Automated tests for diagnosing and monitoring cognitive impairment: a diagnostic accuracy review

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Declared competing interests of authors: Rumona Dickson is on the Health Technology Assessment Evidence Synthesis Board.

Published October 2016
DOI: 10.3310/hta20770

Scientific summary

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Health Technology Assessment 2016; Vol. 20: No. 77
DOI: 10.3310/hta20770

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Background

Cognitive impairment is a growing public health concern, and is one of the most distinctive characteristics of all dementias. The timely recognition of dementia syndromes can be beneficial, as some causes of dementia are treatable and are fully or partially reversible. Health-care professionals in the NHS currently use a number of pen-and-paper-based tools to diagnose and monitor patients with cognitive impairment; the Mini-Mental State Examination and the General Practitioner Assessment of Cognition are two examples of such tests. Several automated computerised cognitive assessment tools for assessing mild cognitive impairment (MCI) and early dementia are also now available; however, their use in diagnosis and/or in monitoring the progression of cognitive impairment or response to treatment has not been evaluated.

Objectives

The aim of this review is to determine whether or not automated computerised tests accurately identify patients with progressive cognitive impairment in MCI and early in dementia and, if so, to investigate their role in monitoring disease progression and/or response to treatment.

Methods

Search strategy

Five electronic databases (MEDLINE, EMBASE, The Cochrane Library, ISI Web of Science and PsycINFO) were searched from 2005 to August 2015. Theses or PhD abstracts were accessed from ProQuest. Backwards and forwards citation tracking for all relevant studies and reviews for further possible titles was undertaken. Trial and research registers were searched for ongoing studies and reviews. After individual tests were identified, a second search was run to identify the individual test costs and acquisition costs for the various tools.

Study selection

The references identified were assessed for inclusion through two stages. In stage 1, two reviewers independently screened all relevant titles and abstracts identified via electronic searching and selected potentially relevant studies for inclusion in the review. In stage 2, full-text copies of the potentially relevant studies were obtained and assessed independently by two reviewers. Any disagreements between reviewers were resolved by discussion with a third reviewer at each stage. Studies that did not meet the inclusion criteria were excluded.

Data extraction and quality assessment strategy

Data extraction forms were developed and piloted in a Microsoft Excel® spreadsheet (Microsoft Corporation, Redmond, WA, USA) using a sample of included studies. One reviewer extracted data on study and population characteristics and outcomes, and a second reviewer independently checked the data for accuracy, with disagreements resolved through discussion with a third reviewer when necessary.

Evidence synthesis

The results of the data extraction and quality assessment for each study are presented in structured tables and as a narrative summary.

Results

The electronic searching of databases resulted in 13,352 references. An additional 5444 records were identified through ProQuest, hand-searching and citation tracking. After deduplication, 13,542 titles and abstracts were screened and 399 articles were shortlisted for full-text assessment. Sixteen studies were included in the diagnostic accuracy review. No studies were identified that described automated computerised tools used to monitor disease progression.

Owing to the heterogeneity of the included studies and the limited data available, it was not possible or appropriate to perform any statistical analyses.

At this time, owing to the limited and poor quality of the evidence base, the use of automated computerised tests in routine clinical practice cannot be recommended.

Conclusions

The overall quality and quantity of information currently available is insufficient to be able to make recommendations on the clinical use of computerised tests for diagnosing and monitoring MCI and early dementia progression.

These test scores do not always correlate with clinical history and, more importantly, with functioning. Hence the diagnosis of patients with MCI and early dementia is based on clinical judgement and medical history as well as the results of cognitive tests. For this reason, we would recommend against approaches that use computerised tests in isolation at this time.

Further research is required to establish stable cut-off points for each automated computerised test used to diagnose patients with MCI or early dementia. These cut-off points also need to be tested in specific patient populations, for example in patients of different age groups or education levels and from different geographical regions.

The prevalence of dementia and alternative diagnoses in the study populations should be clearly reported, making reference to standardised checklists for diagnostic reviews such as the Standards for Reporting Diagnostic Accuracy or the Standards for Reporting Diagnostic Accuracy – dementia.

Future research in this area should also focus on providing more information on the costs of computerised tests, including time for training, administration and scoring of the different tests, as these are important factors for their use in routine clinical practice. This type of information is currently lacking in the published studies describing computerised tests used to diagnose or monitor people with MCI or early dementia.

Study registration

This study is registered as PROSPERO CRD42015025410.

Funding

Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.

Health Technology Assessment

HTA/HTA TAR

ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

Impact factor: 4.058

Health Technology Assessment is indexed in MEDLINE, CINAHL, EMBASE, The Cochrane Library and the ISI Science Citation Index.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

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This report

The research reported in this issue of the journal was funded by the HTA programme as project number 15/67/01. The contractual start date was in August 2015. The draft report began editorial review in March 2016 and was accepted for publication in August 2016. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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