Rapid response systems: a systematic review

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CRD summary
This review evaluated the impact of rapid response systems on rates of hospital mortality and cardiac arrest, and concluded that there was weak evidence of an association; the evidence was not strong enough to conclude that rapid response systems were effective. A paucity of high-quality trial data suggests the cautious conclusion is appropriate and valid.

Authors' objectives
To evaluate the impact of rapid response systems on hospital mortality and cardiac arrest.

Searching
MEDLINE, EMBASE and The Cochrane Library were searched from January 1990 to June 2005 for English-language studies. Search terms were reported. Reference lists of relevant articles were searched to identify further papers for inclusion.

Study selection
Randomised controlled trials (RCTs) and observational studies with a control group that assessed rapid response systems and reported in-hospital mortality rates and cardiac arrest were eligible for inclusion. Studies of interventions that followed cardiac arrest or interventions targeted at patients who were recently discharged from intensive care units were excluded.

Included studies were published between 2000 and 2005. Studies were conducted in Australia, UK or USA, mostly in teaching institutions with a physician on team. Most were conducted in hospitals with between 300 and 800 beds. Study duration was between four and 82 months. Studies were observational studies (with concurrent or historical controls) or had a cluster randomised design. All studies used respiratory rate, heart rate, blood pressure and change in mental status as alert criteria within the rapid response systems; alert criteria used in some but not all studies included peripheral oxygen saturation, urinary output, ward staff expressions of concern about a patient and lab values.

Two reviewers independently performed the assessment; disagreements were resolved by consensus.

Assessment of study quality
Studies were assessed on whether or not treatment and control groups had similar baseline characteristics and, if different, whether studies adjusted appropriately for demographic differences between groups.

Data extraction
Data on the number of events were extracted in order to calculate relative risks (RRs) with 95% confidence intervals (CIs) for risk of mortality, cardiac arrest and unanticipated intensive care unit admission.

Two reviewers independently extracted data. Discrepancies were resolved by consensus.

Methods of synthesis
Meta-analysis was performed using a random-effects model. RCTs and observational studies were pooled separately. Heterogeneity was assessed using a $\chi^2$ test and considered significant if $p<0.05$.

Results of the review
Eight studies were included: two cluster RCTs ($n=127,925$ patients, range 2,795 to 125,132) and six observational studies ($n=approximately 430,000$ patients, range 2,183 to 199,024 patients). Five studies used historical controls. No study included a control group that the reviewers considered clearly comparable to the intervention group; four studies attempted to adjust for differences between groups statistically.
A statistically significant difference in hospital cardiac arrest rate (RR 0.70, 95% CI 0.56 to 0.92) was reported in favour of rapid response systems, based on observational studies (n=five studies). There was no statistically significant difference between rapid response systems and controls in a single RCT (RR 0.94, 95% CI 0.79 to 1.13). There was no statistically significant benefit in hospital mortality with rapid response systems in pooled results from the observational studies (RR 0.87, 95% CI 0.73 to 1.04; five studies) or the RCTs (RR 0.76, 95% CI 0.39 to 1.48; two studies).

In all analyses, $X^2$ tests indicated statistically significant heterogeneity.

**Authors' conclusions**

There was weak evidence that rapid response systems were associated with a reduction in hospital mortality and cardiac arrest rates. It could not be concluded that rapid response systems were effective interventions due to limited study quality and heterogeneity.

**CRD commentary**

The review addressed a clear research question supported by relevant inclusion criteria. A number of relevant databases were searched. The search for unpublished data was limited. Only studies published in English were included. Study selection and data extraction were both conducted in duplicate, which reduced risk of bias and error. Quality assessment was very limited and insufficient details were provided about primary studies to allow the authors' evaluation of trial quality to be independently assessed. Heterogeneity was identified, but the source was not explored. An appropriate (random-effects) model was used to perform the meta-analyses. Overall, the conclusions are likely to be valid.

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

**Practice:** The authors stated that hospitals should consider risks and benefits of rapid response systems compared with other safety interventions rather than adopting rapid response systems as a standard.

**Research:** The authors stated that large randomised trials were needed to provide more precise estimates of effects and costs of rapid response systems. Data on optimal team composition and the most appropriate triggers for activation of rapid response systems were required.

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