Interventions to reduce medication errors in adult intensive care: a systematic review

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CRD summary
This review concluded that there was a lack of conclusive data to support the introduction of interventions to prevent medication errors, in adult intensive care. The authors' conclusions were suitably cautious, given the diversity of study designs and interventions, and the lack of a control group, in most studies.

Authors' objectives
To determine which interventions reduced medication errors in intensive care.

Searching
Eleven databases including PubMed, EMBASE, and Cochrane Central Register of Controlled Trials (CENTRAL) were searched, for studies published in English, from database inception to October 2011. Search terms were reported and reference lists were searched.

Study selection
Studies assessing the delivery of an intervention to reduce medication errors to adults in an intensive care unit were eligible for inclusion. The incidence of medication errors had to be reported as the primary or secondary outcome. Studies in paediatric intensive care units were excluded, as were case studies and epidemiological studies.

Most studies were conducted in one intensive care unit, in an academic hospital; some were in specialist units, such as cardiothoracic or neurosurgical intensive care units. The interventions were: computerised physician order entry; changes in work schedules; intravenous systems; modes of education; medication reconciliation; pharmacist involvement; protocols and guidelines; and support systems for clinical decision-making. Around half of the studies were conducted in the USA; others were conducted in Canada, Europe (including the UK), or Australia.

Studies were selected by two independent reviewers, and disagreements were resolved through discussion.

Assessment of study quality
The Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) checklist was used to assess the quality of quasi-experimental studies. The Consolidated Standards of Reporting Trials (CONSORT) checklist was used for randomised trials. The total possible scores were 58 for TREND and 37 for CONSORT, and these were converted to percentages. Two reviewers independently assessed study quality.

Data extraction
The details of interventions and the numbers of medication errors were extracted by two reviewers independently. Where possible, risk ratios were calculated with 95% confidence intervals.

Methods of synthesis
The results were reported in a narrative synthesis. A meta-analysis was planned, but the results were not reported due to considerable heterogeneity. The risk ratios, for each study, were presented in a forest plot, without a pooled value.

Results of the review
Twenty-four studies were included, with at least 18,000 participants (range 25 to 8,901). There were two randomised controlled trials, five controlled before-and-after studies, and 17 uncontrolled before-and-after studies. Quality ranged from 50% to 76%, and the most common problems were a lack of assessor blinding, a lack of statistical consideration of clustering of patients or health care professionals, and a lack of subgroup and adjusted statistical analyses.

Five studies assessed computerised physician order entry. Three reported a reduction in errors with the intervention; two reported increases in medication errors, overall, but decreases in errors causing patient harm. Two studies assessed strategies for intravenous support involving smart pumps, but neither reported any change in serious medication errors or adverse events.
Two studies assessed modes of education. One found a reduction in errors, using simulation-based training, compared with didactic lectures; the other found a reduction in errors using ward-based teaching.

Three studies assessed protocols and guidelines, and all three showed benefits with guidelines, in reducing medication errors.

Four studies assessed pharmacist involvement. Two reported significant reductions in medication errors, with pharmacist involvement in patient review meetings and ward rounds, but one reported an increase in errors with pharmacist involvement.

Six studies assessed support systems for clinical decision-making, and four reported a significant reduction in medication errors, one found no significant difference, and the other did not perform any statistical analysis.

Authors' conclusions
There was a lack of conclusive data to support interventions to prevent medication errors.

CRD commentary
This review had a clear research question, and reported the inclusion criteria for participants and outcome. A wide range of databases was searched, but only studies published in English were included, increasing the risk of language and publication bias. To reduce error and bias two reviewers independently selected the studies, extracted the data, and assessed quality. Different quality assessment tools were used for different study designs, and the results were reported in full. There was considerable variation in study design, interventions, and results, so the authors chose to present a narrative summary of the results.

The authors' conclusions were suitably cautious given the diversity of study designs and interventions, and the lack of a control group, in most studies.

Implications of the review for practice and research
Practice: The authors stated that their findings had implications for policy makers and clinicians, planning to adopt resource intensive processes and technologies, with little evidence to support their efficacy.

Research: The authors stated that research should gather data on single and multi-faceted interventions, using high-quality research designs.

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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.