CRD summary
The review concluded that just over half of computerised clinical decision support systems showed improvements in the process of chronic disease management and some improved patient outcomes, but the evidence was limited. This was a well-conducted review and the authors' cautious conclusions seem appropriate.

Authors' objectives
To assess the effects of computerised clinical decision support systems on chronic disease management processes and patient outcomes.

Searching
MEDLINE, EMBASE and EBM Reviews were searched from 2004 to January 2010 without language restrictions. Search terms were reported in Haynes 2010 (see Other Publications of Related Interest). Reference list of included trials, relevant systematic reviews and the Inspec bibliographic database were searched.

Study selection
Randomised controlled trials (RCTs) that compared the effects of computerised clinical decision support systems versus no clinical decision support systems for management of chronic conditions were eligible for inclusion. Eligible computerised systems were required to provide patient-specific advice, be used by healthcare professionals and measure process of care (defined as changes in care activities such as diagnosis, treatment and monitoring of disease) or patient outcomes. Studies were excluded if the system was used solely by students, only provided summaries of patient information, reported feedback on groups of patients without individual assessment, provided only computer-aided instruction or was used for image analysis. Computerised systems for managing narrow therapeutic index medications used in some chronic conditions (such as warfarin in atrial fibrillation) were excluded from the main review.

Most of the included studies were conducted in the United States at 974 clinics at more than 705 sites and were published between 1977 and 2009. Computerised clinical decision support systems were standalone or integrated with other systems. Chronic disease included diabetes, diabetes and other, hypertension, asthma and chronic obstructive pulmonary disease (COPD), dyslipidaemia, cardiac conditions and other conditions such as cancer, renal disease and dementia. Methods of delivery of recommendations included computer, email, PDA, pager, project staff, existing non-prescribing staff and other unspecified methods. System users included trainees, physicians, advanced practice nurses, physician assistants, pharmacists and other health professionals. Patient outcomes varied considerably. Treatment comparisons included usual care, health education materials and provision of guidelines.

Two reviewers independently screened studies for inclusion. Disagreements were resolved through referral to a third reviewer.

Assessment of study quality
Two reviewers independently assessed study quality with criteria on allocation concealment, appropriate unit of allocation, appropriate adjustment for baseline differences, blinding of assessment and adequate follow-up.

Data extraction
Two reviewers independently extracted statistical data (proportions, medians and ranges) on the primary/main/most relevant or available outcome. A computerised system was considered effective if it produced a statistically significant improvement (p<0.05) in a primary chronic disease outcome or in at least 50% of multiple relevant pre-specified outcomes. Where outcomes were not pre-specified, the computerised system was considered effective if it produced improvement in at least 50% of all reported chronic disease outcomes.

Primary authors were contacted for clarification on data, where necessary. Discrepancies were resolved through
consensus or referral to a third reviewer.

**Methods of synthesis**
Due to significant heterogeneity, data were reported as a narrative synthesis. Data were reported separately by type of chronic disease.

Sensitivity analysis was performed to assess the impact of studies with mismatch between the unit of allocation (such as clinician) and the unit of analysis (such as individual patients without adjustment for clustering).

Study quality was assessed over time. Quality of trials published before and after 2000 was compared.

**Results of the review**
Fifty-five RCTs (71 publications, 7,335 practitioners and 381,562 patients, range 27 to 156,772) were included in the review. The overall quality of trials was good (median score 8, range 2 to 10). Quality improved over time. Twenty-five of 48 RCTs reported improvements in process of care outcomes and 11 of 36 reported improvements in patient outcomes.

**Diabetes (13 RCTs):** Six of 11 RCTs that assessed process of care outcomes reported improvements, five of eight RCTs that assessed patient outcomes reported improvements. Improvements were more consistently reported in trials published after 2005 (seven RCTs).

**Diabetes and other conditions (five RCTs):** Four of five RCTs showed improvements in process of care. One of the RCTs assessed patient outcomes and showed no benefit.

**Hypertension (10 RCTs):** Four of eight RCTs showed improvements in process of care. Only one of nine RCTs that assessed patient outcomes showed an improvement and this was of poor quality.

**Dyslipidaemia (four RCTs):** Three RCTs assessed process of care outcomes and all demonstrated improvements. Only one of three RCTs that assessed patient outcomes reported positive effects.

**Asthma and COPD (nine RCTs):** Only one of the nine RCTs showed improvements in process of care. Only two of five RCTs that measured patient outcomes showed some benefit.

Sensitivity analysis did not identify any significant impact of mismatch between the unit of allocation and the unit of analysis on studies’ probability of showing benefit on process of care or patient outcomes. Other results were reported in the review.

**Cost information**
One RCT reported improvement in patient outcomes and the computerised system was shown to be more cost-effective than usual asthma care. Of 12 RCTs that compared costs of care between treatment groups, six reported no statistically significant differences, four reported savings with the computerised system and two reported increased costs using computerised systems.

**Authors' conclusions**
Just over half of computerised clinical decision support systems showed improvements in the process of chronic disease management. Some improved patient outcomes. Evidence on the effectiveness of computerised systems was limited.

**CRD commentary**
The review question and supporting inclusion criteria were broadly stated. Several relevant sources were searched for relevant data without language restrictions. Publication bias was not formally assessed. The authors suggested that bias was likely to exist as the computerised systems were assessed by their own developers. Study quality was assessed using appropriate criteria and results were fully reported. Each stage of the review process was undertaken in duplicate, which minimised potential for reviewer error and bias. The authors acknowledged the considerable heterogeneity among
studies. A narrative synthesis was appropriate. The authors acknowledged certain limitations of the included studies, such as limited meaningful patient outcome data and the small number of studies that investigated patient outcomes. The difference in publication dates should be considered.

Given the limitations of the available evidence, the authors’ cautious conclusions seem appropriate.

Implications of the review for practice and research
Practice: The authors stated that policy makers and healthcare administrators and practitioners who were considering local implementation of computerised systems should be aware that the evidence of effectiveness was limited.

Research: The authors stated future trials with clear descriptions of the computerised systems, local context, implementation strategy, costs, adverse outcomes, user satisfaction and impact on user workflow were needed.

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