January 2017 – SUPPORT Summary of a systematic review

Do rapid-response systems improve clinical outcomes?

Rapid-response systems were created to improve recognition of and response to deterioration of hospitalized patients, with the goal of reducing the incidence of cardiorespiratory arrest and hospital mortality. A rapid-response system consists of providers who immediately assess and treat unstable patients. Examples include medical emergency teams and rapid response teams. Preliminary evidence of improvements in patient outcomes led to widespread utilization of rapid-response systems.

Key messages

➔ **Rapid-response systems for hospitalised adults may slightly reduce hospital mortality and cardiopulmonary arrests outside of intensive care units; and may lead to little or no difference in admissions to intensive care units.**

➔ **Rapid-response systems for hospitalised children may slightly reduce cardiopulmonary arrests outside of intensive care units, and the effects on hospital mortality and admissions to intensive care units are uncertain.**

➔ **None of the included studies were conducted in a low-income country.**

Who is this summary for?

People deciding whether to put rapid-response systems into practice

! This summary includes:

- **Key findings** from research based on a systematic review
- **Considerations about the relevance of this research** for low-income countries

X Not included:

- Recommendations
- Additional evidence not included in the systematic review
- Detailed descriptions of interventions or their implementation

This summary is based on the following systematic review:

Maharaj R, Raffaele I, Wendon J. Rapid response systems: a systematic review and meta-analysis. Crit Care 2015; 19:254.

What is a systematic review?

A summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise the relevant research, and to collect and analyse data from the included studies

SUPPORT was an international project to support the use of policy relevant reviews and trials to inform decisions about maternal and child health in low- and middle-income countries, funded by the European Commission (FP6) and the Canadian Institutes of Health Research.

Glossary of terms used in this report: www.supportsummaries.org/glossary-of-terms

Background references on this topic: See back page

Background

Hospitalized patients often experience unrecognized deterioration that may progress to cardiorespiratory arrest. Rapid-response systems, which were created to improve recognition of and response to deterioration of hospitalized patients, generally have three components:

1) Criteria and a system for notifying and activating the response team. These usually include vital signs (single-trigger criteria or aggregated and weighted early warning scoring) or general concern expressed by a clinician or family member.

2) A response team that generally uses a physician (trained in intensive care); rapid-response teams, which do not include a physician; or critical care outreach teams, which follow up on patients discharged from the intensive care unit but also respond to all ward patients.

3) An administrative and quality improvement component that collects and analyses event data, coordinates resources, and ensures improvement or maintenance over time.

How this summary was prepared

After searching widely for systematic reviews that can help inform decisions about health systems, we have selected ones that provide information that is relevant to low-income countries. The methods used to assess the reliability of the review and to make judgements about its relevance are described here: www.supportsummaries.org/how-support-summaries-are-prepared/

Knowing what's not known is important

A reliable review might not find any studies from low-income countries or might not find any well-designed studies. Although that is disappointing, it is important to know what is not known as well as what is known.

A lack of evidence does not mean a lack of effects. It means the effects are uncertain. When there is a lack of evidence, consideration should be given to monitoring and evaluating the effects of the intervention, if it is used.

About the systematic review underlying this summary

Review objective: To assess the effect of the rapid response system on hospital mortality and cardiopulmonary arrest outside the intensive care unit

Types of	What the review authors searched for	What the review authors found
Study designs & Interventions	Comparisons between a control cohort and intervention (rapid response system) cohort that provided quantitative data about mortality rates or cardiopulmonary arrests	29 studies met the inclusion criteria: cluster-randomised trials (2), interrupted time series studies (2), controlled before-after study (1), and before-after studies with no contemporaneous control group (24)
Participants	Hospitalised patients	Hospitalised adults (21 studies) and children (8)
Settings	Hospitals	Academic teaching hospitals (22) and community hospitals (6) in the USA (11), Australia (7), Canada (3), the UK (2), Pakistan, Portugal, Saudi Arabia, South Korea, Sweden, the Netherlands (1 each)
Outcomes	Hospital mortality (primary outcome); non-intensive care unit cardiopulmonary arrest, and intensive care unit admissions (secondary outcomes)	Hospital mortality (27 studies), cardiopulmonary arrests (26), intensive care unit admissions (10)
Date of most recent search: December 2013		
Limitations: This is a well-conducted systematic review with only minor limitations.		

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Summary of findings

1) Adults

Twenty-one studies were included in the systematic review that reported the effects of rapid-response systems for hospitalised adults. Twenty studies reported hospital mortality, 18 reported cardiopulmonary arrests, and 10 reported intensive care unit admissions for hospitalised adults. Most (16) of the studies were uncontrolled before-after studies with a high risk of bias. There was variation in the size of the effects observed in different studies. Neither the duration of the service or having a doctor present was associated with the size of the effect.

For hospitalised adults:

➔ **Rapid-response systems may slightly reduce hospital mortality. The certainty of this evidence is low.**

➔ **Rapid-response systems may slightly reduce cardiopulmonary arrests outside of intensive care units. The certainty of this evidence is low.**

➔ **Rapid-response systems may lead to little or no difference in admissions to intensive care units. The certainty of this evidence is low.**

About the certainty of the evidence (GRADE) *

⨁⨁⨁⨁
High: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different† is low.

⨁⨁⨁◯
Moderate: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different† is moderate.

⨁⨁◯◯
Low: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different† is high.

⨁◯◯◯
Very low: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different† is very high.

* This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'.

† Substantially different = a large enough difference that it might affect a decision

See last page for more information.

Rapid-response systems for hospitalised adults

People Hospitalised adults
Settings Hospitals
Intervention Rapid-response system (RSP)
Comparison No rapid response system

Outcomes	Types of studies	Absolute effect (95% CI)		Relative effect (95% CI)	Certainty of the evidence (GRADE)
		Without RSP	**With RSP**		
Hospital mortality	RCT, CBA, ITS	19 per 1000 admissions	18 per 1000 (16 to 19)	RR 0.91 (0.85 to 0.97)	⨁⨁◯◯ Low
	Before-after studies	19 per 1000 admissions	17 per 1000 (16 to 18)	RR 0.88 (0.81 to 0.95)	
Cardiopulmonary arrest outside the ICU	*RCT, CBA, ITS*	4 per 1000 admissions	3 per 1000 (2 to 4)	RR 0.74 (0.56 to 0.98)	⨁⨁◯◯ Low
	Before-after studies	3 per 1000 admissions	2 per 1000 (2 to 2)	RR 0.62 (0.54 to 0.71)	
ICU admissions	All studies	5 per 1000 admissions	4 per 1000 (2 to 5)	RR 0.90 (0.70 to 1.16)	⨁⨁◯◯ Low

RCT: randomised trial CBA: controlled before-after study ITS: interrupted time series study ICU: intensive care unit
95% CI: 95% confidence interval RR: Risk ratio
GRADE: GRADE Working Group grades of evidence (see above and last page)

2) Children

Eight studies were included in the systematic review that reported the effects of rapid-response systems for children. Seven studies reported hospital mortality, eight reported cardiopulmonary arrests, and none reported intensive care unit admissions for hospitalised children. Most (7) of the studies were uncontrolled before-after studies with a high risk of bias.

For hospitalised children:

➔ **The effect of rapid-response systems on hospital mortality is uncertain. The certainty of this evidence is very low.**

➔ **Rapid-response systems may slightly reduce cardiopulmonary arrests outside of intensive care units. The certainty of this evidence is low.**

➔ **The effect of rapid-response systems on admissions to intensive care units is uncertain. No studies reported this outcome.**

Rapid-response systems for hospitalised children

People Hospitalised children
Settings Hospitals
Intervention Rapid-response system (RSP)
Comparison No rapid response system

Outcomes	Types of studies	Absolute effect (95% CI)		Relative effect (95% CI)	Certainty of the evidence (GRADE)
		Without RSP	**With RSP**		
Hospital mortality	RCT, CBA, ITS	96 per 10,000 admissions	73 per 10,000 (51 to 105)	RR 0.76 (0.53 to 1.09)	⊕◯◯◯ Very low
	Before-after studies	75 per 1000 admissions	60 per 10,000 (47 to 75)	RR 0.80 (0.63 to 1.00)	
Cardiopulmonary arrest outside the ICU	*RCT, CBA, ITS*	10 per 10,000 admissions	4 per 10,000 (1 to 17)	RR 0.35 (0.08 to 1.59)	⊕⊕◯◯ Low
	Before-after studies	23 per 10,000 admissions	15 per 10,000 (12 to 18)	RR 0.64 (0.53 to 0.77)	
ICU admissions	No studies	-	-	-	-

RCT: randomised trial CBA: controlled before-after study ITS: interrupted time series study ICU: intensive care unit
95% CI: 95% confidence interval RR: Risk ratio
GRADE: GRADE Working Group grades of evidence (see above and last page)

Relevance of the review for low-income countries

➔ Findings	▷ Interpretation*
APPLICABILITY	
➔ **None of the included studies were conducted in a low-income country.**	▷ *When assessing the transferability of these findings to low-income countries the availability of resources and the capacity of hospital systems to implement rapid-response services needs to be considered.*
EQUITY	
➔ **There was no information in the included studies regarding effects of the interventions on disadvantaged populations.**	▷ *Resources needed for rapid-response systems may be less available in disadvantaged settings.* ▷ *The interventions could increase inequity if they are effective and are not applied or adapted to hospitals serving disadvantaged populations.*
ECONOMIC CONSIDERATIONS	
➔ **None of the included studies assessed costs associated with rapid-response systems.**	▷ *Local costings should be undertaken, including the costs of training, support, personnel, equipment and supplies.*
MONITORING & EVALUATION	
➔ **There is low certainty evidence about the effects of rapid-response systems.** ➔ **It is uncertain how best to design and implement a rapid-response system.**	▷ *More rigorous studies (randomised trials or interrupted time series studies) are needed to determine the effects and the cost-effectiveness of rapid-response systems prior to scaling up their use in low-income countries.* ▷ *Further studies should focus on identifying which patient populations are at high risk and should compare different rapid-response models.*

*Judgements made by the authors of this summary, not necessarily those of the review authors, based on the findings of the review and consultation with researchers and policymakers in low-income countries. For additional details about how these judgements were made see: www.supportsummaries.org/methods

Additional information

Related literature

Solomon RS, Corwin GS, Barclay DC, et al. Effectiveness of rapid response teams on rates of in-hospital cardiopulmonary arrest and mortality: a systematic review and meta-analysis. J Hosp Med 2016; 11:438-45.

Alam N, Hobbelink EL, van Tienhoven AJet al. The impact of the use of the Early Warning Score (EWS) on patient outcomes: a systematic review. Resuscitation 2014; 85:587-94.

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Conflict of interest

None declared. For details, see: www.supportsummaries.org/coi

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Maharaj R, Raffaele I, Wendon J. Rapid response systems: a systematic review and meta-analysis. Crit Care 2015; 19:254.

The summary should be cited as

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Keywords

evidence-informed health policy, evidence-based, systematic review, health systems research, health care, low and middle-income countries, developing countries, primary health care, rapid-response systems, medical emergency team, mortality, cardiac arrest and outcomes

About certainty of the evidence (GRADE)

The "certainty of the evidence" is an assessment of how good an indication the research provides of the likely effect; i.e. the likelihood that the effect will be substantially different from what the research found. By "substantially different" we mean a large enough difference that it might affect a decision. These judgements are made using the GRADE system, and are provided for each outcome. The judgements are based on the study design (randomised trials versus observational studies), factors that reduce the certainty (risk of bias, inconsistency, indirectness, imprecision, and publication bias) and factors that increase the certainty (a large effect, a dose response relationship, and plausible confounding). For each outcome, the certainty of the evidence is rated as high, moderate, low or very low using the definitions on page 3.

For more information about GRADE:
www.supportsummaries.org/grade

SUPPORT collaborators:

The Cochrane Effective Practice and Organisation of Care Group (EPOC) is part of the Cochrane Collaboration. The Norwegian EPOC satellite supports the production of Cochrane reviews relevant to health systems in low- and middle-income countries .
www.epocoslo.cochrane.org

The Evidence-Informed Policy Network (EVIPNet) is an initiative to promote the use of health research in policymaking in low- and middle-income countries. www.evipnet.org

The Alliance for Health Policy and Systems Research (HPSR) is an international collaboration that promotes the generation and use of health policy and systems research in low- and middle-income countries.
www.who.int/alliance-hpsr

Norad, the Norwegian Agency for Development Cooperation, supports the Norwegian EPOC satellite and the production of SUPPORT Summaries.
www.norad.no

The Effective Health Care Research Consortium is an international partnership that prepares Cochrane reviews relevant to low-income countries. www.evidence4health.org

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