Which blueberries are better value? The development and validation of the functional numeracy assessment for adults with aphasia

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Background

People with aphasia (PWA) can experience functional numeracy difficulties, problems understanding or using numbers in everyday life, which can have numerous negative impacts on their daily lives. There is growing interest in designing functional numeracy interventions for PWA; however, there is a lack of suitable assessments available to monitor the impact of these interventions. Existing functional numeracy assessments lack breadth and are not designed to be accessible for PWA, potentially confounding their performance. Additionally, they do not include real-life demands, such as time pressure, which may increase their ecological validity. Thus, there is a crucial need for a new assessment to facilitate further research of PWA's functional numeracy difficulties.

This study aimed to:
i) Develop and validate a comprehensive aphasia-friendly functional numeracy assessment
ii) Investigate how functional numeracy is impacted by aphasia and by time pressure demands
iii) Explore predictors of PWA's functional numeracy

Methods

Participants

Twenty PWA (7 women and 13 men; aged 39-75) and 102 neurotypical controls (aged 18-86). All but one of the PWA presented with fluent aphasia on the Western Aphasia Battery-Revised (WAB-R)[1].

Assessments (all delivered online, unsupervised and with aphasia-friendly adaptations[2])

- **Functional Numeracy Assessment (FNA23):** Twenty-three questions covering a broad range of functional numeracy skills and various response modalities (spoken, typed and multiple choice; see Fig. 1)
- **Time Pressure Task:** Seven questions adapted from the FNA23 with the addition of time pressure
- **General Health Numeracy Test (GHNT)[3]:** Six-item objective measurement of health numeracy (a subset of functional numeracy)

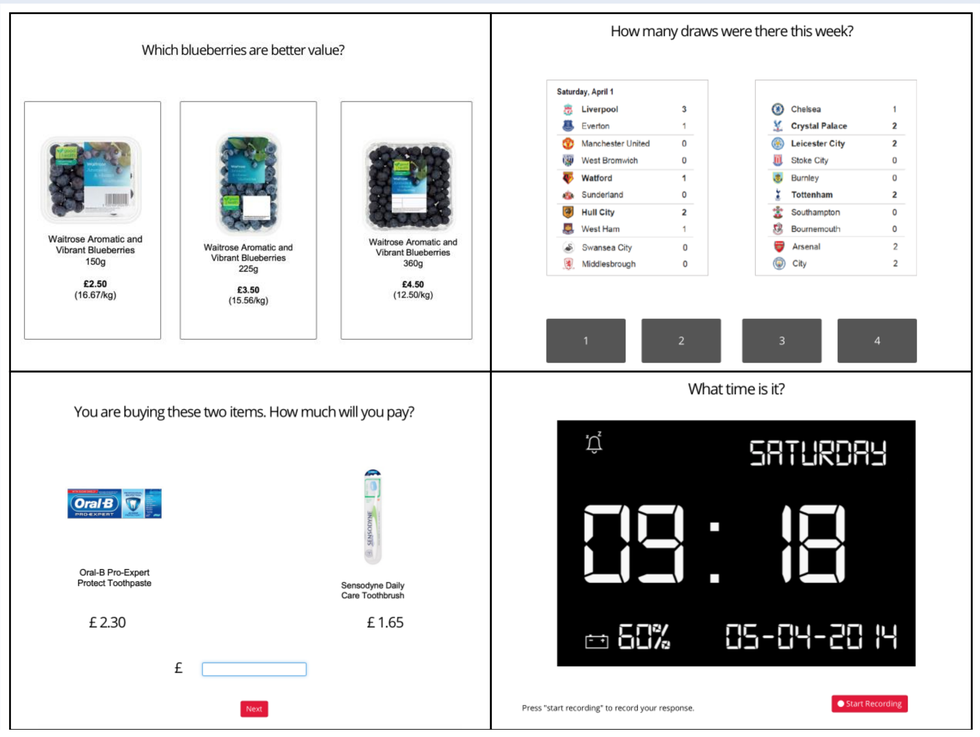

Figure 1. Screenshots showing FNA23 questions

Results

- The FNA23 demonstrated acceptable internal consistency reliability (*KR-20* = .81) and perfect interrater reliability (for spoken responses)
- FNA23 scores were positively associated with GHNT scores, suggesting satisfactory construct validity
- As a group, PWA demonstrated poorer functional numeracy than controls and took longer to complete assessments
- Time pressure did not significantly impact performance ($t(19) = 1.473$, $p = .157$)
- PWA demonstrated a wide range of functional numeracy abilities, with some performing similarly to controls (see Fig. 2)
- Aphasia severity (measured by the WAB-R aphasia quotient), but not age, time post-stroke or education, significantly predicted FNA23 scores

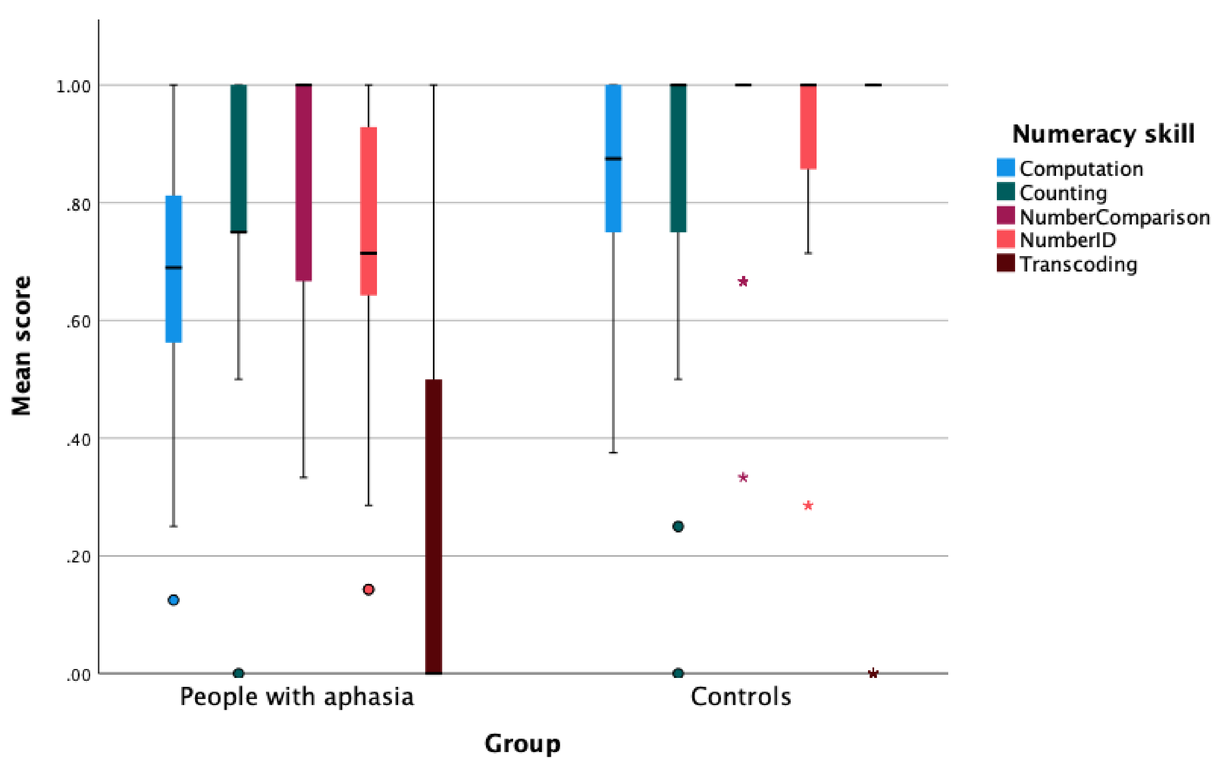

Figure 2. Clustered boxplot showing participants' mean scores across different numeracy skills assessed in the FNA23

Discussion

This study was an important first step in the FNA23's development and showed that:

- The FNA23 is a comprehensive, valid, and reliable assessment which, with further development, could be used to identify and monitor PWA's functional numeracy strengths and difficulties in research and clinical practice
- The FNA23 is sensitive enough to detect a range of functional numeracy abilities

This study adds to the growing body of evidence highlighting the prevalence of functional numeracy difficulties in PWA, the relationship between functional numeracy and aphasia severity, and most importantly, the need for PWA to be evaluated for functional numeracy difficulties as part of their neurorehabilitation journeys.

References

[1]Kertesz, A. (2007). *Western Aphasia Battery–R*. New York, NY: Grune & Stratton.
[2]Rose, T. A., Worrall, L. E., Hickson, L. M., & Hoffmann, T. C. (2011). Aphasia friendly written health information: Content and design characteristics. *International journal of speech-language pathology*, *13*(4), 335-347.
[3]Osborn, C. Y., Wallston, K. A., Shpigel, A., Cavanaugh, K., Kripalani, S., & Rothman, R. L. (2013). Development and validation of the general health numeracy test (GHNT). *Patient education and counseling*, *91*(3), 350-356.