

Verbal Fluency Performance as a Marker of Early Cognitive Impairment in Tanzania: A Pilot and Validation Study from the Akili Mali Project

P4-09

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- Verbal fluency performance reflects similar demographic and cognitive patterns in Tanzania as reported in high-income countries
- Semantic, phonemic and action fluency tasks discriminate between cognitively healthy and impaired groups with moderate to high accuracy
- Phonemic-semantic fluency performance showed additional discriminative utility in clinically determined cognitive impairment

INTRODUCTION

- Sub-Saharan Africa (SSA) is projected to see some of the largest increases in dementia prevalence over the coming years (Nichols et al., 2022)
- Despite this, validated, culturally appropriate cognitive assessments in the region are limited
- Verbal fluency tasks (VFTs) are widely used, easy to administer cognitive tasks
- In high-income countries (HICs), semantic-specific impairment on VFTs is a recognised marker of Alzheimer’s disease (AD, Wright et al, 2023) but data from SSA is lacking
- In a two-stage pilot and validation study, VFTs were examined in relation to demographic variables and cognitive impairment in Tanzania

METHODS

- **Pilot:** 126 older adults from two villages in Kilimanjaro region. Cognitive impairment determined using Identification of Dementia in Elderly Africans (IDEA) cognitive screen (≤ 7)
 - **Healthy controls (HC, n=116), IDEA ≤ 7 (n=16)**
- **Validation:** 89 participants identified from memory clinics in Dodoma and Moshi
 - **HC (n=69), AD dementia (n=16), mild cognitive impairment (MCI, n=4)**
- Cognitive test battery included IDEA screen and five VFTs: two semantic (animals, market items), two phonemic (words beginning with C and B) and one action
- VFT z-scores were derived from the mean and standard deviation of HC
- Phonemic-semantic discrepancy scores calculated as phonemic minus semantic z-scores

RESULTS

- Participants performed better on semantic than phonemic or action fluency tasks (**all $p < 0.001$, Table 1**)
- Age related to market and letter B fluency and sex related to animal and action fluency in pilot but not to any VFT in validation (**Table 2**)
- Education related to all VFT scores in pilot and phonemic fluency/VFT discrepancy scores in validation
- Clinical frailty related to various VFTs across cohorts

Table 1. Demographics and VFT scores

	Total	n*	Total	n*
Age	72.00 (14.00)		70.00 (8.00)	
Sex n(%) male	56 (44.4)		36 (40.9)	
Years of Education	5.00 (6.00)		7.00 (8.00)	88
Clinical Frailty Scale	1.00 (1.00)		2.00 (2.00)	
Total IDEA Screen	12.00 (4.50)	125	13.00 (4.00)	87
Animal Fluency Total	10.08 (3.21)		10.81 (3.53)	
Letter C Fluency Total	5.00 (4.00)	109	5.00 (5.00)	82
Letter B Fluency Total	5.00 (5.00)	114	5.00 (5.25)	82
Market Item Fluency	10.50 (5.00)		11.00 (5.00)	
Action Fluency	6.00 (2.75)	124	7.50 (4.00)	88

Median and interquartile range reported.

- **IDEA scores independently related to all VFT scores (all $p < 0.005$) and letter B-animal fluency discrepancy scores in both studies (all $p \leq 0.028$) and to letter C-animal fluency discrepancy scores in validation ($p = 0.002$)**
- Across cohorts, raw VFT scores correlated with delayed memory and object naming (**all $p \leq 0.005$**) In validation, delayed memory correlated with letter C-animal fluency discrepancies ($p = 0.006$)
- All VFTs classified clinically determined and suspected cognitive impairment in community and clinical cohorts (**AUROC ≥ 0.7 , $p \leq 0.006$, Fig. 1**)
- Phonemic-animal discrepancies classified clinically determined cognitive impairment (**AUROC ≥ 0.75 , $p < 0.005$**)

Table 2. Significant predictors of VFT scores

Dependant Variable	n	Pilot			Validation		
		Sig Predictors*	β (SE)	p	Sig Predictors*	β (SE)	p
Animal Fluency	126	Sex	-0.19 (0.47)	0.012			
		Education	0.44 (0.06)	<.001			
		CFS	-0.19 (0.23)	0.034			
Market Fluency	126	Age	-0.20 (0.04)	0.043	CFS	-0.25 (0.39)	0.039
		Education	0.29 (0.07)	<.001			
Letter C Fluency	109	Education	0.33 (0.07)	<.001	Education	0.50 (0.11)	<.001
Letter B Fluency	114	Age	-0.23 (0.03)	0.017	Education	0.41 (0.10)	0.001
		Education	0.43 (0.06)	<.001	CFS	-0.27 (0.34)	0.020
Action Fluency	124	Sex	0.20 (0.38)	0.009			
		Education	0.45 (0.05)	<.001	CFS	-0.40 (0.34)	0.001
		CFS	-0.20 (0.19)	0.029			
C-Animal Discrepancy*	81	Education	0.36 (0.03)	0.012			
B-Market Discrepancy*	81	Education	0.40 (0.04)	0.005			
C-Market Discrepancy*	81	Education	0.45 (0.04)	0.001			

*All models include age, sex, years of education and clinical frailty scale (CFS), *Z Score analyses include only participants with complete data in all semantic and phonemic fluency tasks. One participant excluded from validation study due to missing education data.

Fig. 1

Pilot

Validation

CONCLUSIONS

- In both Tanzanian cohorts, VFT performance reflected similar demographic and cognitive patterns as reported in HICs, despite lower absolute scores
- Phonemic-animal discrepancies, reflecting a semantic-specific impairment, effectively classified clinically relevant cognitive decline
- The present study validates inclusion of VFTs, including phonemic-semantic discrepancies, in assessments for early cognitive impairment in SSA

REFERENCES

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