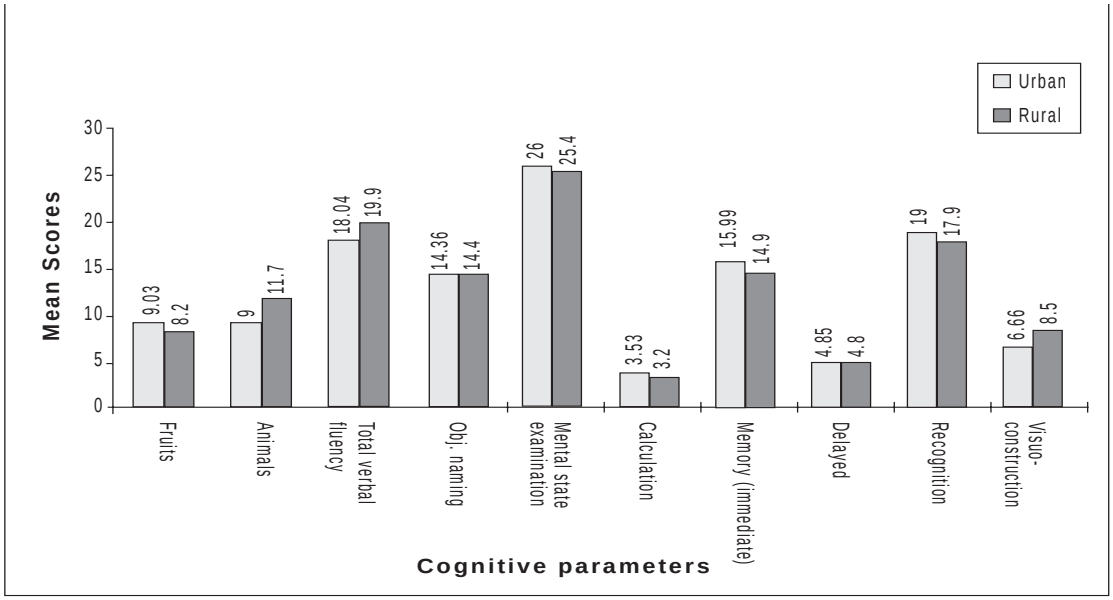

Figure 1: The mean test scores between the present study (urban population) and Ballabgarh study[18] (rural population)

level than Bengali speaking groups. This might be one of the reasons for their low scores in cognitive parameters.

Our results reflected the influence of formal education (i.e., the number of years of education) on neuropsychological test performance as observed by others.[20-22] Literacy or formal education had been associated with the capacity to acquire a broader knowledge-base of general information as well as to process this information in a more abstract and systematic manner.[20] When two extreme educational groups were compared, i.e. between illiterate versus graduates and also between primary educations versus graduates, the differences were clearly significant in all the parameters including the three domains of memory test.

Scores on most domains of cognitive function diminished with age (Table 6). In our study, age related decline was noticed in most parameters, though not uniformly. After 70 years, the decline was prominent in the domain of memory (immediate recall and recognition) and visuo-constructional ability.[23] These may be related to the differential involvement of central structures.

Cognitive test performance showed significant association with gender. All the scores in the tests except for fruits naming and memory (immediate / delayed / recognition) were significantly lower among women. This might be due to significantly lower educational status of women in our study as compared to men. Even after controlling the number of years of education, men performed better than women in calculation, fruits naming and animal naming. In an earlier Indian study it was observed that men had better fluency in the animal category of the verbal fluency test than women[18], similar to our results. A similar observation was made in a study of an urban population of South Indians on verbal fluency.[24] Men had better educational attainment and regular involvements with household accounts which helped them to deal better in numerical, linguistic and visuo-constructional skills.

When the present data was compared with that of a rural Hindi speaking illiterate Ballabgarh population[18], the mean scores differed only in the domains of animal naming and visuo-constructional ability (Figure 1). These differences may be due to the lack of familiarity with different animals in urban living. Some illiterate women in our study could not hold a pencil correctly to draw a simple figure.

We found possible ceiling effects in tests of object naming, calculation, mental state examination and recognition memory (Table 2). Since test scores are influenced by age, education, gender and to some extent also by linguistic factors, we feel that the rural/urban differences could possibly be explained by the literacy effects. Literacy is also a marker of modernization and social change. The improvement in cognitive score in the present study is likely to be due to the large number of literate subjects in an urban milieu. Ceiling effects do not normally affect screening but floor effects do hinder the effectiveness of the screening tool.

The current research also had certain underlying limitations such as the verification of age among the study participants. Some illiterate older subjects, especially those above the age of 70 years did not know their exact date of birth and they are dependent upon significant life events or sought the help of family members to assess their age. So the age was often based on approximation. This could influence the lack of uniformity in age related cognitive decline. Our depression data was totally dependent on subjective self-report questionnaire. We lacked the resources to conduct field evaluation for each and every participant by a psychiatrist. If we include somatic symptoms in the GDS scale, the rate of possible depression could be higher as depression among Indian population often expressed as somatic complaints.

In conclusion, our study presents normative data on global cognitive functioning among elderly urban Indians. In contrast to scores achieved in rural setting, we observed ceiling effects in most of the cognitive parameters. This is possibly due to the effect of literacy. We noticed non–uniformity in age associated cognitive decline. To our knowledge this is the first comprehensive study in an urban population of India with appropriate validation according to the ethnic language spoken. The urban population derived normative data can be used for identifying subjects with cognitive dysfunctions for the population of the city of Kolkata as well as other urban areas of India, and after proper validation in local languages, in neighboring states of predominantly Bengali speaking areas such as Tripura as well as neighboring countries such as Bangladesh.

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Appendix: Kolkata Cognitive Screening Battery

Test 1. Verbal Fluency for Categories

"Name certain things which are similar in some way." For example if I say "tools" then you should name different tools such as hammer, axe, saw etc. "Now you can tell me the names of some other tools?"
Fruits: "Now you can tell me the names of different fruits as much as you can think within one minute time."
Animals: "Now tell me the names of different animals as much as you can think within one minute time."

1 point for each correct response. No maximum score.

Test 2. Object Naming Test

"Now I will show you some objects and name those objects."
1. Flower, Lock, Bottle, Spectacle, Comb
2. Scissors, Safety pin, Calendar, Almirah, Towel
3. Necklace, Basket, Telephone, Sole of the shoe, Dial of the watch.

One point for each correct response. Maximum score: 15

Test 3. Mental State Examination

"Now I will ask you some questions related to memory and concentration. Some of them are easy and some of them are difficult."
1. " Is it morning / afternoon / evening?"
2. "What day of the week is today?"
3. "What is today's date?"
4. "Which month is this? You can tell me in English / Bengali / Hindi?"
5. "Which season is this?"
6. "What is the name of this place / locality?"
7. "This locality falls under which city?"
8. "What is the name of this state?"
9. "What is the name of this country?"
10. "Where are you standing at this moment?"
11. "Registration of three objects: "I went to the market and brought 3 things which are mango, chair and paise." With a gap of 2 seconds between each word, then ask: "Can you tell me which are the three things I brought from the market? Please try to remember these 3 things because I will ask you again after some time."
12. (a) Days of the week forward: "Tell me the names of the days of the week starting from Sunday?"; (b) Days of the week backwards: "Now tell me the names of these days in a backward way from Sunday?
13. Delayed recall of objects: "Tell me the names of those three things which I told you that I have brought from the market?"
14. Show the wrist watch and pen and ask the patient: "Can you see these objects?" Show the wrist watch and ask, "what is this?" If the patient is unable to see the objects, give the wrist watch to his/her hand and ask what he/she feel is this. Show the pen and ask, "What is this?" If the patient is unable to see the objects, give the pen to his/her hand and ask what he/she feel is this.
15. Sentence repetition: "Listen carefully and after my completion of the sentence, exactly repeat what I said, NEITHER THIS, NOR THAT."
16. Follow command: "Now I will ask you a different type of question. Look at my face and do exactly what I do." If the patient has poor vision then gives the instructions: "Listen carefully and does exactly what I say, CLOSE YOUR EYES."
17. Three step command: (oral) "I will give you a piece of paper and do exactly what I ask you to do. First, take the paper in your right hand, then fold it into half with both of your hand and then give the paper back to me."
18. Sentence construction: "Tell me something about your house."
19. Copy figure: "Exactly copy the above drawing in the space given below."

One point each to Questions 1-10, 3 points for Question 11, 5 points for Questions 12, 3 points for Question 13, 2 points for Question 14, one point each for Questions 15, 16, 3 points for Question 17, and one point each for Questions 18, 19. For question 12, only proceed if able to name days of week forward. Give one point for each correct response to days of week backward from Sunday. For Question 17, give one point for take paper right hand, folds and return paper. Maximum score: 30

Test 4. Calculation

"A person has Rs 20 for his bus fare. First day he purchased a ticket for Rs 3, then he will be left with Rs 17. How much money will be left after second day's bus fare? Third day's, fourth day's, fifth day's bus fare?"

One point for each correct answer. Maximum score: 5

Test 5. Word List Memory Task (Immediate Recall)

"I will read 10 words from this paper. Listen to them carefully and repeat them in any order after I finished my reading. Remember I will ask you to recall these words later." Same instructions repeated for the 2nd and 3rd trial.

Trial 1: Butter, Arm, Corner, Letter, Queen, Ticket, Grass, Stone, Book, Stick
Trial 2: Ticket, Book, Butter, Corner, Stone, Arm, Queen, Letter, Stick, Grass
Trial 3: Queen, Grass, Arm, Book, Stick, Corner, Butter, Stone, Ticket, Letter

One point for each word correctly recalled. Maximum score: 30

Test 6. Visuo-constructional Ability

"I will show you some figures and exactly copy the above drawing in the space given below"-
(i) Circle, (ii) Diamond, (iii) Overlapping rectangles, and (iv) Box

Circle: Closed circle, one point; circular shape, one point. Diamond: Draw 4 sides, one point; closes all 4 angles, one point; sides are equal, one point; acute angles, one point; obtuse angles, one point. Overlapping rectangles: Forms have 4 sides, one point; overlap resemble original figure, one point. Box: - Outer figure has 4 sides closed, one point; inner figure has 4 sides closed, one point; lines at each corner joining the outer with inner rectangle, one point; inner rectangle approximately one third size of outer rectangle, one point. Maximum score: 13

Test 7. Delayed Word List Memory Task

"Few minutes ago, I read out a list of 10 words from this paper. Tell me those words again."

One point fore each correct word recalled. Maximum score: 10

Test 8. Delayed Recognition Word Task

"Few minutes ago, I read out 10 words from this paper. Tell me whether "tree" was there on the list."- If the patient gives correct response, say "correct" or if he/she gives "incorrect" response, then say this is incorrect and continue for next word.
Butter, Temple, Arm, Tea, Key, Corner, Five, Letter, Hotel, Mountain, Queen, Book, Shoe, Stick, Village, Thread, Ticket, Soldier, Grass, Stone

One point for each word recognized. Maximum score: 20