

Smartphone Game-Based Cognitive Performance in Older Adults and Its Relationship with Cognitive Status

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Background

- As the global population continues to age, rates of cognitive decline are also on the rise.¹ Smartphone apps have emerged as a low-burden method of cognitive training.
- Lumosity** is a colorful gamified approach to exercise brain functions, with over 40 games targeted to skills like language, processing speed, memory, divided attention, executive function, and problem solving.²
- Despite their disputed effect on reversing or hindering cognitive decline,^{3,4} brain training games may provide valuable information on a user's cognitive state.

Word Snatchers

- Word Snatchers** is a Lumosity game in the Language domain that targets vocabulary proficiency.
- Users are shown a set number of characters and the scrambled letters of a word. The objective is to type the unscrambled word as quickly as possible, using the definition provided.
- Users must think analytically to brainstorm letter combinations and recall words from their memory to match the definitions.

Study Objective

- Word Snatchers data was analyzed to determine if time spent playing and game score were statistically related to cognitive status, and if Word Snatchers score was reflective of a user's overall performance.

Methods

Study Population

- 117 members of the Boston University Alzheimer's Disease Research Center (BU ADRC) used Lumosity, with data collection spanning from June 2021 to June 2025. Participants were older adults living in the Boston area. All individuals' cognitive status was verified (adhering to the criteria set by the National Alzheimer's Coordinating Center Uniform Data Set) within 3 years of their engagement on Lumosity.

App Engagement

- Participants completed a median of 6.5 sessions on Word Snatchers, with an interquartile range (IQR) of 2 to 15.25. There was a median time span of 428 days between first and last session (IQR: 89.75 to 730.75).

Variable	n = 117
Age (years), mean (SD)	70.4 (10.0)
Education (years), mean (SD)	16.9 (2.1)
Female, n (%)	72 (61.50%)
Cognitive Status, n (%)	
Cognitively intact	92 (78.63%)
Mild Cognitive Impairment	16 (13.68%)
Impaired (not MCI)	9 (7.69%)

Figure 2. Sample characteristics



Figure 1. Word Snatchers game⁵

Performance Metrics

- LPI (Lumosity Performance Index)** is a number measuring a participant's overall performance that is applied across most games and updated after each session.
- Game score, by contrast, is a measured independently from game to game, and only indicates performance in one particular session.
- The Word Snatchers game exclusively measures score and does not generate an LPI; however, users' performance across other games can be evaluated using their LPI.

Statistical Methods

- The distribution for each digital measure was presented as the median (2.5th and 97.5th percentiles) in each cognitive stratified group.
- The correlation between score LPI was derived with linear regression.
- Differences in characteristics between cognitive groups were compared using the Wilcoxon Rank-Sum test for continuous variables.
- Logistic regression was used in the association analysis between cognitive status and performance.
- Statistical significance was considered for p values < 0.05.

Results

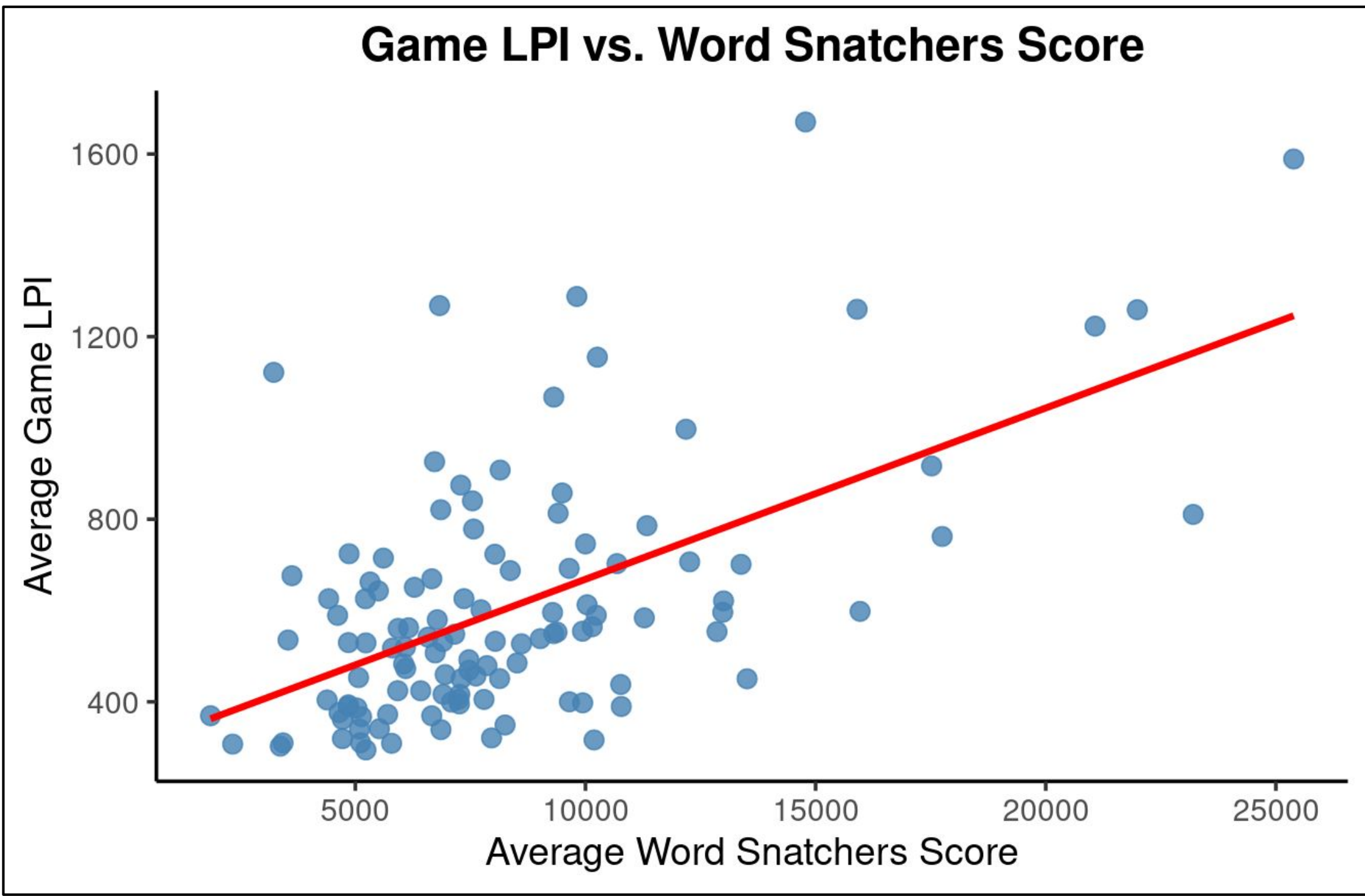


Figure 3. Users' average LPI across all Lumosity games was positively correlated with average score in Word Snatchers ($r = 0.574$, $p < 0.001$).

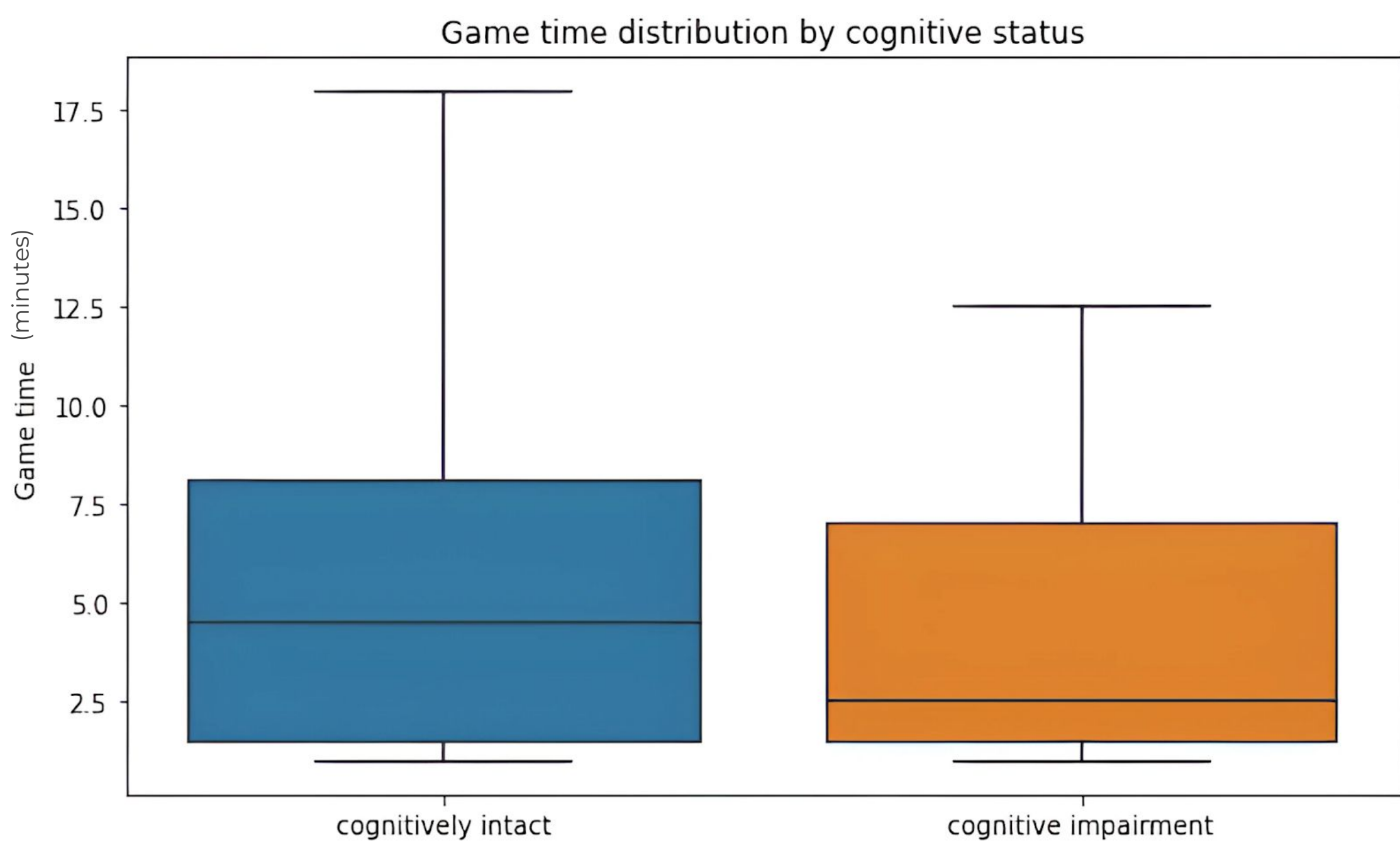


Figure 4. There was no statistically significant difference in Word Snatchers game time distribution between cognitively intact and cognitively impaired participants ($p = 0.39$).

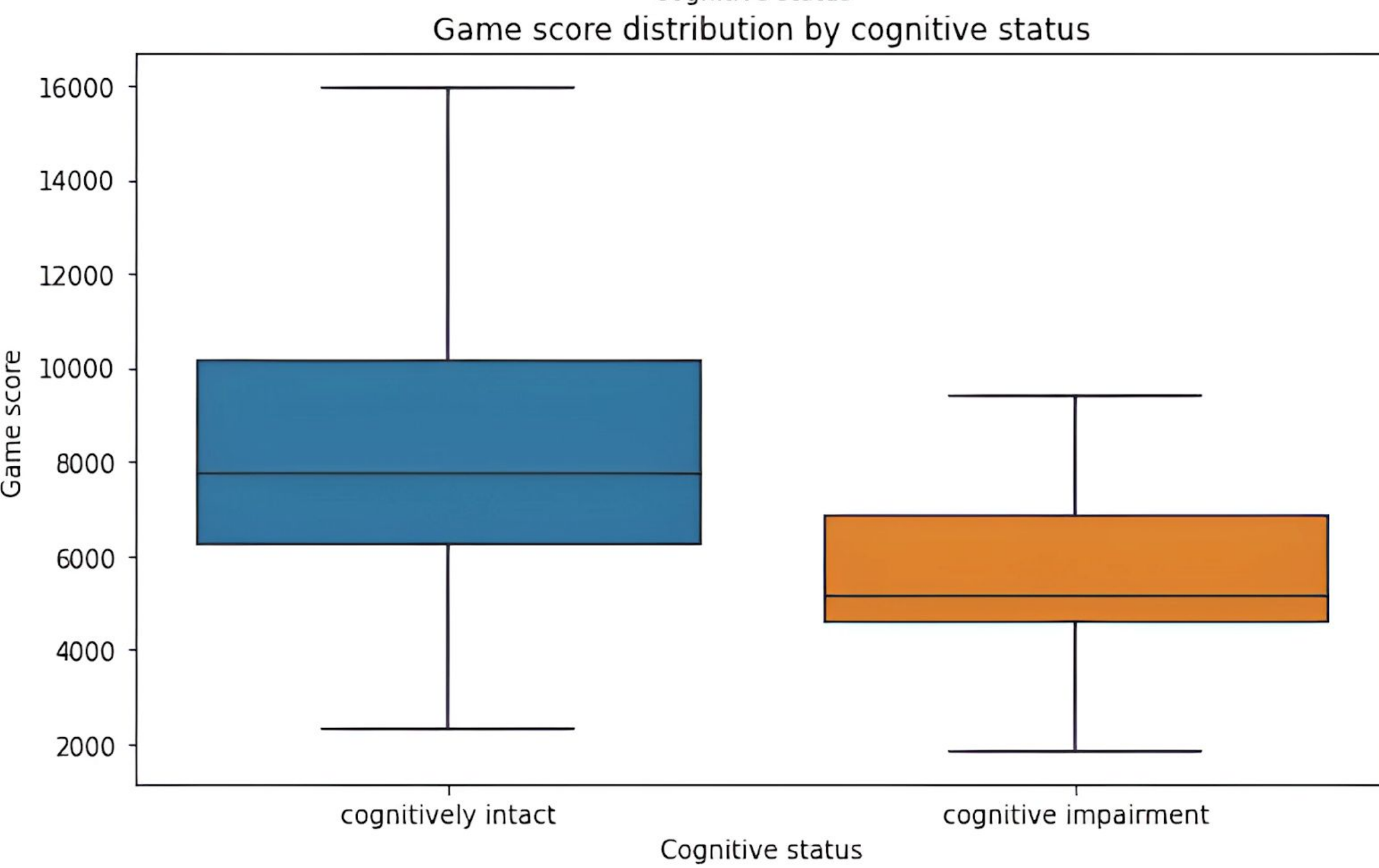


Figure 5. Cognitively impaired users had significantly lower game score distribution ($p = < 0.001$).

In the association analysis between game performance and cognitive status, score was significantly associated with MCI. For each 100-point increase in mean game score, the odds of MCI decreased by 4%.

Conclusions

- Cognitive impairment has a notable connection to performance on Word Snatchers. The similar average game time between groups reduces the likelihood that the difference in scores is merely a result of longer practice.
- The increasing relationship between Word Snatchers Score and LPI justifies Word Snatchers as representative of overall performance on Lumosity.
- This suggests that, given enough data, Word Snatchers is an adequate cognitive assessment, and general performance on Lumosity may be as well. Accurate digital tools increasingly demonstrate their value as an accessible tool for monitoring cognitive status.

Limitations

- A relatively small proportion of the Word Snatchers cohort was cognitively impaired (21.37%), which may limit the generalizability of findings related to this subgroup.

References



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