Clinical decision support systems in the care of inpatients with diabetes in non-critical care setting: systematic review

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CRD summary
There was some evidence that clinical decision support systems might improve the care of hospitalised patients with diabetes, but more evidence was needed. The authors' conclusions were suitably cautious, given the quality of the data, and they appear to be reliable.

Authors' objectives
To determine the role and effectiveness of computer-based clinical decision support systems, in improving the care for patients with diabetes, who were in hospital, but not in critical care.

Searching
MEDLINE, EMBASE, CINAHL and The Cochrane Library were searched to August (December for MEDLINE) 2010; search terms were reported. There were no restrictions on study design or outcome, language, or peer-reviewed journals. Relevant journal websites were searched, and bibliographies of included articles were handsearched.

Study selection
Studies assessing computer systems to support clinical decisions, in secondary care, for patients with diabetes or hypercalcaemia, were eligible. Studies were identified by their description of the computer support system in the article's introduction. Settings were limited to in-patient, non-critical care. Eligible studies had to report the beneficial or harmful effects on glucose control, insulin use, patient satisfaction, length of hospital stay, or quality of diabetic care. Case reports or case series with less than five patients were excluded.

Most of the included studies were conducted in the USA, one was carried out in Israel and two in Germany. The mean patient age at baseline ranged from 48.4 to 70 years (where reported). The intervention components included education, order sets, management protocols, use of connective technology, and active finding of patients in need (using information systems).

Two reviewers independently selected studies for inclusion.

Assessment of study quality
Where applicable, study quality was assessed according to the design, description of the intervention, participant recruitment (blinding, and randomisation methods), baseline differences between groups, analysis method and power calculation, follow-up and measurement bias, and assessment of confounding factors.

One reviewer assessed quality, and two other reviewers independently checked the assessments.

Data extraction
The outcomes were extracted by one reviewer; two other reviewers independently checked the data extraction.

Methods of synthesis
Studies were categorised by outcome and synthesised in a narrative.

Results of the review
Fourteen studies were included; the exact number of participants was unclear, but there were over 29,000. There were two cluster randomised controlled trials (RCTs), with 307 patients; eight before-and-after studies; three observational descriptive studies; and one case series. Study duration ranged from one month to four years, where reported.

Neither of the two cluster RCTs reported dropouts or withdrawals, or adequate blinding of assessors. One cluster RCT did not report the randomisation method. Three studies reported baseline differences between treatment and control
groups, three reported a power calculation, and two reported intention-to-treat analyses. Most of the studies had limited adjustment for confounding variables in their analyses.

Nine out of 10 studies reported reductions in the mean blood glucose or a similar measure (patient-day weighted, mean blood glucose) during in-patient stay, with the intervention. With a computerised physician order entry system, the reduction in patient-day weighted, mean blood glucose ranged from 0.6 to 0.8 millimoles per litre (10.8 to 15.6 mg/dL). Other beneficial effects, during in-patient stay, included a decreased use of sliding scale insulin and an increased use of basal-bolus insulin.

Following the introduction of computerised physician order entry, one observational study reported a statistically significant increase in the proportion of patient-days with hypoglycaemia. Two out of three studies reported significant increases in glycated haemoglobin testing, and one out of five studies reported a significant reduction in the hospital stay.

**Authors’ conclusions**
There was some evidence that clinical decision support systems might improve the care of hospitalised patients with diabetes, but more evidence was needed.

**CRD commentary**
The review question was clear and the inclusion criteria were sufficiently replicable; there were no criteria for study design. Relevant data sources were accessed and studies in any language and from any source were eligible, reducing the likelihood of language and publication bias. Attempts were made to minimise error and bias during the review. The quality assessment criteria seem to have been appropriate for the various designs of the included studies, and the authors stated that overall the quality of the studies was below optimal. The study details were presented, for all but one study, which was missing from the table (reference 25). The method of synthesis seems to have been appropriate for the data presented.

The authors’ conclusions were suitably cautious, given the quality of the data, and they appear to be reliable.

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

**Practice:** The authors stated that their findings should help diabetes care providers to decide which elements should be used in clinical decision support systems. These included the implementation of validated alerts and prescription guidelines for anti-diabetic medication; planned times for the measurement of blood glucose; and the identification of referral criteria to target patients in need of specialist care.

**Research:** The authors stated that future studies should evaluate clinical decision support systems, using better methods to study complex programmes in a controlled environment.

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