Information technology interventions to improve medication safety in primary care: a systematic review

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CRD summary
This review found that information technology (IT) interventions reduced medication errors if they addressed a limited number of clearly defined medications and target groups, or if the IT intervention involved pharmacists and physicians. IT interventions were also associated with possible safety hazards. The authors' conclusions appear reliable, based on limited quality evidence. Their recommendations for high quality research are appropriate.

Authors' objectives
To assess the effects of information technology (IT) interventions on medication safety in primary care.

Searching
Four electronic databases were searched up to March 2011 for published studies in any language. Search terms were reported. The references of all eligible studies were checked for further studies.

Study selection
Eligible studies had to be randomised controlled trials (RCTs) that compared any IT intervention to usual care (with no IT intervention) in the primary care setting with a view to improvement of medication safety. Primary care included all out-patient settings, nursing homes and emergency departments. Improvement of medication safety was defined as reduction of medication errors, adverse drug events and adverse drug reactions (definitions reported in the paper).

Interventions included computerised provider order entry with clinical decision support, telemedicine, and pharmacist-led interventions. Studies lasted between three and 30 months, where stated. There was wide variation in participant characteristics and outcome measures (reported in the paper).

Two reviewers independently screened studies for inclusion in the review, with discrepancies resolved through consensus or referral to another reviewer.

Assessment of study quality
The Cochrane risk of bias tool was used to assess study quality. Two reviewers independently assessed the studies, with disagreements resolved with a third reviewer.

Data extraction
The relative risks or odds ratios of all comparisons between intervention and control were extracted from included studies. Two reviewers independently extracted data, and disagreements were resolved with a third reviewer.

Methods of synthesis
Studies were categorised according to the type of IT intervention into three groups: computerised provider order entry with clinical decision support, telemedicine and pharmacist-led interventions. They were synthesised narratively.

Results of the review
Ten RCTs were included in the review. Three of these were cluster randomised, of which two accounted for the cluster design in their analysis. Overall, all trials in the review had considerable risk of bias. According to tabulated data, five of ten trials reported adequate sequence generation, and three reported adequate concealment of allocation. It was not clear if there had been any selective reporting of outcomes in any trial. There were discrepancies in reporting of quality between the text and table of the article.

Of the six studies that evaluated computerised provider order entry with clinical decision support, three effectively reduced unsafe prescribing. In the only computerised provider order entry study that evaluated adverse drug events, no statistically significant reduction of overall adverse drug events was observed. Both pharmacist-led IT interventions
decreased the prescription of potentially inappropriate medication in older patients or unsafe prescribing in pregnancy. However, one of these trials was stopped early due to false-positive alerts and failure of pregnancy recognition caused by delay in data transfer. Neither of the two telemedicine interventions reduced adverse drug events, but the trials may not have been sufficiently powered for these secondary outcomes.

**Authors’ conclusions**
IT interventions have been shown to reduce medication errors if they addressed a limited number of clearly defined medications and target groups, or if the IT intervention was accompanied by collaboration between pharmacists and physicians. IT interventions were also associated with possible safety hazards.

**CRD commentary**
This review was based on defined inclusion criteria and was underpinned by a search of several relevant sources. Study quality was assessed using an appropriate tool and risks of bias were presented although not with all relevant detail. More than one reviewer was involved in the selection, data extraction and quality assessment of the review which helps to minimise bias and error, although there were some discrepancies in the reporting of the quality results. A narrative synthesis was appropriate given the diversity of the trials.

The authors’ conclusions appear reliable and given the limited quality of the included trials, their recommendations for research are appropriate.

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

**Practice:** The authors stated that some errors and potential patient harms were related to unreliable IT systems and suggested the need for development of more robust and reliable technology.

**Research:** The authors stressed the need to urgently evaluate IT interventions using high quality studies. They stated that future interventions may wish to recommend discontinuation of pre-existing treatment only if the risk was considerable. They also stated a need to evaluate reducing the alert burden in clinical decision support to only clinically relevant alerts (further detail provided in the article).

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