The Mater-Royal Parkinson's Disease Cognitive Screen (M-R PDCS)

Parkinson's Disease (PD) is the most common neurological movement disorder, with the highest rates found in Northern Ireland (Okunoye et al., 2022). Mild Cognitive Impairment is common, often being one of the main symptoms, affecting quality of life.

Rationale for M-R PDCS:
There is no guidance from the International Parkinson's Disease Movement Disorder Society as to what "standardised tests" should be used to identify and monitor PD-MCI (Rosca & Simu, 2020) or used before undergoing Deep Brain Stimulation surgery (pre-cognitive testing is required before undergoing DBS surgery) (Foley et al., 2018). Additionally, current tests do not account for PD motor symptoms, which can influence test scores. As well, tests are not specific to PD-MCI, and there is a need for digitalised testing, affording for more accessible services.

Phase I

Aims: Explore the acceptability and validity of the M-R PDCS.

Methods

Design: Cross-sectional study (completed an online survey through Qualtrics).

Participants: 20 experts (professional Neurologists, Neuropsychologists, Specialist Parkinson Disease Nurses and Geriatricians practising within the UK) were recruited by purposive sampling methods.

Analyses: Quantitative data were analysed by descriptive statistics. Qualitative data were analysed content analysis (Elo & Kyngäs, 2008)

Ethics: Approved from the Faculty of Engineering and Physical Sciences, Queen's University Belfast.

Results

1. **Acceptability**
   - 65% reported the administration time was appropriate.
   - 50% reported no barriers to use.
   - 95% reported positive feedback relating to test instructions and 85% reported positive feedback relating to the scoring system
   - Qualitative data: 3 key themes emerged- Test Design, Subtests and Time to administer the M-R PDCS.

2. **Face Validity**
   - 95% reported that the M-R PDCS differentiates between motor and cognitive functioning.
   - 47% would change specific subtests, 25% were not sure, and the remaining would not make any changes.
   - Qualitative data: 2 key themes emerged- Specific Subtests, and Overall impression of the M-R PDCS.

3. **Content Validity**
   - 95% of experts agreed that total score and all domains (except for orientation which 100% agreed) demonstrated content validity for assessing PD-MCI.
   - Qualitative data: 4 key themes emerged- Subtests, Domains, Layout, and comparisons to other tests.

Changes to the M-R PDCS following expert feedback:
Added a test of effort to the memory domain, adhering to BPS guidelines.
New administration and score sheets were created, with clearer guidance for clinicians.
Formatting changes were made to some subtests.

References:

Elo, S., & Kyngäs, H. (2008). *The qualitative content analysis process.* Journal of advanced nursing, *62(1)*, 107-115. https://doi.org/10.1111/j.1365-2648.2007.04569.x.

Foley, J. A., Foltynie, T., Limousin, P., & Cipolotti, L. (2018). *Standardised neuropsychological assessment for the selection of patients undergoing DBS for Parkinson's disease.* Parkinson's disease, 2018. https://doi.org.10.115.2018/4328371.

Okunoye, O., Marston, L., Walters, K., & Schrag, A. (2022). *Change in the incidence of Parkinson's disease in a large UK primary care database.* npj Parkinson's Disease, 8(1), 1-7. https://doi.org/10.1038/s41531-022-00284-0.

Rosca, E. C., & Simu, M. (2020). *Parkinson's disease-cognitive rating scale for evaluating cognitive impairment in Parkinson's disease: A systematic review.* Brain Sciences, 10(9), 588. https://doi.org/10.3390/brainsci11060709.

Wang, Y., Chen, H. J. (2012). *Use of percentiles and z scores in anthropology.* The Handbook of Anthropology: Physical measures of human form in health and disease. *Springer.*

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Phase II

Aim: To investigate the psychometric properties of the M-R PDCS.

Methods

Design: Cross-sectional experimental study, with participants completing the digital M-R PDCS and ACE-III (Addenbrookes-III) cognitive tests, using Zoom platform.

Participants: Purposive sampling recruited 100 adults from the British Isles (n= 34 male, n= 66 females, aged 50-79, with secondary and tertiary educational backgrounds, with sub-clinical mood (PHQ-9) and anxiety (GAD-7) scores. Participants were randomly assigned to Group A (completing M-R PDCS, then ACE-III) or Group B (ACE-III, then M-R PDCS).

Analyses:

Normative data: Descriptive statistics, floor, and ceiling effects, Kolmogorov test and Q-Q plots to examine normality, mean-based percentiles (Percentile= Mean + (Z-score * Standard Deviation), as cited by Wang & Chen, 2012). To assess how demographic variables influenced cognitive scores, correlational Cohen's d, and regression analyses were performed.

Convergent validity: Pearson's correlation and Bland Altman analyses (with ACE-III scores).

Reliability: Internal-consistency (Cronbach α, using M-R PDCS items) and test administration effects (two independent samples, t test) were performed.

Ethics: Approved from the Faculty of Engineering and Physical Sciences, Queen's University Belfast.

Results

Normative data

M-R PDCS and ACE-III data were both normally distributed (p < .001).

M-R PDCS only had significant ceiling effects (<15%) on language and visuospatial domains, but all were found for ACE-III domains.

M-R PDCS	Mean	SD
Attention	86.60	4.86
Memory	73.36	7.62
Language	14.56	1.00
Executive Functioning	25.21	3.72
Visuospatial	12.85	1.17
Total	211.52	13.17

Demographic	M-R PDCS	Correlation (*p* <.05)
Education	Total	✓
Age	Total	✓
Gender	Total	
Mood	Total	
Anxiety	Total	

Regression model statistically predicated M-R PDCS Attention, Memory, Language and Executive functioning scores, with small effect sizes (according to Cohen, 2013).

Convergent Validity
- Significant correlations with Attention (p< .05), Memory and Visuospatial and Executive Functioning scores (p<.001).
- Bland-Altman plots indicated that data lay within the points, ranging from 94-98 %, within ±2SD of the mean difference.

Reliability

M-R PDCS	Cronbach's alpha (α)	Interpretation (recommended by Streiner et al., 2003)
Attention	0.18	
Memory	0.60	Acceptable
Language	0.07	
Executive Functioning	0.82	Acceptable
Visuospatial	0.18	
Total	0.70	Acceptable

Test administration order did not statistically effect M-R PDCS or ACE-III test-scores (p > .05).

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