Cognitive testing and mental health policies: Translation concerns with mobile technology

Title

Kai Ruggeri
Áine Maguire
Jack Andrews
Eric Martin
Shantanu Menon

Team

9.9 Million New Cases of Dementia Annually.

A cost of $818 billion this year (1).

The use of mobile platforms in testing cognitive function is expanding, often replacing traditional tests completed on pen and paper in the presence of a professional.

It cannot be assumed that the same normative data collected for traditional style tests can be applied to computer based versions (2).

This work examines implications of new screening and testing practices, generating evidence on the impact utilising mobile platforms for testing cognitive function.

Overview

UNIVERSITY OF CAMBRIDGE

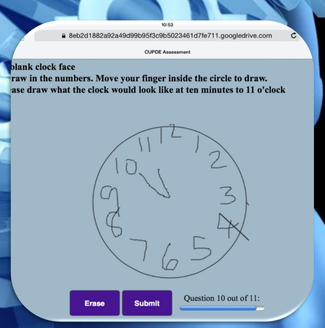
Affiliation

Instruments
SLUMS, the Saint Louis University Mental State examination, is a pen and paper screening tool for mild cognitive impairment and dementia (3).
CUPDE, the Cambridge University Pen to Digital Equivalence Exam, is the digital translation of SLUMS
SAGE, the Self-Administered Gerocognitive Exam is a pen and paper based assessment (4) that was used to compare the concurrent validity of CUPDE and SLUMS.

Participants
Healthy, individuals (aged 50-79) with no history of memory complaints. Randomly assigned to either the SLUMS (N=30) or the CUPDE (N=30) condition.

Procedure
Researchers administered SLUMS to the participants.
CUPDE was self administered via an iPad.
SAGE was self administered after taking either measure.

Method



Task

Itemized comparisons between SLUMS and CUPDE

Question	X^2	df	p
1. Day of Week[1]	-	-	-
2. Year	1.02	1	.313
3. County	27.78**	1	.001
5. Calculation (Spent)	.27	1	.605
5. Calculation (Change)	.07	1	.793
6. Animals[1]	-	-	-
7. Objects[3]	7.94	5	.160
8. Back digit	2.38	2	.304
9. Clock Hours	3.36	1	.067
9. Clock Time	.27	1	.605
10. Shape (Triangle)	2.31	1	.129
10. Shape (Largest)	.001	1	1.0
11a. Story (Name)	2.44	1	.118
11b. Story (Work)	35.62**	1	.001
11c. Story (Back to work)	6.70*	1	.010
11d. Story (Country)	12.27	1	.001

1. Item 1 was answered correctly in both conditions. 2. Did not meet criteria for minimum expected cell frequency. *p<.05. **p<01.

Results

	Mean
Condition A: SLUMS[1]	22.53 (3.32)
Condition B: CUPDE[1]	16.8 (4.13)
Condition A: SAGE[1]	18.83 (2.25)
Condition B: SAGE[1]	17.87 (3.19)
Condition A: SLUMS[1]	22.53 (3.32)
	ρ
SAGE and SLUMS[1]	.54**
SAGE and CUPDE[1]	.44*
	t(df)
SLUMS and CUPDE[2]	5.93 (58)***
SLUMS and CUPDE[3]	3.02 (15)****

1. n = 30. 2. n= 60. 3. Matched pairs (n=17) based on SAGE scores and age. Item 6 was excluded from the analysis due translation issues. *p<.05. **p<.005. ***p<.001. ****p<.01.

Test comparisons

When a pen and paper test of cognitive function is translated to a computerized mobile format, the result is effectively a completely new test.

A bespoke scoring system must be designed for a translated mobile-based test.

Whilst new normative data might generate the ability for a test to show differences between typical and atypical scores, such translations may in fact be testing dissimilar cognitive constructs.

Conclusions

Policymakers should require evidence not only on testing elements involved in specific instruments, but also how scoring has been developed specifically, considering the medium used. This will ensure resources are used effectively and only on tools that have been validated on all relevant levels. Only at this point should there be a consideration to apply on a large scale, if it is to happen at all.

Policy

Future research should integrate voice recognition software into test translations.

There is a need to investigate whether different areas of the brain are employed when testing on a mobile platform compared to pen and paper, and how this difference in activity relates to test outcomes.

Greater understanding of the interplay and related mechanisms between auditory and visual systems, which are not well understood yet in the context of mobile technologies, is also required.

Cognitive neuroscience has roles in addressing these gaps and influencing policies that involve the use of new platforms for testing cognitive function.

Considerations

(1) Prince M, Wimo A, Guerchet M, Ali GC, Wu YT, Prina M. World Alzheimer's Report 2015. The Global Impact of Dementia: An analysis of prevalence, incidence, cost and trends. London: Alzheimer's Disease International (ADI). August 2015. 82 p.
(2) Bauer RM, Iverson GL, Cernich AN, Binder LM, Ruff RM, Naugle RI. Computerised neuropsychological assessment devices: joint position paper of the American Academy of Clinical Neuropsychology and the National Academy of Neuropsychology. Clin Neuropsychol 2012; 26(2):177-196.
(3) Tariq SH, Tumosa N, Chibnall JT, Perry MH 3rd, Morley JE. Comparison of the Saint Louis University mental status examination and the mini-mental state examination for detecting dementia and mild neurocognitive disorder – a pilot 470 study. Am J Geriatr Psychiatry 2006; 14 (11): 900-910.
(4) Scharre DW, Chang SI, Murden RA, Lamb J, Beversdorf DQ, Kataki M, Nagaraja HN, Bornstein RA. Self-administered Gerocognitive Examination (SAGE): a brief cognitive assessment Instrument for mild cognitive impairment (MCI) and early dementia. Alzheimer Dis Assoc Disord. 2010; 24(1): 64-71.
(5) Image credit: The brains blog. 2015. Retrieved from: http://philosophyofbrains.com/2015/08/31/mindsonline-2015-session-1-social-cognition.aspx

References