



Phonemic Verbal Fluency in Healthy Adults of Eastern India: A Normative Population-Based Study Using the Controlled Oral Word Association Test

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ABSTRACT

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Background: The Controlled Oral Word Association Test (COWAT) is a widely used measure of phonemic verbal fluency reflecting language ability and executive control. Interpretation of COWAT performance requires culturally and demographically appropriate normative data, which remain limited for Indian populations.

Objectives: To generate normative data for COWAT total and mistake scores in a healthy Indian adult sample and to examine the influence of socio-demographic variables on performance.

Methods: This cross-sectional study was conducted at a tertiary medical college in eastern India. A total of 132 healthy adults aged 18–60 years were recruited through purposive sampling. Psychiatric morbidity was excluded using clinical evaluation and CGI-S. Participants completed the COWAT along with socio-demographic assessments. Group differences were analyzed using t-tests and one-way ANOVA, associations among categorical variables using chi-square tests, and relationships between age and COWAT scores using Pearson's correlation.

Results: Mean COWAT scores were significantly higher among urban participants compared to rural participants and among students compared to teachers ($p < 0.05$). Education had a significant effect on COWAT performance ($F(5,126) = 7.97, p < 0.001$), with higher scores observed in more educated groups. Age showed a weak but significant negative correlation with COWAT total scores ($r = -0.19$). No significant associations were found between demographic variables and COWAT mistake scores. Sex, religion, marital status, stream of study, and socioeconomic class did not show significant effects on total scores.

Conclusions: COWAT performance in healthy Indian adults is significantly influenced by age, education, profession, and urban–rural background, while mistake scores remain relatively stable across demographic groups. These findings provide context-specific normative data that can improve the clinical interpretation of phonemic verbal fluency assessments in India.

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Keywords: verbal fluency, COWAT, COWAT Mistake, normative

INTRODUCTION

Verbal fluency tasks are widely used neuropsychological measures that assess an individual's ability to rapidly generate words under specific constraints, reflecting both language ability and executive control functions^[1,2]. The Controlled Oral Word Association Test (COWAT), a commonly used phonemic fluency task^[2], requires individuals to produce as many words as possible beginning with designated letters within one minute^[3,4].

Performance on the COWAT depends on mental lexicon access, cognitive flexibility, and self-monitoring, making it a sensitive tool in the assessment of frontal lobe functions^[5,6].

COWAT has important clinical relevance because verbal fluency deficits commonly occur in psychiatric and neurological disorders, including schizophrenia^[7,8], ADHD^[9], Parkinson's disease^[10], Alzheimer's dementia including mild cognitive impairment^[11,12] and brain injury^[13]. Establishing normative data is essential for differentiating pathological performance from normal variation. Interpretation of COWAT scores requires norms matched to linguistic, cultural, and educational backgrounds, which can vary significantly in multilingual countries like India^[14].

However, Indian normative data for COWAT are limited. Prior research shows that education, age, gender and environmental stimulation strongly influence verbal fluency performance^[15,16]. Urban–rural differences also substantially affect cognitive test results in India^[15]. Therefore, generating context-specific normative values from a tertiary medical centre and few urban teaching centres (where students come from various backgrounds) is important for improving the accuracy of neuropsychiatric assessments.

Keeping in mind the paucity of Indian normative data, this study aimed to assess COWAT total scores and mistake scores in an educated Indian adult population and examine associations with demographic variables such as age, education, profession, stream and urban–rural background.

Materials and Methods

Study Design: Cross-sectional study

Place of Study: i) Department of Psychiatry, Burdwan Medical College.

ii) Institute of Education for women Hastings House, Kolkata

iii) David Hare Training College, Kolkata

Study Duration: 6 month (1st December, 2023 – 31st May, 2024)

Study Population: normal adult male and females, fulfilling the selection criteria, who voluntarily participated in this study

Sample Size: 132

Sampling Method: Consecutive Purposive Sampling

Inclusion Criteria:

1. Any normal adult (> 18 yrs and < 60 yrs) male and female with formal education of English (minimum 5 yrs) who voluntarily participated in this study

Exclusion Criteria:

1. Person with a CGI-S^[17] Score of '> 1 or 0' are excluded from the study
2. Person who have serious physical illness are excluded from this study
3. Person who are <18 yrs or > 60 yrs of age are also excluded from this study

Study Variables:

1. Socio-Demographic variables like religion, age, sex, education, background, social class by Modified BG Prasad scale^[18] etc
2. Controlled Oral Word Association Test (COWAT) as per 'NIMHANS NEUROPSYCHOLOGICAL BATTERY- 2004': scores and mistakes

Technique: Interview method and assessment as per neuropsychology tools

Data collection: pre-designed, semi-structured proforma for data collection

Tools:

1. Proforma for socio-demographic data collection
2. CGI-S^[17]
3. Controlled Oral Word Association Test (COWAT) as per 'NIMHANS NEUROPSYCHOLOGICAL BATTERY- 2004'^[19]
4. Consent form

Statistical Analysis: Statistical methods using standard statistical software. Tests included Chi-square, ANOVA with post-hoc Tukey analysis, Spearman's bi-variate correlation coefficient analysis.

Ethical clearance: Received clearance from The Institutional Ethics Committee of Burdwan Medical College

Results:

Our research is a cross-sectional study where participants, most of which are students (both medical and non-medical), teachers and doctors, voluntarily took part in this study. All kinds of psychiatric disorders were excluded by experienced psychiatrists. Moreover CGI-S was applied to confirm the exclusion of the same.

The results are as follows:

A. A.Socio-Demographic Profile:

In this study, among a total of 132 participants, 74 male (56.1 %) and 58 (43.9%) female. Most of them (114) were Hindu by religion (86.4%). Rest were Muslims.

Most of the patients were married 92 (69.7 %), 36 unmarried (29.7 %) and only 4(3%) were separated or divorced. Mean age 34 years.

96 participants (72.7%) were urban and 36 (27.3 %) were rural. 100 participants (75.8%) were socio-economically from upper class and 28 (21.2 %) from upper-middle and 4 (3%) were from lower-middle class. No representation from lower class. 98 (74.2%) students were from science stream and rest were from humanities. This study was done on students and teachers. So, 62 participants (47%) were students and rest were teachers.

All were educated people. Among participants 66 (53%) recently completed their post-graduation and 40 were Post Graduate trainees (30.3%). Only 2 participants were educated up to high school standard.

Table 1. Descriptive statistics for the total sample (N = 132).

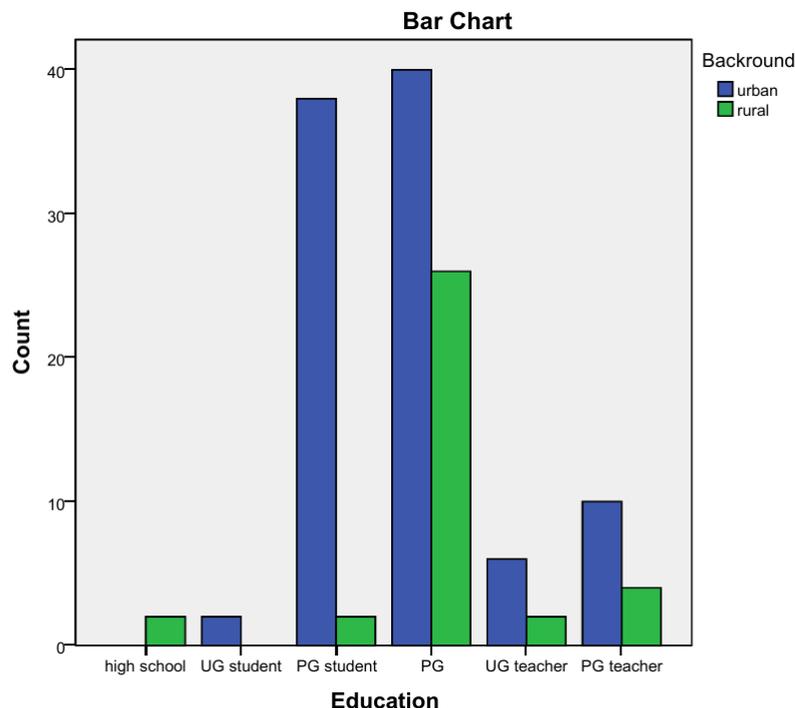
Variable	Subgroup	Number (n)	Percentage (%)
1)Sex	Male	74	56.1%
	Female	58	43.9%
2)Marital status	Single	36	29.7%
	Married	92	69.7%
	Divorced/Separated	4	3%
3)Background	Urban	96	72.7%
	Rural	36	27.3%
4)Socio-economic class	Upper	100	75.8%
	Upper-middle	28	21.2%
	Lower-middle	4	3%
	Lower	0	0%
5)Stream	Science	98	74.2%
	Humanities	34	25.8%
6(Profession	Student	62	47%
	Teacher	70	53%
7)Education	PG Teacher	14	10.6%
	UG Teacher	8	6.1%
	Post Graduate	66	50%
	PG Student	40	30.3%
	UG Student	2	1.5%
	High School	2	1.5%
	Illiterate	0	0%
8)Religion	Hindu	114	87%
	Muslim	18	13%

B. Non-Parametric Test :

Chi-Square test done to examine if any association between categorical variable.

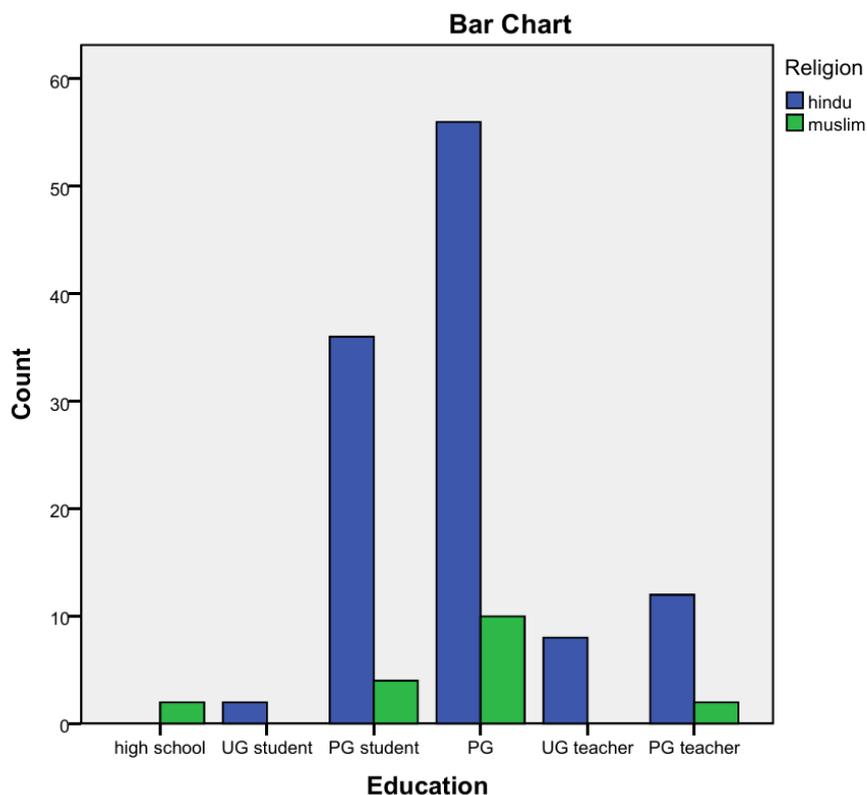
Significant association found among following variables :

1.background and education : $\chi^2 (5, N= 132) =21.01, p< 0.05$ with phi co-efficient 0.40 indicating medium to strong relationship with urban people being educationally advanced



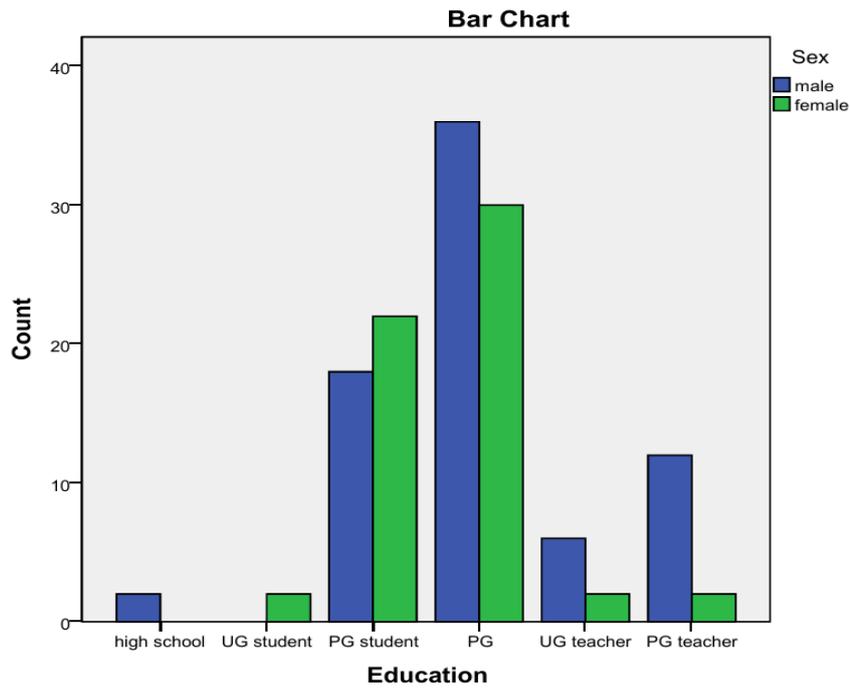
Bar Chart Showing Education Status and Background

2. Religion and education : $\chi^2 (5, N= 132) =14.84, p< 0.05$ with phi co-efficient 0.34 indicating small to medium relationship with Hindus being educationally advanced.

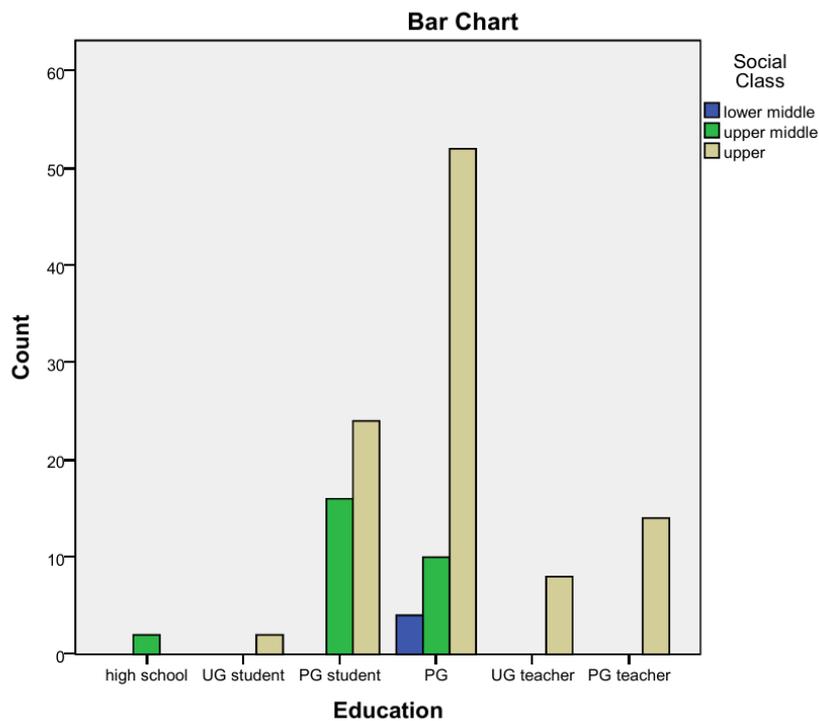


Bar Chart Showing Education Status and Religion

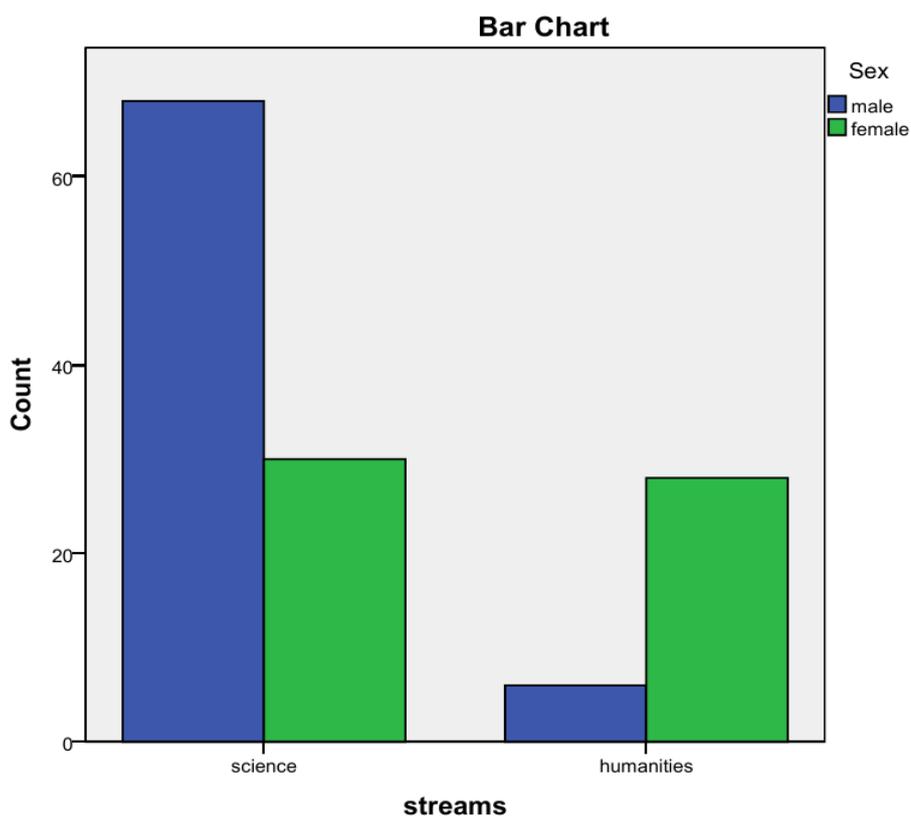
3.sex and education : $\chi^2 (5, N= 132) =12.33, p< 0.05$ with phi co-efficient 0.31 indicating small to medium relationship.PG and UG teachers and PG students are mostly male.



4.Social class and education : $\chi^2 (5, N= 132) =27.51, p< 0.05$ with phi co-efficient 0.46 indicating medium to strong relationship.More educated people are clearly from upper class.



5.sex and stream : $\chi^2 (1, N= 132) =27.43, p< 0.001$ with phi co-efficient 0.46 indicating medium to strong relationship



6.Social class and stream : $\chi^2 (2, N= 132) = 55.06, p < 0.001$ with phi co-efficient 0.65 indicating medium to strong relationship.

C. Parametric Tests

Independent sample t test done to compare mean COWAT scores in different groups of participants who were grouped according to their background, marital status, sex, religion, profession, and stream.

Statistically significant differences in means were found in different background (rural/urban) and profession (teacher/ student) groups only.

In other groups, no significant result found.

Categorical variables	COWAT score Mean (SD)	t value
Background: Urban Rural	35.17 (10.32) 28.89 (7.63)	t = 0.001**
Sex: Male Female	32.32(9.99) 34.90 (9.99)	t =0.145
Religion: Hindu Muslim	33.67 (10.34) 32.11(7.95)	t =0.543
Profession: Student Teacher	35.97 (10.35) 31.22 (9.27)	t = 0.006*
Stream: Science Humanities	33.43 (9.99) 33.53 (10.32)	t = 0.960
Marital Status: Married Unmarried	33.13(10.08) 34.83(10.39)	t=0.396

*p < 0.05

** p < 0.001

Regarding background, two groups, urban and rural were also significantly different in mean COWAT score. Mean COWAT score of urban group (M= 35.17, SD = 10.32) was significantly higher (mean difference 6.278, 95% CI (2.54, 10.02) than that of rural group (M= 28.89, SD = 7.63) , t (df 130) = 0.001 , p< 0.001, two tailed. This is shown in the box-plot.

Regarding profession, two groups, teacher and student were significantly different in COWAT score. Mean COWAT score of students (M= 35.97, SD = 10.35) was significantly higher (mean difference 4.739, 95% CI (1.36, 8.12)) than that of teachers (M= 31.23, SD = 9.27), $t (df 130) = 2.776 , p < 0.05$, two tailed.

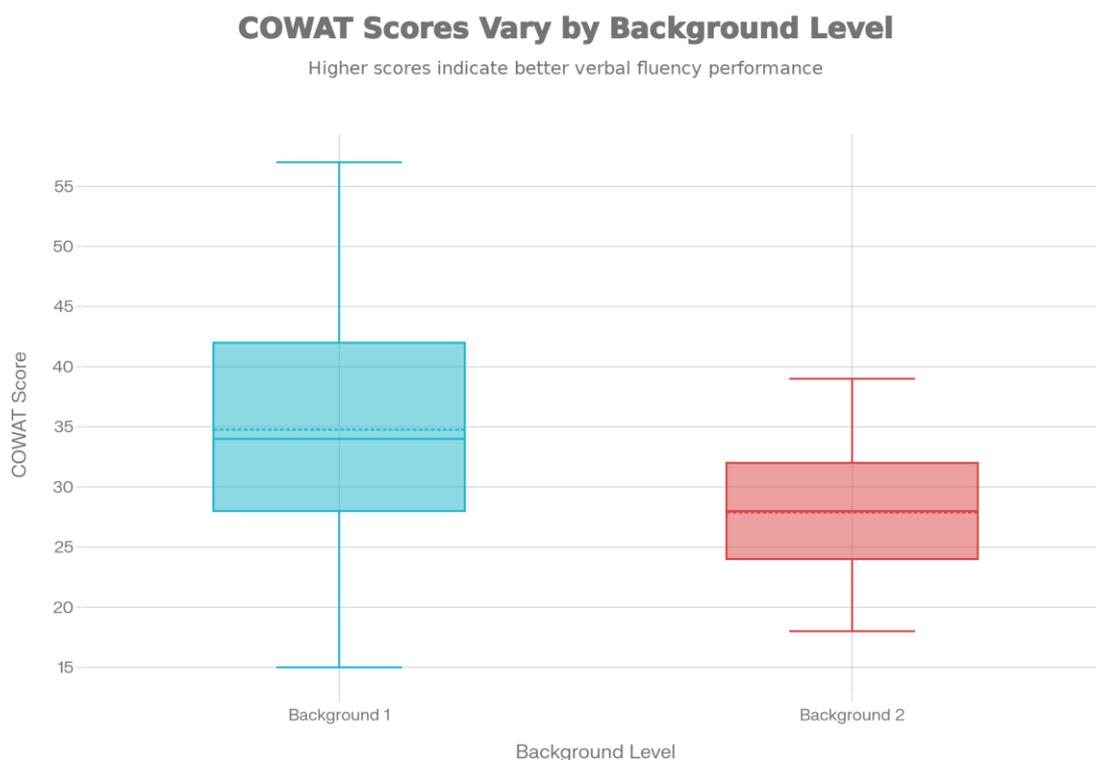
A one-way ANOVA was done to see effect of education on COWAT score. The effect was statistically significant ($p < 0.05$) for the six (6) groups $F(5,126)=7.97 , p < 0.001$. Post hoc comparison using the Tukey HSD test reveals that COWAT score of UG teacher (M=46,SD=11.54) significantly higher than Highschool (M=19,SD=0), UG student (M=22, SD=0) and PGs (M=30.18, SD=8.94).

ANOVA tests also showed teachers to perform poorly ($P < 0.05$)

No effect of social class, religion or marital status found on COWAT score by one-way ANOVA.

To assess the size and direction between linear relationship between age and COWAT score, a bi-variate Pearson's product-moment correlation co-efficient (r) was calculated. The bi-variate co-relation between these two variables was negative, $r(132) = (-0.19)$, $p < 0.5$.

Similar correlational statistics was done to assess relationship between age and COWAT mistake score. But, no significant correlation found.



Background 1- Urban, Background 2- Rural.

Discussion

The present study found a **negative correlation between age and COWAT scores**, consistent with established findings showing that verbal fluency declines with age due to slowing of processing speed and reduced lexical access^{[4][20]}. Studies have documented that older adults perform significantly worse on phonemic fluency tasks than younger adults, even in the absence of clinical cognitive impairment^[20,21].

The finding that mistake scores did not increase with age suggests that older adults generate fewer words but maintain adequate error monitoring—an observation similar to prior normative studies^[22,23].

Education had a significant effect on COWAT performance, aligning with numerous studies emphasizing education as one of the strongest predictors of verbal fluency output^{[16][21]}. Highly educated individuals have larger vocabulary stores (lexicon) and more efficient retrieval strategies. Our findings that teachers scored higher than students further support the cognitive reserve theory^[25-26]. Professions involving regular linguistic and executive demands tend to enhance verbal retrieval efficiency^[11].

Urban participants scored significantly higher on COWAT than rural participants. This mirrors Indian studies showing that urban residents generally have better cognitive performance due to superior schooling, language exposure, and enriched cognitive environments^[15]. Urban–rural differences persisted across various cognitive domains even after adjusting for education and socioeconomic status in earlier research^[28], supporting the environmental stimulation hypothesis.

Gender and stream had no influence on COWAT measures. This is in contrast to an earlier study had postulated that women^{[15][29]} and art students^[29] perform better on Verbal fluency because of continuous application in training. Here women had better scores, but it was not statistically significant.

But, surprisingly, no effect of social class or marital status found on COWAT score. Some studies in older adults found that education, rather than income or socioeconomic background, was the more consistent predictor of verbal fluency performance^[16].

Teachers had lower mean scores on COWAT; this rather surprising finding may be due to task-occupation mismatch^[24,30] as teachers are mostly involved with semantic fluency. Excessive monitoring^[31], confounding effects of age^[32] (Teachers mean age was 14 yr more than students) and fatigue due to cognitive overload and stress^[33,34] may contribute to this finding. Indian studies have commented on stress and burnout in teachers^[35]

COWAT Mistake scores did not show significant associations with demographic variables. Error rates in verbal fluency tasks are known to remain relatively stable in healthy adults, with major increases observed primarily in neurodegenerative conditions or frontal lobe dysfunction^[5,13]. This consistency indicates that COWAT mistake scores may be more useful diagnostically for clinical populations rather than for distinguishing variation within healthy groups.

Limitations

Our study is one of few studies in India to address Verbal fluency performance in multiple centres addressing educated adults aged 18-60. However the study had following limitation:

1. **Sampling limitations** – Purposive sampling from a three centres (colleges/hospitals) restricts generalizability. Prior neuropsychological norms highlight the need for diverse sampling to avoid cultural bias. Larger community based studies may help in this regard.
2. **Cross-sectional design** – The inability to track changes over time limits causal interpretation.
3. **Restricted age range** – Adults above 60 years were excluded, so age-related effects of fluency deficits could not be properly assessed
4. **Language and cultural factors** – Fluency tests depend heavily on linguistic proficiency; India's linguistic diversity complicates the development of universal norms^[14].
5. **Unmeasured confounders** – Factors such as IQ, occupational complexity, and bilingualism/multilingualism (previously shown to influence verbal fluency^[36]) were not assessed.

Conclusion

This study provides normative COWAT total and mistake scores for adults aged 18–60 from a tertiary medical centre in India. COWAT performance was significantly influenced by age, education, urban–rural background, and profession, while mistake scores showed no substantial demographic trend. These findings are consistent with global literature showing that verbal fluency reflects both linguistic capacity and executive control^[4,12,15,16,24,28]. Our study found no impact of gender or stream on COWAT measures, which is in contrast to some studies^[29] and gender stereotypes. Also social class did not play a major role in COWAT performance.

The results underscore the need for culturally and linguistically appropriate normative data in India, where wide educational and environmental disparities exist with a different set-point needed for rural and mono-lingual patients. Further community-based case control and follow-up retrospective cohort studies may uncover the deficits of the study. However the normative values generated in this study can aid psychiatrists and clinical psychologists in interpreting COWAT scores more accurately during cognitive assessments.

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