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| Question |
| **Should Rapid Response System vs. No Rapid Response System be used for hospitalised adults at risk of deterioration?** |
| **Population:** | hospitalised adults at risk of deterioration |
| **Intervention:** | Rapid Response System |
| **Comparison:** | No Rapid Response System |
| **Main outcomes:** | Survival to hospital discharge - RCT; Survival to hospital discharge adjusted - Cohort study - adjusted data; Incidence of cardiac arrests - RCT; Incidence of cardiac arrests - Cohort studies adjusted analyses; |
| **Setting:** | Adults, in-hospital |
| **Perspective:** |  |
| **Background:** | Up to 86% of in-hospital cardiac arrests are preceded by a period of physiological deterioration, and in-hospital cardiac arrest confers a high mortality. Rapid response systems are based upon the premise that intervention during this period of deterioration is likely to reduce the incidence of cardiac arrest and death. |
| **Conflict of interests:** | None |

# Assessment

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| ProblemIs the problem a priority? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes● Yes○ Varies○ Don't know | Up to 86% of in-hospital cardiac arrests are preceded by a period of physiological deterioration, and in-hospital cardiac arrest confers a high mortality. Rapid response systems are based upon the premise that intervention during this period of deterioration is likely to reduce the incidence of cardiac arrest and death. | The ability of a healthcare institute to demonstrate a means of detecting the physiologically deteriorating patient (‘afferent limb’), a means of responding to this deterioration with a response team (‘efferent limb’), an ongoing evaluative component and an ongoing administrative component is now utilised by some healthcare jurisdictions and regulatory organizations to credential/accredit healthcare institutions.  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small○ Moderate● Large○ Varies○ Don't know | * There is low certainty of evidence that RRS reduce in hospital mortality and incidence of cardiac arrests in adult.
* There may be other desirable effect of rapid response system such as to improve care of patients with end of life care {Jones 2013 616} and in reduction of medical errors {Braithwaite 2004 255}.
* Included studies reported an expected increase in number of calls to rapid response system.
* There was no report of increased mortality or harm caused by rapid response systems.

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| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate● Small○ Trivial○ Varies○ Don't know | * There is low certainty of evidence that RRS reduce in hospital mortality and incidence of cardiac arrests in adult.
* There may be other desirable effect of rapid response system such as to improve care of patients with end of life care {Jones 2013 616} and in reduction of medical errors {Braithwaite 2004 255}.
* Included studies reported an expected increase in number of calls to rapid response system.
* There was no report of increased mortality or harm caused by rapid response systems.

 | Studies have reported that increased number of calls did necessarily lead to change in treatment or patient admission to intensive care unit {Herod 2014 1083}.  |
| Certainty of evidenceWhat is the overall certainty of the evidence of effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low● Low○ Moderate○ High○ No included studies | There was high heterogeneity among studies. The overall certainty of evidence was rated as very low to low for all outcomes primarily due to a very serious risk of bias. The individual studies were all at a serious to critical risk of bias.  |  |
| ValuesIs there important uncertainty about or variability in how much people value the main outcomes? |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability○ Possibly important uncertainty or variability● Probably no important uncertainty or variability○ No important uncertainty or variability | In-hospital cardiac arrest is a major adverse event with an incidence of 1–6/1000 admissions. Long term survival from IHCA is poor at 13.4% {Schluep 2018 90}. Abnormal vital signs are prevalent 1–4h before in-hospital cardiac arrest on hospital wards. In-hospital mortality increases with increasing number of pre-arrest abnormal vital signs {Andersen 2016 112}. |  |
| Balance of effectsDoes the balance between desirable and undesirable effects favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison● Probably favors the intervention○ Favors the intervention○ Varies○ Don't know | Based large desirable effect and small undesirable effects, rapid response system is probably favored. |  |
| Resources requiredHow large are the resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs○ Moderate costs○ Negligible costs and savings○ Moderate savings○ Large savings● Varies○ Don't know | In a 2016 survey of 207 Australian and New Zealand hospitals revealed that ICU staff provided staff for most RRTs, and oversight for more than 80% of RRTs. However, additional funding for ICU RRT staff and dedicated doctors was relatively uncommon {Jones 2016 275}.  | Resources required is likely to vary depending on healthcare setting, make up and context of different rapid response systems. |
| Certainty of evidence of required resourcesWhat is the certainty of the evidence of resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low○ Low○ Moderate○ High● No included studies | No included studies reported on resource use of RRS. |  |
| Cost effectivenessDoes the cost-effectiveness of the intervention favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison○ Probably favors the intervention○ Favors the intervention● Varies○ No included studies | A study reported a cost analysis of an RRS on a surgical ward, including costs for implementation, a 1-day training programme for nurses, nursing time for extra vital signs observation, medical emergency team (MET) consults and differences in unplanned ICU days before and after RRS implementation {Simmes 2014 342}. The authors reported a mean RRS costs were €26.87 per patient-day: implementation €0.33 (1%), training €0.90 (3%), nursing time spent on extended observation of vital signs €2.20 (8%), MET consults €0.57 (2%) and increased number of unplanned ICU days after RRS implementation €22.87 (85%). In the scenario analysis mean costs per patient-day were €10.18. The costs for extra unplanned ICU days were relatively high but the remaining RRS costs were relatively low.  | Costs for the number of unplanned ICU days can be reduced if RRS can detect clinical deterioration in time and less severely ill patients are referred to the ICU.  |
| EquityWhat would be the impact on health equity? |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced○ Probably reduced○ Probably no impact○ Probably increased○ Increased○ Varies● Don't know |  | As rapid response systems should be available to all hospitalised patients, it is unlikely to impact on health equity. |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | High level of staff satisfaction has been reported by qualitative survey {Aitken 2015 107}. Clear leadership, interprofessional trust and collaboration are crucial for succeeding with a RRS. Clear protocols, feedback, continuous evaluation and interprofessional training were highlighted as facilitators. Reprimanding down the hierarchy, underestimating the importance of call-criteria, alarm fatigue and a lack of integration with other hospital systems were identified as barriers {Olsen 2019 75}. | Rapid response system is recommended by Institute for Healthcare Improvement. National initiatives such as National Safety Goals (2008 Joint Commission National Patient Safety Goal) |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know |  | Rapid response system is recommended by Institute for Healthcare Improvement. The National Health Service in UK has adopted National Early Warning Scores 2 (NEWS2) widely as a system to recognise deteriorating patients (NHS England 2018). Many versions of rapid response systems exist in healthcare organisations around the world. It is unknown whether the provision of RRS service is universal across all patient types or during all hours of the day.  |

# Summary of judgements

|  | **Judgement** |
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| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | Moderate | **Large** |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | **Small** | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | Very low | **Low** | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | Moderate savings | Large savings | **Varies** | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | **Varies** | No included studies |
| **Equity** | Reduced | Probably reduced | Probably no impact | Probably increased | Increased | Varies | **Don't know** |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |

# Type of recommendation

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| Strong recommendation against the intervention | Conditional recommendation against the intervention | Conditional recommendation for either the intervention or the comparison | **Conditional recommendation for the intervention** | Strong recommendation for the intervention |
| ○  | ○  | ○  | **●**  | ○  |

# Conclusions

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| Recommendation |
| *We suggest that hospitals consider the introduction of rapid response system (rapid response team/medical emergency team) to reduce the incidence of IHCA and in-hospital mortality (weak recommendation, low-quality evidence).*  |
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| Justification |
| * *The task force places a high value on the outcomes—the prevention of IHCA and death—relative to the likely substantial cost of the system. Rapid response systems have been successfully implemented in many healthcare settings worldwide {Lyons 2018 191}.*
* *Rapid response system is recommended by Institute for Healthcare Improvement and other national patient safety initiatives around the world.*
* *There may be a role for rapid response system in patients with end of life care {Jones 2013 616} and also in reduction of medical errors {Braithwaite 2004 255}.*
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| Subgroup considerations |
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| Implementation considerations |
| * *Careful consideration need to be given to the elements of such system. Effective afferent and efferent limbs may need the support of administrative and quality improvement limbs {Olsen 2019 75}.*
* *Adequate resources should be dedicated to such systems to include (a) staff education about the signs of patient deterioration; (b) appropriate and regular vital signs monitoring of patients; (c) clear guidance (eg, alert systems or early warning scores) to assist staff in the early detection of patient deterioration; (d) a clear, uniform system of tiered clinical response; and (e) a clinical response to calls for assistance. The optimal method of patient monitoring and delivery of these components remains unclear {DeVita 2010 375; Mancini 2010 S539}.*

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| Monitoring and evaluation |
| * *The performance of rapid response systems should be monitored and used as part of quality improvement program of healthcare organisations.*
* *The “Recommended Guidelines for Monitoring, Reporting, and Conducting Research on Medical Emergency Team, Outreach, and Rapid Response Systems: An Utstein-Style Scientific Statement” {Peberdy 2007 2481} should be used by hospitals to collect the most meaningful data to optimize system interventions and improve clinical outcomes.*
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| Research priorities |
| * *There is lack of evidence on long term survival with favorable neurological outcomes.*
* *What is the role of technology in rapid response systems (e.g. remote monitoring, wearable devices)?*
* *What are the ideal components of the “afferent limb” of a rapid response system, eg, which vital signs, observations, and/or laboratory parameters, and with what frequency?*
* *What are the ideal components of an education program in the recognition of a deteriorating patient?*
* *What is the ideal mechanism for escalation for assistance (eg, conventional escalation versus automated electronic escalation)?*
* *What is the ideal makeup of the efferent limb (the response team)?*
* *What are the causes of ‘failure to rescue’ or underutilisation of rapid response systems?*
* *What is the cost effectiveness of rapid response systems?*
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