A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment

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CRD summary
This review concluded that the mini-mental state examination was best reserved for exclusion of dementia in community and primary care settings. The review suffered from a number of limitations, but the author's conclusions appear reasonable.

Authors' objectives
To assess the accuracy and clinical utility of the mini-mental state examination in the detection of dementia and mild cognitive impairment in high and low prevalence settings.

Searching
MEDLINE, PsycINFO and EMBASE were searched from inception to April 2008. The Web of Knowledge and the online journal collections: Science Direct, Ingenta Select, Ovid Full Text, Blackwell Online and Wiley Interscience were also searched. Bibliographies of key papers were searched. Search terms were reported, including methodological terms for diagnostic accuracy studies.

Study selection
Studies that compared the diagnostic validity of the mini-mental state examination to a validated standard of either dementia or mild cognitive impairment were eligible for inclusion. The mini-mental state examination had to be the unmodified, original, English language version. Included studies also had to contain adequate data for inclusion. Validated standards for dementia included: Diagnostic and DSM (Statistical Manual of Mental Disorders, III, IIIIR and IV), NINCDS-ADRDA (National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer’s Disease and Related Disorders Association), AGECAT (Automated Geriatric Examination for Computer Assisted Taxonomy), CAMDEX (Cambridge Mental Disorders of the Elderly Examination) and expert diagnosis. For mild cognitive impairment, validated standards included Mayo clinic criteria, prospective validation and Clinical Dementia Rating of 0.5 without functional deficits.

Following a sample size calculation, studies that contained a sample size of less that 160 were excluded. Inclusion criteria were not defined for study design. In terms of the outcomes, studies were included only if sensitivity and specificity were either stated or calculable. The outcomes reported in the review were the sensitivity, specificity, positive and negative predictive values, predictive summary index and Youden score.

Studies from all settings were included, but separated into low prevalence (primary care, community studies and nursing homes) and high prevalence (memory clinics, mixed hospital) settings. Subject demographics were variable. Age range (where reported) varied between under 59 to 100 years. Some trials included subjects with psychiatric illness or predominantly involved ethnic minorities. Educational attainment was rarely reported. Diagnostic cut-off thresholds for the mini-mental state examination were variable but the majority of included studies used a threshold of 23v24 (the threshold recommended for people with at least eight years of education).

The author did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
Studies were assessed for reporting and methodological quality using the STARD (Standards for Reporting of Diagnostic Accuracy) guidelines for reporting diagnostic accuracy studies.

The author did not state how many reviewers performed the validity assessment.
Data extraction
The prevalence, sensitivity, specificity, positive and negative predictive values, and Youden’s index were extracted as reported or were calculated from the primary data or receiver operating characteristic curve. The utility index (a measure of the clinical value of a test) was also calculated.

The author does not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The results were analysed separately according to the setting (high or low prevalence) and aim (detection of dementia or mild cognitive impairment). The pooled sensitivity, specificity, positive and negative predictive values were estimated. Meta-analyses of sensitivity and specificity were performed using fixed-effect and random-effect models. Investigation of heterogeneity was limited to visual examination of the fixed-effect proportion meta-analysis plots.

Results of the review
Accuracy of mini-mental state examination in identifying dementia versus healthy people (34 studies, n=31,388 participants): Thirteen studies (n=5,369 participants) were identified from high prevalence settings. The pooled sensitivity was 77.0% (95% confidence interval (CI): 75.5 to 78.5) and pooled specificity was 91.2% (95% CI: 90.0 to 92.3), using a fixed-effect model. Twenty-one studies (n=26,019 participants) were identified from low prevalence settings. The pooled sensitivity was 83.3% (95% CI: 81.9 to 84.7) and pooled specificity was 86.6% (95% CI: 86.2 to 87.1), using a fixed-effect model.

Accuracy of mini-mental state examination in identifying mild cognitive impairment versus healthy people (five studies, n=1,857 participants): All studies were in high prevalence settings. The polled sensitivity was 63.4% (95% CI: 59.1 to 67.7%) and the pooled specificity was 65.4% (95% CI: 62.9 to 67.9), using a fixed-effect model.

Accuracy of mini-mental state examination in identifying dementia versus mild cognitive impairment (three studies, n=555 participants): All studies were in high prevalence settings. The pooled sensitivity was 89.2% (95% CI: 85.4 to 92.4) and the pooled specificity was 45.1% (95% CI: 39.2 to 51.1), using a fixed-effect model.

Pooled estimates of sensitivity and specificity derived from a random-effects model were also reported.

Authors’ conclusions
The mini-mental state examination offered only modest accuracy and was best used for ruling out a diagnosis of dementia in community and primary care.

CRD commentary
This review addressed a clear research question. Several relevant sources were searched to identify potential studies, but specific language limitations were included and no apparent attempts were made to locate unpublished material; this means that language and publication bias cannot be ruled out. Search terms included methodological terms for diagnostic accuracy studies, an approach that is not generally recommended. Inclusion criteria were specified but the variable subject demographics in the included studies may have introduced heterogeneity, as age, education and literacy are known to affect the results of the mini-mental state examination. It was not clear if methods were used to minimise bias and reviewer error in the selection of studies and data extraction.

Studies were assessed for reporting and methodological quality against the STARD criteria, but the results of this assessment were not reported. Visual inspection of the forest plots suggested heterogeneity between included studies, but this was not formally tested or discussed. Pooling was performed across different diagnostic thresholds, without assessing threshold effect. As heterogeneity appeared to be present, pooled estimates are likely to be of limited reliability. Given the size of the data set, an summary receiver operating characteristic curve might have proved more useful, and could have included regression to assess heterogeneity. No attempt was made to assess publication bias. Despite these limitations, the author’s conclusions do not appear unreasonable.
Implications of the review for practice and research

**Practice:** The author stated that mini-mental state examination is best used to rule out a diagnosis of dementia in community or primary care. For all other uses it should be combined with or replaced by other methods.

**Research:** The author did not state any implications for further research.

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