Evidence on interventions to reduce medical errors: an overview and recommendations for future research

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Authors' objectives
To critically evaluate the available randomised evidence on interventions specifically aimed at reducing medical errors. In addition to summarising the evidence, the aim of the review was also to evaluate study designs and limitations in order to make recommendations for improving future research in this area.

Searching
MEDLINE and EMBASE were searched from 1966 and 1982, respectively, up until June 1999; the search was subsequently updated until March 2000. The Cochrane Controlled Trials Register was also searched. The search terms were reported in the paper and no language restrictions were applied. In addition, the references of retrieved papers were screened and experts and colleagues were contacted for information on additional published and unpublished material.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were included in the review.

Specific interventions included in the review
Studies were eligible for inclusion if they examined: medication errors, including prescription, dosing and omission errors; the prescription of inappropriate or harmful diagnostic tests, or the omission of necessary orders or prescriptions directly related to patient safety; or misdiagnosis errors beyond the inherent limitations of applied diagnostic tests. Studies that examined behavioural, education, information and management interventions, including computerised interventions, were also included.

Studies in which the emphasis was upon patient compliance were excluded, unless the emphasis was entirely upon errors (not simply missed doses) made by patients or parents because of inadequate information. Studies assessing only the omission of orders or actions suggested by preventive medicine guidelines were also excluded. Other studies excluded were those where the intervention was a different imaging or laboratory test that could improve diagnosis beyond the diagnostic technology used in the control arm; studies of computerised systems for altering physician behaviour where the emphasis was not specifically on errors; studies where fictitious or simulated cases were considered; and studies using different approaches to read the imaging techniques.

Participants included in the review
The authors did not state any inclusion criteria in relation to the participants. However, studies in which trainees rather than professional staff or the patients themselves were involved were excluded.

Outcomes assessed in the review
The outcomes assessed were the number of errors made by physicians, nurses, pharmacists, patients themselves or (in the case of sick children) their parents. These were measured either on the basis of the number of patients or the opportunities for errors. Studies in which the outcome was only inter-rater variability in the absence of a ‘gold’ standard, or only the time to response of caregivers was assessed without actual errors being counted, were excluded.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The studies were assessed according to whether masking had been implemented, randomisation and allocation...
concealment had been undertaken, and whether details of withdrawals and excluded data were reported. The authors did not provide further details of how many reviewers were involved in the validity assessment, or how any discrepancies were resolved.

**Data extraction**
The data extraction was performed in duplicate and any disagreements were discussed in a consensus conference. The following types of data were tabulated: bibliographic details, the error definition details, the type of intervention, the sample size and setting of the study, the mean age of the participants, and details about the quality of the study (masking, randomisation, allocation concealment and withdrawals).

**Methods of synthesis**
How were the studies combined?
The studies were combined narratively, with the risk ratio (RR) and number-needed-to-treat being presented. No 95% confidence intervals were reported.

How were differences between studies investigated?
The interventions were found to be effective in reducing error rates in 9 of the 13 studies. The authors therefore focused upon the 4 cases in which the intervention did not reduce the error rates significantly to examine how the study interventions and outcomes might have influenced the results obtained.

**Results of the review**
Thirteen RCTs with a total of 22,920 participants were included. Four of the studies examined diagnostic errors, nine assessed medication errors and two examined management issues.

Six of the studies that examined interventions to reduce medication errors (including the provision of patient information leaflets, marked versus unmarked syringes, and altering the luminance of the work setting) reported significant results (RR: 0 to 0.90).

One of the studies that addressed interventions aimed at diagnostic errors reported significant results (RR=0.22).

The two studies that addressed medication and management errors together (omission errors) both reported significant results (RR: 0.47 to 0.66), while the study that assessed both diagnostic and management errors together reported an insignificant risk reduction.

**Authors’ conclusions**
The authors highlighted the fact that medical errors were very frequent in the identified studies (ranging from 10 to 63.3% in the control arms), sometimes arising in more than half of the cases where there is an opportunity for error. They therefore concluded that relatively simple interventions may achieve large reductions in error rates, and that emphasis should be placed upon serious errors.

**CRD commentary**
This was a reasonable review in which a clear question was addressed by explicitly stated inclusion criteria. The literature search was thorough with no language restrictions and efforts were made to find unpublished studies; it is therefore unlikely that important studies in the field were missed. It was clear that a validity assessment was undertaken, but the methods of the assessment were not described.

The authors reported adequate details of the primary studies and responded appropriately to the heterogeneity of the interventions assessed by undertaking a narrative synthesis, although it would have aided clarity if the studies had been grouped by type of error. The authors also failed to explore differences between the studies, which might have influenced the results observed, in adequate detail. Overall, the authors’ conclusions appear to follow from the results.
presented but, owing to the heterogeneity of the interventions assessed, are limited in their application.

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

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that the efficacy of the interventions should be assessed through RCTs. Evidence on the reduction of medical errors needs to be better categorised, replicated and tested using study designs that maximise protection from bias. Emphasis should be placed on serious errors. Cost-effectiveness and quality of life should also be considered. Specific interventions must be evaluated according to their own merits with respect to effectiveness and cost-effectiveness in specific health-care settings. Studies incorporating hard patient outcomes (e.g. iatrogenic mortality) should be encouraged.

**Bibliographic details**


**PubMedID**

11359552

**Other publications of related interest**

This additional published commentary may also be of interest. Review: some interventions are effective in reducing medical errors. Evid Based Med 2001;6:190.

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Humans; Medical Errors /prevention & control; Meta-Analysis as Topic; Odds Ratio; Randomized Controlled Trials as Topic; Research Design

**AccessionNumber**

12001001425

**Date bibliographic record published**

31/05/2005

**Date abstract record published**

31/05/2005

**Record Status**

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.