Age-Stratified Normative Cognitive Scores in Urban and Rural Populations: A Community-based Study

Indian ethnic and educational diversities make it necessary to obtain normative cognitive data in different populations. We present the findings of our study in which we aimed to evaluate cognitive scores using the Kolkata Cognitive Battery (KCB) developed by Das *et al*.[1] in Maharashtrian rural and urban communities, and to assess the correlation of cognition scores with demographic and co-morbidity variables.

Methodology

We studied 2651 individuals aged ≥40 years, without pre-existing neuropsychiatric conditions, from urban (Mumbai) and selected rural districts of Maharashtra state over a period of 16 months from March 2015 to July 2016, during weekend camps. These areas were chosen because they are the setting of ongoing primary healthcare projects under the community health department of the parent hospital. The KCB has been validated in urban populations by Das *et al*. and the Hindi cognitive battery from which it was derived, has been validated in the rural setting by Ganguli *et al*.[2] Cognition was assessed using a Marathi translation of KCB. Following the precedent set by Das *et al*., the lowest 10th percentile of the KCB score was set as the operational cut-off to define cognitive impairment. We chose the highest 90th percentile of GDS as the operational cut-off point to identify masked depression. Data about co-morbidities and substance use habits was also collected. Depression was assessed using a Marathi translation of the GDS (Geriatric Depression Scale). Data collected on completed years of schooling was classified into educational categories namely illiterate, primary (1-5 years), secondary (6-12 years), and graduation level (≥13 years).

Results

Our study group included 1435 (54%) rural and 1216 (46%) urban dwellers equally divided by gender (1316 women, 1335 men), average age being 54 years. Most of the participants were poorly educated - 752/1335 men (56.3%) had studied for 5 years or less, and among women the corresponding proportion was significantly higher (1001/1316, 76.1%, $P < 0.01$). Conversely, men significantly outnumbered women in the better educated subgroups. Among women,

Table 1: KCB score descriptors

Parameter	*n*	Mean	Std. Deviation	Median	10th percentile score	90th percentile score
KCB Score	2651	82.74	23.84	86	50	109

84% (1108) were housewives and 62% of the men (825) were unskilled/semiskilled laborers. Table 1 shows the main KCB score descriptors.

Our study showed significantly poorer scores for women compared to men (Mann Whitney U test $P < 0.01$), with female gender being a significant negative predictor of scores (B = -6.84, 95CI -8.64 to -5.04, $P < 0.01$) in linear regression. However, a regression model adjusting for age, education, place of residence (rural/urban) and other variables showed the female gender to have a small positive effect (not statistically significant) on KCB score. Mean KCB scores were significantly lower with older age, poorer education, low BMI, high depression scores and being a housewife/unemployed/unskilled laborer (Kruskal Wallis H test $P < 0.01$). Scores were significantly lower among tobacco users (Mann Whitney U test $P < 0.01$). Known hypertensives and diabetics had higher mean scores which could be explained by better awareness levels as most of the diagnosed individuals were also urban dwellers (DM 64.5%, HTN 59.8%). Multiple linear regression showed urban residence to be the strongest predictor of high scores (B = 12.34, 95CI 10.46-14.22, $P < 0.01$) after adjusting for age, sex, education, occupation, GD score, tobacco/alcohol use and comorbidities.

Discussion

Until recently, the only cognitive screening instrument tailored to an Indian population subset was the one developed for a rural, illiterate Hindi speaking population in Ballabhgarh, North India[2] Das *et al*.[1] have developed the Kolkata Cognitive Battery for the urban, predominantly Bengali speaking elderly population in Kolkata, and we have attempted to modify and tailor the KCB for Maharashtrian populations. Das *et al*. had obtained a GDS cut off score of 21 to identify the severely depressed tenth of their study population. A cut-off score of 22 at 90th percentile level has been accepted in rural India to indicate the 10 percent of the population with severe depression.[3] However, the cut off obtained for our study sample is 17. This may be because our methodology comprised inviting respondents to camps, rather than making house visits. This may have resulted in many severely depressed individuals staying home, thereby eliminating the highest GDS scores. However, even with the lower cut off, we have observed a significant diminishing of cognitive scores, which indicates an association between depression and low cognition that warrants further study. Our study showed significantly poorer scores among women, who had significantly fewer years of education than men and were mainly housewives by occupation. We also had more than twice as many illiterate women than men in our study group. Researchers have demonstrated the association of education, particularly literacy,[4] with high cognition. Ganguli *et al*. similarly posited that the lower scores obtained by women in their study sample could correspond to their lack of education.[2] While we noted statistically significant differences in scores between different genders, age groups, and educational groups, striking gaps were observed between rural and urban dwellers. Urban dwellers were significantly younger, and had more years of schooling, than rural dwellers. Less than 300 out of 1435 rural participants had secondary level or higher education, while the corresponding proportion was 50% (608 out of 1216) in the urban subset.

Further, the rural subset had a higher proportion (55.1%) of women compared to the urban subset (43.2%). The urban subset also had greater proportions of occupational groups with higher mean scores; clerical and semiskilled/skilled labor. Researchers in Mexico and Japan have described similar cognitive disadvantage in rural older adults, attributing it to historical educational disparity and potentially modifiable factors other than lifestyle.[5,6] A researcher studying working memory differences between children living in rural and urban poverty in the United States, surmised that rural environments have less everyday visual stimulation and opportunities to navigate public transportation systems, leading to less frequent use of working memory.[7] Similar factors could affect cognition in rural older adults.

Conclusion

Cognitive testing instruments for Indian communities need further calibration by place of residence and education, in order to improve their validity.

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Conflicts of interest

There are no conflicts of interest.

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