The effect of computerized physician order entry on medication prescription errors and clinical outcome in pediatric and intensive care: a systematic review
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CRD summary
This review concluded that computerised physician order entry systems resulted in fewer medical prescription errors in paediatric and intensive care unit settings; effects on clinical outcomes were unclear. As the review methods were unclear and data came from observational studies (some details of which were not clearly reported) the authors' conclusions should be treated with caution.

Authors' objectives
To assess the effects of computerised physician order entry systems in paediatric and neonatal inpatient care and in adult intensive care settings.

Searching
PubMed, The Cochrane Library and EMBASE were searched to November 2007. Search terms were reported. Bibliographies of included studies and a previous review were checked.

Study selection
Randomised controlled trials (RCTs) and observational cohort studies that assessed use of computerised physician order entry systems in any paediatric inpatient population or in adults in intensive care units were eligible for inclusion. Studies that assessed systems in populations with specific diseases were excluded. Outcomes of interest were medication prescription errors, potential and actual adverse drug events, and mortality.

In the included studies, some paediatric studies were set in intensive care units and others were described as set in wards. Comparators were no computerised system, handwritten orders or paper-based unit. Additional outcomes reported included ordering times and medication turnaround times. Definitions of outcomes varied across studies (full details were reported in an additional file). Study periods appeared to cover up to 25 months; some studies collected data immediately after implementation.

The authors did not state how papers were selected for the review.

Assessment of study quality
The quality of observational studies was assessed using STROBE criteria based on definitions of control and intervention groups, possible sources of confounding, selection bias or misclassification identified or adjusted for, whether outcome measures, study period and implementation process were clearly defined and outcome data detailed. Quality of RCTs was to have been assessed using the Jadad scale.

The authors did not state how many reviewers performed the validity assessment.

Data extraction
Data were extracted to enable calculation of risk ratios (RR) and 95% confidence intervals (CI) for each outcome.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Data were analysed on an intention-to-treat basis. A random-effects model was used to calculate pooled risk ratios and 95% CIs. Heterogeneity was assessed using I². Results were reported in tables and in a narrative grouped according to patient population.
Results of the review

Twelve observational studies were included: three prospective cohort studies, eight retrospective cohort studies and one controlled cross-sectional study. Four studies were on adults in intensive care units. Eight were paediatric studies (four in intensive care unit settings and three on paediatric wards). Sample sizes were not reported.

Use of computerised physician order entry systems was associated with a statistically significant reduction in medication prescription errors (RR 0.08, 95% CI 0.01 to 0.77, $I^2=34\%$; three studies). Although there was some reduction in potential or actual adverse drug events this was not statistically significant and there was considerable heterogeneity ($I^2=65\%$, three studies). Overall there was no effect on mortality (heterogeneity reported as $I^2=0\%$, four studies); one study reported a statistically significant increase in mortality.

Use of computerised physician order entry systems in adult intensive care unit settings was associated with an increase in medical prescription errors in the initial implementation period in one study and a clinically beneficial effect in three studies.

In paediatric settings, five studies reported on medical prescription errors or adverse drug events. Use of computerised physician order entry systems were associated with a statistically significant benefit in three studies and a statistically non-significant benefit in one study; in one study overall results were beneficial, but there was an increase in potential adverse drug events. Three studies reported on mortality: one reported an increase with use of computerised physician order entry systems; one reported a decrease; and one reported a statistically non-significant decrease.

Authors’ conclusions

Computerised physician order entry systems reduced medical prescription errors effectively. Any effects on improved patient safety or clinical outcomes, in paediatric and intensive care unit settings remained unclear.

CRD commentary

The aims of this review were clearly stated in terms of participants, intervention and study design. The search covered several relevant sources. There was no mention of whether language and publication restrictions were applied, so it was unclear whether publication and language biases may have affected the review. Methods of study selection, data extraction and quality assessment were not described, so it was not possible to say whether these minimised reviewer error and bias. It appeared that quality was assessed appropriately, but the results of this assessment were not reported. It was unclear whether statistical meta-analysis was entirely appropriate. There appeared to be significant heterogeneity for some outcomes, although this did not appear to have been reported clearly (for example, for the outcome of mortality). It was unclear why some studies that appeared to report on particular outcomes were not included in the meta-analyses. Some details of the included studies (such as sample sizes and full details of some outcome data) were not well reported. Data came from observational studies (generally considered less reliable than RCTs).

As the methods of the review were unclear and data came from observational studies, some details of which were not clearly reported, the authors’ conclusions should be treated with caution.

Implications of the review for practice and research

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

Research: The authors stated that further research was needed to assess the use of computerised physician order entry systems in paediatric and intensive care unit settings. Although an RCT was ideal, it was probable that controlled before-and-after studies in a multicentre setting were more likely to be suitable. Future studies should use clear criteria to define outcomes and methods of detecting and evaluating these. The period immediately after implementation should be considered for collection of data to assess any effect of a potential learning curve.

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