Effects of computerized decision support systems on nursing performance and patient outcomes: a systematic review

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CRD summary
This review assessed the use of computerised decision support systems (CDSS) on nursing performance and patient outcomes. The authors concluded that the introduction of CDSS may not have a positive outcome, and further research is required to identify those contexts in which its use is most effective. This was a generally well-conducted review, but the lack of detailed reporting means that the reliability of these cautious conclusions is not entirely clear.

Authors' objectives
To assess the effect of computerised decision support systems (CDSS) on nursing performance and patient outcomes.

Searching
MEDLINE, CINAHL, EMBASE, British Nursing Index, HMIC, the Cochrane Controlled Trials Register, ASSIA, Sociological Abstracts, PsycINFO, Inspec, SIGLE, National Research Register and Social Sciences Citation Index were searched to May 2006; the search terms were reported. The references of included studies and relevant reviews were checked and experts were contacted. No language restrictions were applied.

Study selection
Randomised controlled trials (RCTs), controlled clinical trials, controlled before-and-after studies and interrupted time series that assessed CDSS use by nurses in a clinical setting were eligible for inclusion. Eligible studies reported measurable professional or patient outcomes. The included studies used comparison groups of either nurses not using CDSS or other health professionals not using CDSS. Most of the included studies were undertaken in the UK and the majority were based in primary care settings. It appears that all of the included studies were RCTs. A variety of behaviours and settings were targeted in the included studies. These included glucose management in intensive care, patient management and triage by the NHS Direct telephone service, and other first contact care settings such as practice nurses, and anticoagulation management. The outcomes reported by the included studies included final management of patient, need for consultations of various types, hospital admissions, adverse events, and adherence to prothrombin or glucose targets.

Two reviewers independently assessed studies for inclusion. Any disagreements were resolved through discussion or by consultation with a third reviewer.

Assessment of study quality
The validity of the studies was assessed using the checklist of the Cochrane Effective Practice and Organisation of Care Group, which employs the following criteria for RCTs: allocation concealment, blinding, follow-up of professionals and patients, baseline measurement, reliable outcome measurement and protection from contamination of the control group.

Two reviewers independently performed the validity assessment.

Data extraction
Risk differences (RDs) with 95% confidence intervals (CIs) were calculated for dichotomous outcomes. Data were extracted on all reported practitioner and patient outcomes.

Two reviewers independently performed the data extraction.

Methods of synthesis
The studies were combined in a narrative. The studies were grouped according to whether the comparison group...
consisted of nurses or of other health professionals; other differences between the studies were discussed in the text.

**Results of the review**

Eight studies were included in the review. Sample sizes were reported but it was not always clear whether nurses or patients were being referred to; the authors stated that more than 100 nurses and 24,000 patients participated in the included studies.

The assessment of study quality showed a risk of contamination in 4 studies.

Studies using a comparison group of nurses not using CDSS (3 studies).

In one study the use of CDSS improved performance on three out of four outcomes, while in a second study it was associated with poorer performance outcomes. None of the 3 studies showed any significant impact on patient outcomes measured by prothrombin levels or glucose levels within recommended ranges.

Studies using a comparison group of other health professionals not using CDSS (5 studies).

Three RCTs compared nurses using CDSS with doctors in anticoagulation management, and none found a significant difference in patient outcomes. Performance outcomes showed a statistically significant increase in one study, with an RD for acceptance of dose and interval advice of 0.19 (95% CI: 0.09, 0.29, p=0.00) dependent on patient variables. Two studies of triage for first contact care found that CDSS had a statistically significant benefit when assessed by performance outcomes: one found a reduction in general practitioner (GP) telephone advice as final point of contact (RD 0.34, 95% CI: 0.33, 0.36, p=0.00), while the other found a similar reduction in GP appointments (RD 0.23, 95% CI: 0.20, 0.26, p=0.00). One showed a negative effect on patient outcomes measured by visits to accident and emergency, out-of-hours consultations and return consultations (data not reported), while another showed some positive impact on patient outcomes measured by adverse effects including hospital admissions within 3 days (RD 0.01, 95% CI: 0.00, 0.02, p=0.02) and within 24 hours (RD 0.01, 95% CI: 0.00, 0.02, p=0.04). There was no significant effect on accident and emergency attendance or deaths.

Further details of individual performance and patient outcomes were reported in the paper.

**Authors' conclusions**

The introduction of CDSS may not have a positive outcome. Further research is required to identify those contexts in which its use is most effective.

**CRD commentary**

The review question and inclusion criteria were clear if broad. The authors searched a large number of relevant databases without language restrictions and made additional attempts to identify unpublished studies. These factors reduced the likelihood that some relevant studies were not included in the review, as well as the risks of language and publication bias. The authors used appropriate methods to minimise reviewer bias and error at all stages of the review process. The validity assessment used appropriate criteria. Only limited information was reported on the included studies, making it difficult to assess the reliability of the conclusions based on their evidence. The decision to adopt a narrative synthesis appears appropriate in view of the clinical heterogeneity between the included studies. The authors' cautious conclusions are an accurate reflection of the evidence presented but their reliability is not entirely clear.

**Implications of the review for practice and research**

Practice: The authors stated that protocols should be evaluated before the development of a CDSS is begun, after which the CDSS should be evaluated against its paper-based comparator using the Medical Research Council framework for the evaluation of complex interventions.

Research: The authors stated that further research is required to identify those contexts in which the use of CDSS by nurses is most effective.

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