

# A normative study of lexical verbal fluency in an educationally-diverse elderly population

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# Verbal fluency tests (VFTs)

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- A person's capacity for generating suitable words
  - For a given category or subcategory
  - In a limited amount of time.
- The most widely employed measures
  - For assessing cognitive functioning following neurological damage
  - Involve associative exploration and word retrieval.

# VFT performance

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- VFT performance declines in patients
  - Frontotemporal lobar degeneration (Libon et al., 2009)
  - Parkinson's disease (Bayles et al., 1993)
  - Subcortical vascular dementia (Cummings, 1994)
  - Alzheimer's disease (Lonie et al., 2009)
- Useful for identifying individuals
  - Early Alzheimer's disease (Eslinger et al., 1985)
  - Who were at risk of dementia,
    - Age-associated memory impairment (Hanninen et al., 1995)
    - Mild cognitive impairment (Lonie et al., 2009).

# Two forms of VFT

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- Two forms of VFT
  - The categorical verbal fluency test (CVFT)
    - Generate a list of words within a specific category (e.g., animals, fruits and vegetables, or shopping items)
  - The lexical verbal fluency test (LVFT)
    - Generate a list of words beginning with a specific alphabet letter.
- Functional imaging studies of CVFTs and LVFTs
  - CVFT heavily relies on left temporal regions (Pihlajamaki et al., 2000)
  - LVFT relies more on left frontal regions (Audenaert et al., 2000)

# Verbal fluency and demographic characteristics

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- Verbal fluency is influenced by demographic characteristics
- Age and CVFT performance:
  - CVFT performance declines with advancing age; elderly individuals performed worse than young individuals on CVFTs in many previous studies
  - Some studies have shown significant differences in LVFT performance across age groups, whereas others have failed to detect any age-related differences
- Gender and education on LVFT performances
  - Inconsistent (Ardila et al., 2000; Capitani et al., 1998).

# Purpose

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- In a large, non-demented, non-depressed sample of elderly Koreans having wide age- and educational level-ranges
  - Investigate the influence of age, gender, and education on the LVFT performance.
  - Provide normative data of the LVFT for Korean elders aged 60 years or older.
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# Methods

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## ■ Participants

- All participants were community-dwelling persons, aged 60 or over
  - The Korean Longitudinal Study on Health and Aging (KLOSHA; (Park et al., 2007),
  - The Ansan Geriatric study (AGE; (Han et al., 2009),
  - The Gwangju Dementia and Mild Cognitive Impairment Study (GDEMCIS; (Lee et al., 2009).

# Methods

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- Assessments

- Neuropsychological testing battery
  - CERAD-K for the KLOSHA and the AGE
  - SNSB-D for the GDEMCIS.
- Global dementia severity using the Clinical Dementia Rating
- Depressive symptoms using the Korean version of the Geriatric Depression Scale (GDS).



# Methods

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- Lexical verbal fluency test (LVFT)
  - The Korean letter "ㄱ"
  - Ask to generate as many words beginning with a specific letter as possible within one minute
  - Scored the LVFT by counting the number of acceptable words produced
  - Unacceptable responses
    - a participant repeats a previous response (i.e., a perseveration), includes a word starting with the wrong letter, or commits another violation of the rules stated in the manual (Ruff et al., 1996).

# Methods

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- Inclusion and exclusion criteria
    - Enrolled participants who had neither dementia nor major psychiatric disorders according to DSM-IV
    - Exclude participants with serious medical or neurological disorders that could affect mental functioning
    - Include individuals with minor physical abnormalities (e.g., diabetes with no serious complications, essential hypertension, or mild hearing loss)
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# Results and discussion

# Participant demographic characteristics

Variable	Men	Women	Total
<b>Number<sup>a</sup></b>	736 (43.9)	940 (56.1)	1676
<b>Age (years)<sup>b</sup></b>	70.2 ± 5.5	69.8 ± 5.9	70.0 ± 5.8
<b>60-64<sup>a</sup></b>	130 (17.7) <sup>b</sup>	193 (20.5)	323 (19.3)
<b>65-69<sup>a</sup></b>	225 (30.6)	306 (32.6)	531 (31.7)
<b>70-74<sup>a</sup></b>	220 (29.9)	250 (26.6)	470 (28.0)
<b>75-79<sup>a</sup></b>	120 (16.3)	121 (12.9)	241 (14.4)
<b>80≤<sup>a</sup></b>	41 (5.6)	70 (7.4)	111 (6.6)
<b>Education (years)<sup>b</sup></b>	9.8 ± 4.3	5.7 ± 4.4*	7.5 ± 4.8
<b>0-3<sup>a</sup></b>	48 (6.5)	310 (33.0)	358 (21.4)
<b>4-6<sup>a</sup></b>	180 (24.5)	342 (36.4)	522 (31.1)
<b>7-9<sup>a</sup></b>	151 (20.5)	126 (13.4)	277 (16.5)
<b>10-12<sup>a</sup></b>	191 (26.0)	116 (12.3)	307 (18.3)
<b>13≤<sup>a</sup></b>	166 (22.6)	46 (4.9)	212 (12.6)

# Stepwise multiple linear regression regarding age, education, and gender effects on LVFTs scores

Lexical Verbal Fluency Test				
	B	SE(B)	$\beta$	R <sup>2</sup>
<b>Education</b>	0.40	0.02	0.51*	28.5
<b>Age</b>	−0.10	0.01	−0.15*	5.42
<b>Gender</b>	−0.05	0.18	−0.01	4.84

# The analysis of variance for main effects and interactions among age, education, and gender on the Lexical Verbal Fluency Test

Main effect		Interaction	
Variable	F	Variable	F
Education	42.15*	Age x Education	1.54
Age	18.99*	Age x Gender	2.05
Gender	3.77	Education x Gender	0.59

# Normative data for the Lexical Verbal Fluency Test in Korean elders

Education		0-3	4-6	7-9	10-12	≥13
60-69 <sup>a</sup>	Number	249	418	229	258	170
	Mean ± SD	2.56 ± 2.88	4.70 ± 3.23	5.97 ± 3.07	7.12 ± 3.82	8.76 ± 3.85
	5-95 percentile	0.00-8.00	0.00-10.00	1.00-12.00	2.00-14.05	3.00-16.00
70-74 <sup>b</sup>	Number	275	396	189	221	161
	Mean ± SD	2.11 ± 2.67	4.51 ± 3.19	5.79 ± 3.08	6.82 ± 4.00	8.03 ± 3.58
	5-95 percentile	0.00-7.00	0.00-10.00	1.00-12.00	1.10-15.00	3.00-15.00
75-79 <sup>c</sup>	Number	211	245	109	137	102
	Mean ± SD	1.61 ± 2.32	4.06 ± 3.04	5.46 ± 3.20	6.34 ± 3.72	7.51 ± 3.60
	5-95 percentile	0.00-6.00	0.00-9.00	0.00-11.00	1.00-13.20	1.00-14.00
80-90 <sup>d</sup>	Number	109	104	48	49	42
	Mean ± SD	1.01 ± 1.73	3.93 ± 2.98	4.94 ± 2.65	5.82 ± 3.53	6.86 ± 3.43
	5-95 percentile	0.00-5.00	0.00-9.00	0.00-9.00	0.00-11.00	1.00-13.00

# Limitations

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- Employed only a single letter for evaluating lexical fluency.
- The sample sizes for some normative data cells were relatively small
- Median and fifth percentiles score were zero in the low education cell (0-3 years)



# Conclusions

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- Lexical fluency in the elderly was influenced by education and age but not by gender, and education was the most influential demographic factor.
- Age- and education-specific normative data of the LVFT for Korean elders.