# Effect of Age on Health Literacy & Cognitive Function

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# Disclosure

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- Abbott Labs
- Earthbound LLC
- McNeil Consumer Healthcare
- Merck Pharmaceuticals
- Pfizer Pharmaceuticals
- UnitedHealthcare

- AHRQ
- CA Endowment
- CA Healthcare Foundation
- NIA
- NICHD
- NHLBI
- NINR
- OBSSR

# Background

- **Health Literacy** [HL] as it is most commonly measured ≈ a cognitive skill set

# Literacy, Cognitive Function, and Health: Results of the LitCog Study

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**Table 3. Correlations with Cognitive & Health Literacy Tests**

| Cognitive Ability | Literacy Measures | | |
|---|---|---|---|
| | TOFHLA | REALM | NVS |
| Processing Speed | 0.68 | 0.52 | 0.60 |
| Working Memory | 0.65 | 0.43 | 0.59 |
| Inductive Reasoning | 0.71 | 0.54 | 0.71 |
| Long Term Memory | 0.48 | 0.36 | 0.51 |
| Prospective Memory | 0.40 | 0.28 | 0.42 |
| Fluid Cognitive Ability | 0.76 | 0.57 | 0.73 |
| Crystallized Cognitive Ability | 0.77 | 0.74 | 0.71 |

*All correlations statistically significant at $p < 0.001$*

nce suggests the rela- and health outcomes bilities.
what degree cognitive ween health literacy, tasks, and functional
tructured interviews health literacy assess- nitive battery measur- learn and apply new bilities such as back-
al internal medicine lified health centers in
l eighty-two English-
y was measured using Literacy in Medicine alth Literacy in Adults (NVS). Performance on lobally assessed and g print information, 2) recalling multimedia information, 4) dosing and organizing medication, and 5) healthcare problem-solving.

***RESULTS:*** Health literacy measures were strongly correlated with fluid and crystallized cognitive abilities (range: r=0.57 to 0.77, all p<0.001). Lower health literacy and weaker fluid and crystallized abilities were associated with poorer performance on healthcare tasks. In multivariable analyses, the association between health literacy and task performance was substantially reduced once fluid and crystallized cognitive abilities were entered into models (without cognitive abilities: β=−28.9, 95 % Confidence Interval (CI) -31.4 to −26.4, p; with cognitive abilities: β=−8.5, 95 % CI −10.9 to −6.0).

***LIMITATIONS:*** Cross-sectional analyses, English-speaking, older adults only.

***CONCLUSIONS:*** The most common measures used in health literacy studies are detecting individual differences in cognitive abilities, which may predict one's capacity to engage in self-care and achieve desirable health outcomes. Future interventions should respond to all of the cognitive demands patients face in managing health, beyond reading and numeracy.

*KEY WORDS*: health literacy; cognitive abilities; health tasks; patient-reported outcomes; physical health; mental health.
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The relationship between adult literacy skills, health knowledge, behaviors, and clinical outcomes has been repeatedly investigated.[1–3] More than 500 research publications have demonstrated associations between crude measures of reading and numeracy skills with various health-related outcomes, including risk of hospitalization and mortality.[4–6] This has been the foundation for the field now known as 'health literacy' research.

Despite more expansive and accepted definitions, the problem of low health literacy has often been characterized as difficulties in reading and math skills. Early studies therefore responded by re-writing health materials at a simpler level or following other design principles to enhance reading comprehension; an approach found to have limited success.[7,8] Still lacking a deeper understanding of the problem, recent investigations have tested comprehensive strategies with more promising results.[9–11] However, as these were multi-faceted interventions targeting system

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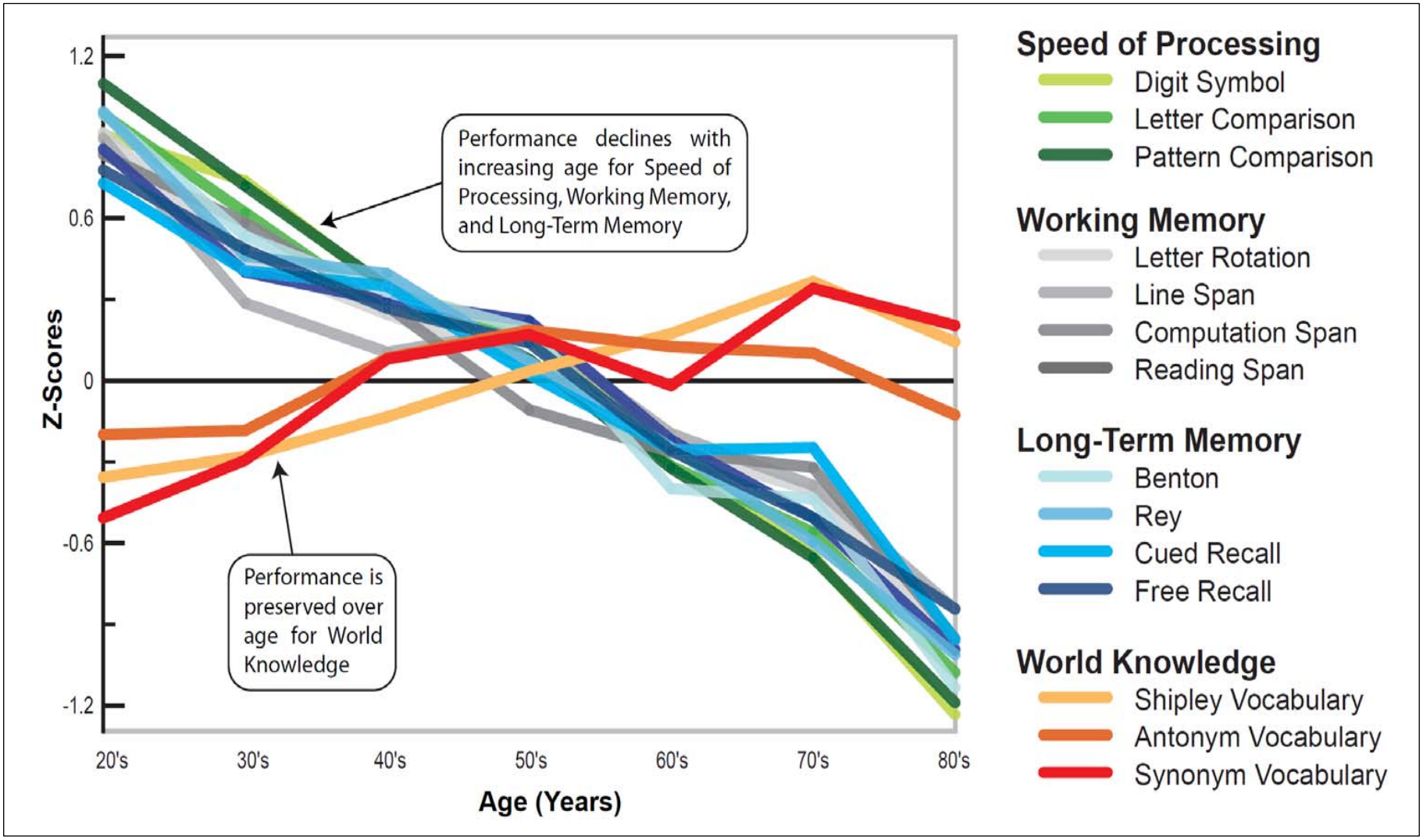
- It is well known that many cognitive abilities decline with age
  - 'fluid' abilities decline
  - 'crystallized' knowledge stabilizes or improves

# Cognitive Performance Across the Lifespan




†Data adapted from Park et al. (2002) showing cross sectional performance on fluid

and crystallized cognitive abilities for a sample of adults aged 20-89.

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- **Objective:** Investigate health literacy performance - as measured by TOFHLA, REALM, and NVS - across age groups

# LitCog Cohort Study

- Funded by National Institute of Aging (R01AG03611) - 2007 to present
- 1100 Community-dwelling older adults (55-74) (798 available for current analyses)
- Recruitment at1 Academic GIM practice and 6 federally qualified health centers (FQHCs)
- 2 interviews ~1 week apart (2.5 hours each)
- Full medical record access and review

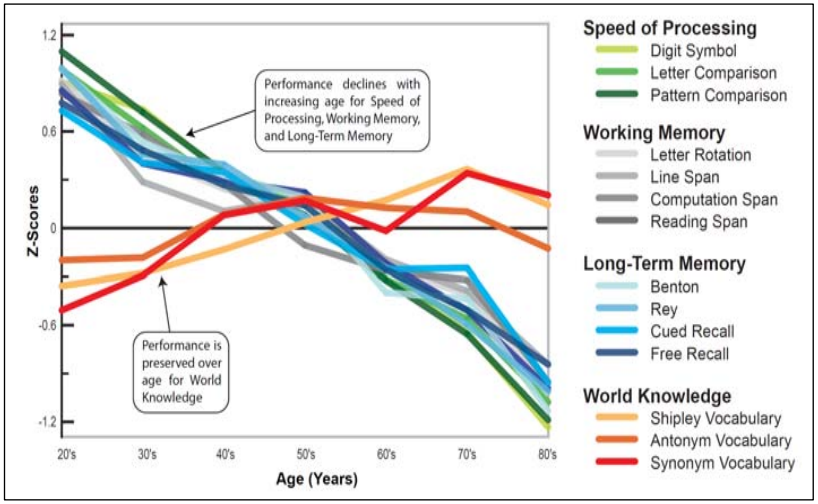
| Table 1. LitCog Interview Schedule | |
|---|---|
| **Day 1** | **Day 2** |
| **Health Questionnaire** | **Cognitive Assessments** |
| Mini Mental Status Exam | Induction Motor Assessment |
| Quality of life (SF-36) | Speed of Processing |
| Depression, Anxiety (PROMIS) | (Digit and Pattern Comparison, Symbol Digit) |
| Social Support Index | Verbal Ability |
| Patient Activation (PAM) | (Shipley Vocab, AM-NART, Graded Naming) |
| Demographics | Working Memory |
| Socioeconomic status | (Spatial working memory, size judgment, spatial span) |
| **Health Literacy Tests** | Long Term Memory |
| REALM, TOFHLA, NVS | (New York paragraph, verbal recognition) |
| **Performance on Everyday Health Tasks** | Inductive Reasoning |
| Comprehend print information | (Ravens Progressive Matrices, ETS Letter Sets, Stockings of Cambridge) |
| Recall spoken information | |
| Recall multimedia information | Prospective Memory Assessment |
| Organize and dose medications | **Measures of Personality** |
| Healthcare problem solving | IPIP, NEO |

*** Full access to medical record**

# Methods

- Examine correlations between HL, cognition, and age.
- Replicate Park et al. lifespan model for HL performance
- Limited age range (55-74); utilize age groups:

**55-59 60-64 65-69 70-74**

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# Sample

- More female
- AA and White
- Diverse by
  - education
  - income
  - employment
- Moderate comorbidity
- Average health status

(based on normative data from SF-36, PROMIS)

**Table 3. Characteristics of LitCog Sample (N=827)**

| VARIABLE | SUMMARY VALUE |
|---|---|
| **Age, M (SD)** | 63 (5.5) |
| **Gender (%)** | |
| Female | 68 |
| **Race (%)** | |
| Black | 42 |
| White | 51 |
| Other | 7 |
| **Education (%)** | |
| High school or less | 26 |
| Some college or technical school | 22 |
| College graduate | 21 |
| Graduate degree | 31 |
| **Income (%)** | |
| < $10,000 | 12 |
| $10,000 - $24,999 | 19 |
| $25,000 - $49,999 | 16 |
| > $50,000 | 54 |
| **Employment Status (%)** | |
| Full-time | 21 |
| Part-time | 15 |
| Not working | 64 |
| **Chronic Conditions, M (SD)** | 2 (1.4) |
| **Number of prescription medications, M (SD)** | 4 (3.1) |

# Results

| | FLUID | | | | CRYSTALLIZED | HEALTH LITERACY | | |
|---|---|---|---|---|---|---|---|---|
| | Processing Speed | Working Memory | Inductive Reasoning | LT Memory | Verbal Ability | TOFHLA | REALM | NVS |
| Processing | N/A | | | | | | | |
| Working Memory | 0.64* | N/A | | | | | | |
| Inductive Reasoning | 0.72* | 0.73* | N/A | | | | | |
| LT Memory | 0.54* | 0.49* | 0.54* | N/A | | | | |
| Crystal Abilities | 0.66* | 0.63* | 0.75* | 0.50* | N/A | | | |
| TOFHLA | 0.68* | 0.65* | 0.71* | 0.48* | 0.77* | N/A | | |
| REALM | 0.53* | 0.43* | 0.54* | 0.37* | 0.74* | 0.75* | NA | |
| NVS | 0.61* | 0.59* | 0.71* | 0.51* | 0.71* | 0.62* | 0.46* | NA |
| Age | -0.17* | -0.12** | -0.13* | -0.11** | 0.02 | -0.11** | 0.01 | -0.09 |

* p<.001 **P<0.05

**HL to HL**: 0.46 to 0.75

**FA to HL**: 0.37 to 0.71

**CA to HL**: 0.71 to 0.74

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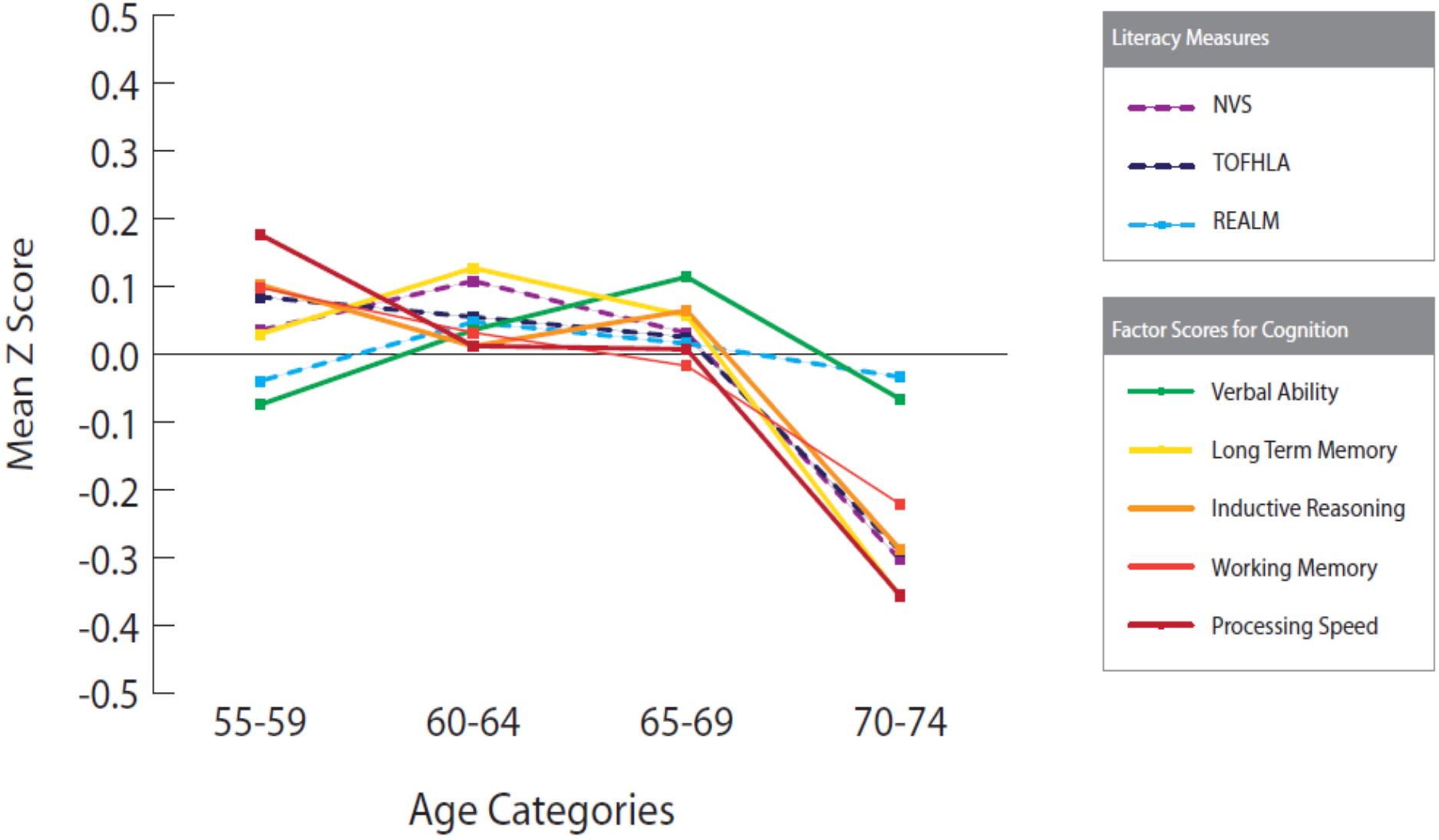
**Age to FA: +**

**Age to CA: -**

**Age to TOFHLA: +**

**Age to REALM: -**

# The Effect of Age on Health Literacy and Cognitive Function



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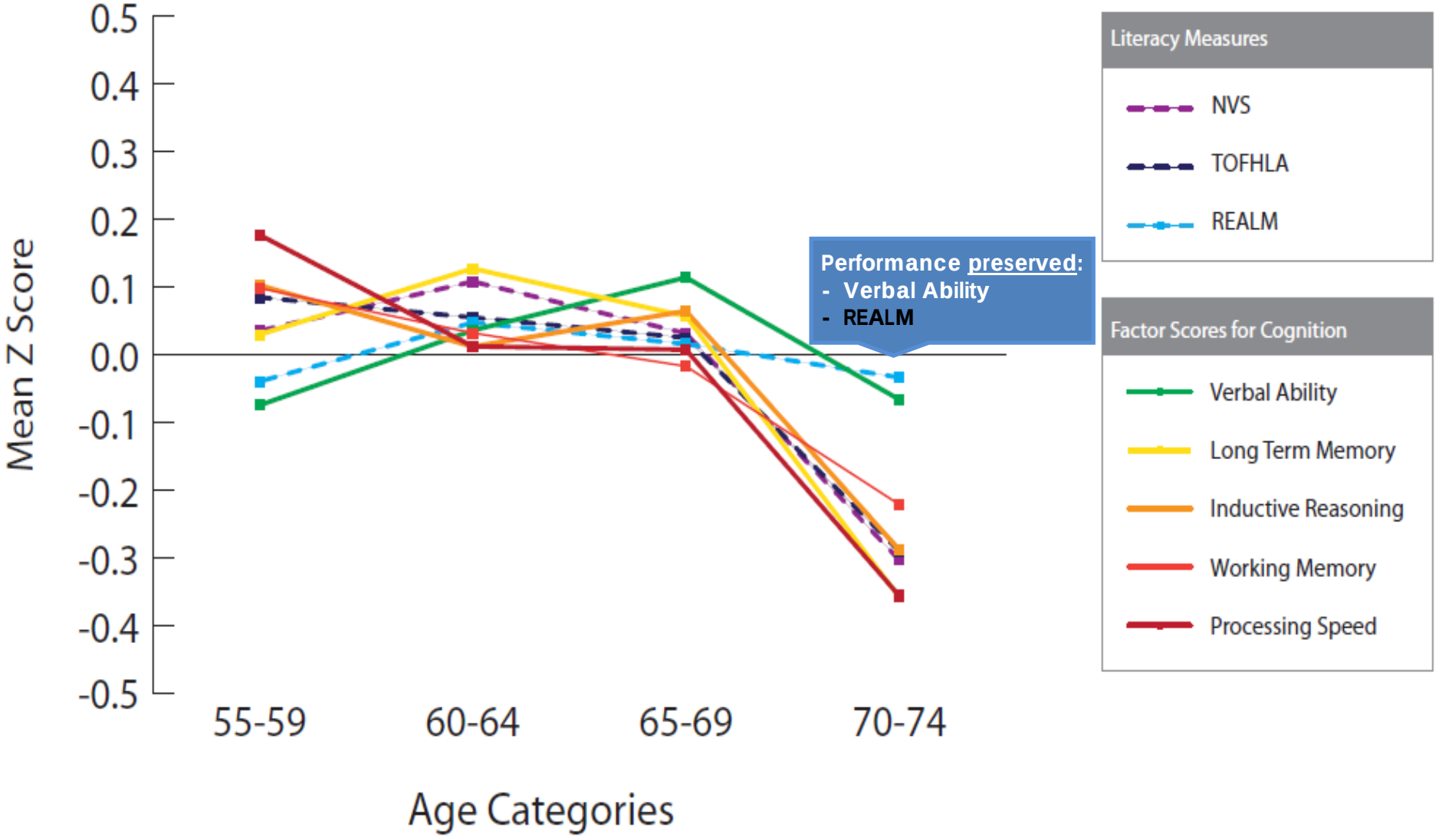

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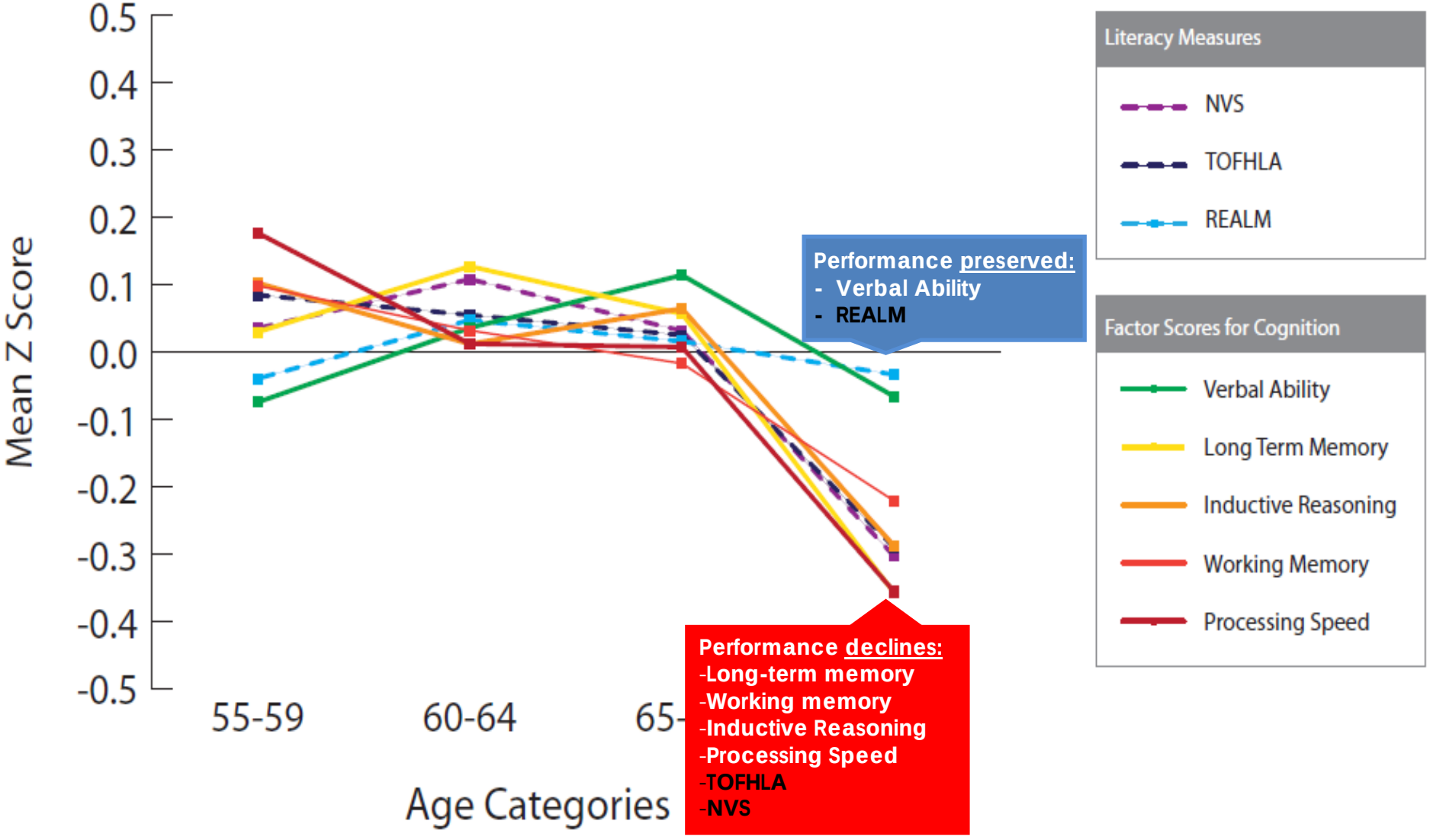

# Discussion

- HL is strongly linked to cognitive function
- TOFHLA and NVS decline, as do fluid abilities
- REALM scores tend to be maintained, as with world knowledge

# Discussion

- Patients continue to learn and acquire health information across life course.
- Yet the skills needed to obtain, access, process, understand and use health information are marginalized with age.
- Interventions should be aimed at simplifying health tasks and supporting processing of health information and memory, among other targets

# Other Implications

- Important implications for measurement
- Prior studies consistently find HL is strongly associated with  health knowledge
- REALM may be closer proxy of knowledge
- TOFHLA/NVS more reflect problem-solving abilities for healthcare
- Both may be important for aging research

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