

## Deteriorating patients and MET calls

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## Executive Summary

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### Background

Medical Emergency Teams (MET) or Rapid Response Teams (RRT) have become a fixed part of the clinical landscape in the majority of adult hospitals throughout Australia [1]. These teams aim to bring critical care expertise to the bedside of clinically deteriorating patients residing in general hospital wards with the aim of preventing adverse outcomes, in particular death or cardiorespiratory arrests [1].

The Monash Health Deteriorating Patient Committee are currently reviewing performance indicators for deteriorating patients with particular interest in understanding benchmarks and standards related to MET calls for ward patients as well as the use of MET calls and Rapid Response systems in high risk areas.

### Objective

This Scoping Review was undertaken to answer the following questions:

1. What is current best practice for recognising and responding to deteriorating patients in high risk areas (ED, Theatre/recovery, and ICU)?
2. What is an acceptable number of MET calls per patient admission?
  - a. What should the baseline expected number of MET calls be (acceptable) on the ward 4-6 hours after being transferred from a high risk area?
  - b. How many is too many? Eg >3 in a 24 hour period per patient?

### Identifying evidence

A search of Google and Medline was undertaken using a combination of relevant search terms for peer reviewed and grey literature published from 2014 onwards.

### Results

A total of 14 national and international grey literature and peer reviewed papers were included in this review.

#### ***Best practice for recognising and responding to deteriorating patients in high risk areas***

Interventions for recognising and responding to deteriorating patients in high risk areas is not forthcoming in the literature despite known occurrences. The incidence of under reporting of clinical deterioration in ED is reported and studies were identified in both the adult and paediatric high risk settings testing the reliability and usefulness of early warning checklists as a method for predicting clinical deterioration, reducing mortality and length of stay and accurately recording vital signs.

#### ***What is an acceptable number of MET calls per patient admission?***

The literature is in agreement that MET calls should be reported as a rate per 1000 admission/separations however, there is inconsistency in the suggested optimal rapid response rates for individual hospitals with reported rates ranging from 1.3 to 70 per 1000 separations.

### Conclusion

This scoping review was unable to determine current best practice for recognising and responding to deteriorating patients in high risk areas nor was there a reported expected number of MET calls per patient on the ward 4-6 hours after being transferred from a high risk area. The issue of how many MET calls is too many was difficult to address directly as there appears to be opposing areas of research. One body of research aims for low dose rates indicating that early warning systems are effective and the other aims to show that an increase in MET dose is associated with improved hospital outcomes.

Our examination of the literature, while specific to our detailed search questions posed by the requestors mirrors the challenges that are also discussed by others undertaking reviews of rapid response systems. Hillman et al (2014) and White (2015) both maintain the idea that high quality evidence supporting the effectiveness of rapid response systems related to the care of adult patients is lacking and numerous controversies exist as to the optimal methods of implementation. More research is needed in better understanding the strengths and limitations of the different forms of RRT that currently exist, and how they may be reconfigured in optimising patient outcomes, enhancing professional skills and teamwork, and minimising inefficient use of limited resources [1, 2].

## Background

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### Search strategy

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### Inclusion criteria

#### Q1: Best practice for deteriorating patients in high risk areas

<b>Population</b>	Adult and Paediatric population
<b>Concept</b>	Best practice in recognising and responding to deterioration
<b>Context</b>	High risk areas only – ED, Theatre, Recovery ICU
<b>Types of information</b>	Peer reviewed literature, grey literature
<b>Timeframe</b>	2014 - current

#### Q2: MET calls per patient admission

<b>Population</b>	Adult and Paediatric population
<b>Concept</b>	Benchmarking, indicators, acceptable rates of MET calls per patient
<b>Context</b>	General ward setting
<b>Types of information</b>	Peer reviewed literature, grey literature
<b>Timeframe</b>	2014 - current

## Review methodology

Due to the emergent and exploratory nature of the questions posed in this review, the search was highly iterative and modified in response to search results and findings from retrieved items. In cases such as these the questions posed by the requestors were used as a compass to guide our searching to help identify the best available and most appropriate evidence to aid decision-making.

## Results

A total of 14 papers [1-14] have been included in this scoping review. The papers consist of systematic reviews, observational studies, evaluation reports and grey literature. Limited information was identified to answer the specific questions set out in this review. Additional information has been included in the results section to assist the Committee in their decision-making processes around benchmarking, outcome indicators and evaluation of deteriorating patient data.

### 1. Best practice for recognising and responding to deteriorating patients in high risk areas

There are only a few published studies detailing the effect of formal systems for recognising and responding to deteriorating patients in high risk areas including emergency departments, intensive care units, operating theaters and recovery wards [4]. Despite the occurrence of clinical deterioration in high risk settings, Rapid Response Systems (RRS) (or METs) in Australia and internationally are seen only to operate in inpatient units despite 1.5% to 7.5% of ED patients experiencing clinical deterioration during their presentation [4].

To show cause for the need for a rapid response system (RRS) in the Emergency Department setting, a retrospective cross sectional study was undertaken to evaluate the effect of an ED RRS on reporting of clinical deterioration and determine if there were differences between patients who did and did not deteriorate during ED care [4]. Implementing an ED specific track and trigger protocol the study found that a staged ED specific RRS decreased the frequency of unreported clinical deterioration. Patients who suffered deterioration during their ED care had a higher rate of hospital admission, in-hospital mortality and longer ED length of stay [4].

The Canadian Agency for Drugs and Technologies in Health (CADTH) undertook a rapid response report to identify tools for the early identification of adult inpatients at risk for deterioration in 2017. The overall summary of results for this report identified that the use of electronic early warning score systems in hospitals resulted in reduced mortality rates, length of stay in both intensive care units and general wards and accuracy of vital sign measurement was improved [8].

A pilot study undertaken in a paediatric (medical-surgical) intensive care unit looked at the feasibility of a simple checklist of clinical variables to predict deterioration. The checklist assessed patient risk for critical deterioration defined as cardiac arrest or code blue activation within 24 hours of the checklist screen [6]. The high-risk clinical screening checklist was found to be feasible and provided timely and accurate identification of the intensive care unit patients at risk of a code blue activation or cardiac arrest [6].

### 2. Acceptable number of MET calls per patient admission

#### a. *What should the baseline expected number of MET calls be (acceptable) on the ward 4-6 hours after being transferred from a high risk area?*

Evidence to identify a baseline expected number of MET calls for any ward patient regardless of time after being transferred from a high risk area to general ward is mixed. While there is consensus in the literature that MET calls are reported as rates per 1000 separations (where same-day admissions are excluded) [1-3, 5, 7, 9, 10, 14] there is inconsistency in current evidence to suggest an optimal rapid response rate for patients and individual hospitals [1, 3, 9, 13, 14].

Effective doses reported in the literature include:

- 26-56 per 1000 separations [5]
- 1.3 to 71 per 1000 admissions [4, 9]
- 9.2 to 14.1 per 1000 admissions in the first 24 hours from admission [1].

The simple reporting of these rates however is impractical as comparisons cannot be made due to uncertainties around case mix, health service size, and make up of rapid response system (eg use of early warning systems) [5].

#### b. *How many is too many?*

The literature identified in this review was not able to distinguish an optimal number of MET calls. This in part is due to the inferiority of the data being produced and the inability to compare across like RRS and settings. Some services are aiming for low dose rates to indicate that their early warning systems are effective while others are looking at the opposite where an increased MET dose is thought to be associated with improved hospital outcomes [5].

In a paper published by Barocas et al (2014) they too concur that determining an optimal use of rapid response team services is challenging. They propose that one method of benchmarking performance is to determine whether a department's event rate is commensurate with its volume and acuity [3].

### 3. Evaluating the effectiveness of rapid response systems

#### *What is known about rapid response calls in Australia?*

In 2014, Jones undertook a review of the literature to determine the epidemiology of adult Rapid Response Team (RRT) patients in Australia [9]. The following is a summary of findings from the review:

- Common causes of RRT calls include pulmonary oedema, seizures, sepsis and atrial fibrillation.
- Approximately one-fifth of patients subject to RRT review will have more than one call during the same hospital admission.
- Calls are least common overnight.
- Many ward patients fulfilling RRT criteria do not have a RRT call made.
- Delayed RRT review is associated with increased in-hospital mortality.
- The in-hospital mortality of Medical Emergency Team (MET) patients is approximately:
  - 25% overall
  - 15% for patients with no limitation of medical therapy
  - 50% for patients with a limitation of medical therapy.
- Admission to critical care areas occurs in 10 to 25% of patients following RRT review.
- Up to one-third of RRT calls occur in patients with end-of-life care issues.

#### *Data collection for rapid response systems*

The 2017 National Consensus statement for the essential elements for recognising and responding to acute physiological deterioration state that RRS should be evaluated to determine whether they are improving the recognition of and response to acute physiological deterioration [12]. Evaluation may include collecting and reviewing data about calls for emergency assistance, unplanned transfers to a higher-level health service or higher-acuity care environment, and adverse events such as cardiac arrests and unexpected deaths.

The consensus statement outlines the following data that should be collected for each call for emergency assistance that is made to the rapid response system:

- patient demographics
- date and time of call, response time and 'stand-down' time
- the reason for the call
- the treatment or intervention provided
- any changes to calling criteria or new limitations of medical treatment documented as a result of the call
- outcomes of the call, including disposition of the patient.

The most up to date measure of the utilisation of a rapid response team is documented by the Institute for Healthcare Improvement [15]. They provide the following information:

**Definition:** Number of calls to the Rapid Response Team per 1,000 discharges in a defined time period to assess that the team is being utilised and to measure its effectiveness.

**Goal:** Increase the use of the Rapid Response Team over time. (Initial goal may be 20 to 25 calls/1,000 discharges)

**Data Collection Plan:** Determine the total number of calls to the Rapid Response Team per 1000 discharges. Obtain the inpatient discharges data from the hospital information system or other reliable sources on a monthly or quarterly basis as soon as discharge and death data are available.

**Calculate monthly as:**  $(\text{Total number of inpatient codes}) / (\text{Total number of inpatient discharges}) \times 1,000$

Others describe important outcome indicators for health services to review in terms of effectiveness of rapid response systems as [2, 9]:

- Cardiac arrest rates (which usually range between 0.5 and 6.0 cardiac arrests per 1000 admissions) and crude mortality rates.
- Mortality rates where do-not resuscitate orders are excluded as RRS is not designed to improve the outcome of patients for whom further active management is thought to be futile.

- Data on cardiac arrests and deaths can be further refined by examining whether there were calling criteria that were not responded to appropriately in the 24 hours before the event. This gives insight into potential preventability.
- Delays in the rapid response can also be a useful indicator of the system's effectiveness.
- Deaths in low-mortality diagnosis-related groups

#### 4. Evaluating the effectiveness of rapid response systems in the Paediatric setting

In the paediatric setting, the use of the Victorian Children's Tool for Observation and Response (ViCTOR) Medical Emergency Response Metrics chart has been evaluated [14]. The report highlights the utility of benchmarking reports and measures suitable for benchmarking. They emphasize the difficulty in determining measures suitable for benchmarking, in part, because of the variability of the number of calls across sites, and due to the fact that different medical emergency response systems existed within each of the health services and furthermore the optimal rate of medical emergency response calls is unknown [14].

The process measures proposed for health services to monitor included:

- The rate of medical emergency response calls as determined by the number of calls per 1000 patient separations or admissions.
- The rate of transfers to a higher level of care (ED, HDU, ICU or another hospital) per 1000 patient separations or admissions.

The report also suggests the following measures can be included:

- calls stratified by time of day and day of week
- family activated calls
- the proportion of calls that occur following recent transfer from ED, ICU or Recovery and
- the proportion of calls that are 'transferred up' to ICU or 'transferred out' to another hospital.

Over the 5 month period of implementation the Medical Emergency Response Metrics and related reports were found to be valuable for health services in reviewing processes and outcomes in relation to paediatric deterioration activity. Collection of the data was feasible although a standardised paediatric electronic tool would facilitate ongoing data collection [14].

Alternatively, a high calling rate may represent a failure of other processes of care to prevent or detect deterioration within the health service. Nevertheless, trending this information could be useful for individual organisations [14].

Although, benchmarking was not generally considered feasible due to the variability in sites and the low numbers of patients involved, key stakeholders highlighted the importance of being able to share information between services. Utilisation of the standardised Medical Emergency Response Metrics measures would facilitate such sharing of data [14].

#### 5. Additional information related to RRS

While the nature of the search undertaken for this review was specific to the questions posed – additional information relevant to the requestors is presented in Appendix 1. The nature of the additional information addresses: Strategies for maximising impact of RRS; Interventions to promote the efficiency of RRS, and Rapid Response Team Syndromes and implications for treatment, education and preventative strategies.

## Conclusions

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Interventions for recognising and responding to deteriorating patients in high risk areas is not forthcoming in the literature despite known occurrences. The incidence of under reporting of clinical deterioration in ED is reported and studies were identified in both the adult and paediatric high risk settings testing the reliability and usefulness of early warning checklists as a method for predicting clinical deterioration, reducing mortality and length of stay and accurately recording vital signs.

Identifying a recognised acceptable number of MET calls per patient admission is a challenge acknowledged by the literature. Much of the evidence for rapid response systems effectiveness is based on nonrandomized and observational studies making comparisons difficult due to differences in case-mix, health service size, and make up of rapid response system.

The literature is in agreement that MET calls should be reported as a rate per 1000 admission/separations however, there is inconsistency in the suggested optimal rapid response rates (or dose) for individual hospitals with reported rates ranging from 1.3 to 70 per 1000 separations. Inconsistencies are also seen in the intentions of MET call measurements where some services are aiming for low dose rates to indicate that their early warning systems are effective while others see an increased MET dose is associated with improved hospital outcomes.

Our examination of the literature, while specific to our detailed search questions posed by the requestors mirrors the challenges that are also discussed by others undertaking reviews of rapid response systems. Hillman et al (2014) and White (2015) both maintain the idea that high quality evidence supporting the effectiveness of rapid response systems related to the care of adult patients is lacking and numerous controversies exist as to the optimal methods of implementation. More research is needed to better understanding the strengths and limitations of the different forms of RRT that currently exist, and how they may be reconfigured in optimising patient outcomes, enhancing professional skills and teamwork, and minimising inefficient use of limited resources [1, 2].

## References

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## Appendix 1 – Additional information related to RRS

### Strategies for maximising impact of RRS

The following strategies are outlined by Hillman et al (2014) for maximising the impact of a hospital rapid response system [11]:

- Engage the support of all doctors and nurses
- Ensure that there is leadership and support from senior hospital executives
- Implement strategies that promote hospital-wide awareness of the system
- Ensure an urgent response to any staff concern, whether life-threatening or not
- Ensure a 24/7 response by staff with appropriate skills, knowledge and experience
- Build outcome indicators into the system and ensure targeted feedback of data
- Conduct regular multidisciplinary meetings to discuss individual cases and outcome indicators

### Interventions to promote the efficiency of RRS

In order to identify literature on the specific review questions we also identified studies which examined interventions to promote the efficiency of rapid response systems. These are summarised in the table below.

Study	Summary of intervention and outcome
Bergmeir, 2017	<p><b>Aim:</b> to design a preemptive management algorithm that allowed direct institution of treatment to patients without having to wait for attendance of the MET team and to model its potential impact on MET call incidence and patient outcomes.</p> <p><b>Conclusion:</b> that using routinely collected data and specific analytic techniques, it is possible to develop a preemptive management algorithm to administer intravenous fluid therapy to a specific group of hypotensive patients without the need to initiate a MET call. Application of such an algorithm is likely to be safe, result in a reduction in total MET calls, improved efficiency of the MET system and may lead to improved patient outcomes.</p>
Mullany, 2016	<p><b>Aim:</b> to describe the implementation process and outcomes of an RRS when introduced simultaneously under an overarching quality improvement program.</p> <p><b>Conclusion:</b> demonstrated a reduced cardiac arrest rate and progressive improvement in hospital risk-adjusted mortality after the introduction of RRS with a relatively low MET dose. We propose that MEWS does protect the MET. That is, a MEWS coupled to a well-defined escalation system allows improvement in outcomes with a low MET activation rate and thereby reduced resource consumption for the MET-providing unit.</p>
Bannard-Smith, 2016	<p><b>Aim:</b> to characterize short-term outcomes of deteriorating ward patients triggering a Rapid Response Team (RRT), and describe variability between hospitals or groups thereof.</p> <p><b>Conclusion:</b> Among patients triggering RRT review, 1 in 10 died within 24 h; 1 in 4 required ICU admission, and 1 in 4 had new limitations in therapy implemented. We provide a template for an international comparison of outcomes at RRT level.</p>

### Rapid Response Team Syndromes and implications for treatment, education and preventative strategies

In a review of current literature about RRT patients, suggestions for education and preventative strategies are presented in the table below [9].

Models for RRT syndrome	Implications for training of responders	Implications for preventative strategies in the period before RRT calls
RRT activation trigger e.g. hypotension or respiratory distress	Algorithms or standardised approaches can be developed to train responders to assess and initially manage these derangements	Guidelines and education can be developed hospital-wide or in certain areas to prevent or pre-emptively manage common causes of such deterioration prior to RRT criteria being reached
Clinical cause of deterioration e.g. sepsis, atrial fibrillation, pulmonary oedema	Guidelines can be developed to standardise treatment, escalation and follow-up of such conditions	As above
Outcome and major theme of	Having sensitive discussions in cases where	Improving advanced care planning,



Models for RRT syndrome	Implications for training of responders	Implications for preventative strategies in the period before RRT calls
the RRT review 1. End-of-life care (≈one-third of calls)	documentation of limitations of medical therapy are not clear Provision of appropriate palliative care/active symptom control	recognition of the dying patient and early referral to palliative care services
2. Expertise and escalation of care (≈one-fifth to one-tenth of calls)	Team-based management of severely unwell patients who require admission to critical care area Emphasis on crisis resource management	Audit of such calls may identify earlier deterioration
3. Education and expeditious care (≈half of calls)	Patient unwell but stable enough to remain on the ward at the moment A major focus of the call could be ward staff education, as well as handover and follow-up	Guidelines and education can be developed hospital-wide or in certain areas to prevent or pre-emptively manage common causes of such deterioration