

Improving risk stratification and decision support for deteriorating hospital patients

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Accepted 20 February 2023

In the 1990s, there was increased interest in understanding the antecedents to serious adverse events such as in-hospital cardiac arrest, unplanned admission to the intensive care unit (ICU) and in-hospital death. Studies from multiple countries around the world revealed that such adverse events were often preceded by objective signs of instability that manifested in derangements in vital signs, documentation of staff concern or increasing intensities of treatment such as oxygen therapy.¹⁻³ In addition, staff on hospital wards did not reliably or consistently recognise clinical deterioration, nor respond in a manner that was commensurate to the requirements of the patient's clinical needs.²⁻⁴

In response to such observations, rapid response systems were developed to improve the recognition of, and response to signs of, clinical deterioration.⁵⁻⁶ This approach involves the use of objective criteria that trigger escalation to a predefined team of clinicians. These criteria are either single parameter or aggregated early warning scores. The responding team is variable but often comprises staff from the ICU. For example, in the UK, the team is typically a nurse-led critical care outreach team,⁷ whereas in Australia, it is most frequently a physician-led medical emergency team (MET).⁸

At least four systematic reviews report that the introduction of rapid response teams was associated with reductions in in-hospital cardiac arrests and in-hospital mortality.⁹⁻¹² In addition, rapid response teams are also frequently involved in the assessment of patients whose medical conditions mean that ICU admission is not appropriate.¹³⁻¹⁴ However, rapid response teams have not been shown to consistently reduce the

frequency of unplanned admissions to the ICU.¹⁵⁻¹⁶

Published studies suggest that approximately 80% of patients reviewed by the rapid response team remain on the same ward following review.¹⁷ Moreover, some patients receive multiple reviews by the rapid response team during the same hospital admission, which is associated with increased risk of admission to the ICU and subsequent in-hospital mortality.¹⁷

Thus, while rapid response teams have improved the outcomes of hospitalised patients, there is a need to develop systems and processes to further improve patient outcomes. Many institutions now have well-established databases that allow determination of which hospitalised patients are at increased risk of rapid response team review.¹⁸⁻²² In addition, several investigators have attempted to evaluate associations with worse patient outcomes following rapid response team review, including repeat calls and subsequent ICU admission.²³⁻²⁵

In an effort to identify patients at risk of poor outcomes and needing enhanced care following a MET review, in this edition of the journal, Batterbury and colleagues²⁶ describe a retrospective cohort study with 1500 adult patients who remained on the ward following a MET call at an Australian quaternary hospital. The authors measured illness severity and care dependency using the Sequential Organ Failure Assessment and Nursing Activities Instruments, both of which are validated in the critically ill. Outcomes included all-cause mortality, unplanned ICU admission and repeat MET review within 48 hours. Latent profile analysis was used to identify five distinct patient clusters with increasing illness severity and care complexity (dependency).



► <http://dx.doi.org/10.1136/bmjqs-2022-015637>



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To cite: Orosz J, Jones DA. *BMJ Qual Saf* Epub ahead of print: [please include Day Month Year]. doi:10.1136/bmjqs-2022-015881

Not surprisingly, patients in clusters with the highest illness severity had the highest risk of death, unplanned ICU admission and subsequent MET review within 48 hours. Clusters with the highest care complexity had workload intensity similar to high dependency unit or ICU patients. The authors concluded that profiling illness severity at the conclusion of the MET may be used to determine the need for special resource/staffing arrangement on the ward if the patient is not admitted to the ICU.

The study by Batterbury and colleagues provides an important proof of concept that it is possible to stratify patients reviewed by the rapid response team to identify those who might be subsequently at increased risk of adverse outcomes. The statistical approach used resulted in a limited number of discrete categories, rather than a continuous score (as is the case with the Sequential Organ Failure Assessment and Nursing Activities Instruments). It will be important to next confirm the findings of this study in other settings with well-established rapid response teams. It is possible that the variables that predict adverse outcomes may differ between organisations according to patient case mix, ICU bed availability, and other systems and processes that target deteriorating patients. Future research should also attempt to separate out mortality that is potentially preventable versus deaths associated with chronic and progressive comorbidity in the context of limitations of medical treatment. In addition, it will be interesting to ascertain whether this approach can be employed using longer-term outcomes and patient-reported outcome measures.

It will also be important to establish whether such risk stratification can be conducted in real time, in order to provide decision support to clinicians at the point of patient care. By identifying the risk of subsequent adverse outcomes, clinicians may opt to provide increased surveillance, closer patient follow-up by critical care outreach staff or pre-emptive admission to the ICU. Finally, in some circumstances, it may be appropriate to initiate discussions regarding goals of care end decisions around limitations of care or transition to a more palliative approach.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Not applicable.

Provenance and peer review Commissioned; internally peer reviewed.

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REFERENCES

- Buist MD, Jarmolowski E, Burton PR, *et al.* Recognising clinical instability in hospital patients before cardiac arrest or unplanned admission to intensive care. A pilot study in a tertiary-care Hospital. *Med J Aust* 1999;171:22–5.
- Hodgetts TJ, Kenward G, Vlackonikolis I, *et al.* Incidence, location and reasons for avoidable in-hospital cardiac arrest in a district general Hospital. *Resuscitation* 2002;54:115–23.
- McQuillan P, Pilkington S, Allan A, *et al.* Confidential inquiry into quality of care before admission to intensive care. *BMJ* 1998;316:1853–8.
- Wilson RM, Harrison BT, Gibberd RW, *et al.* An analysis of the causes of adverse events from the quality in Australian health care study. *Med J Aust* 1999;170:411–5.
- Devita MA, Bellomo R, Hillman K, *et al.* Findings of the first consensus conference on medical emergency teams. *Crit Care Med* 2006;34:2463–78.
- Jones DA, DeVita MA, Bellomo R. Rapid-response teams. *N Engl J Med* 2011;365:139–46.
- McDonnell A, Esmonde L, Morgan R, *et al.* The provision of critical care outreach services in England: findings from a national survey. *J Crit Care* 2007;22:212–8.
- ANZICS-CORE MET dose Investigators, Jones D, Drennan K, *et al.* Rapid response team composition, resourcing and calling criteria in Australia. *Resuscitation* 2012;83:563–7.
- Chan PS, Jain R, Nallmothu BK, *et al.* Rapid response teams: a systematic review and meta-analysis. *Arch Intern Med* 2010;170:18–26.
- De Jong A, Jung B, Daurat A, *et al.* Effect of rapid response systems on hospital mortality: a systematic review and meta-analysis. *Intensive Care Med* 2016;42:615–7.
- Maharaj R, Raffaele I, Wendon J. Rapid response systems: a systematic review and meta-analysis. *Crit Care* 2015;19:254.
- 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.
- Jones D, Moran J, Winters B, *et al.* The rapid response system and end-of-life care. *Curr Opin Crit Care* 2013;19:616–23.
- Jones DA, Bagshaw SM, Barrett J, *et al.* The role of the medical emergency team in end-of-life care: a multicenter, prospective, observational study. *Crit Care Med* 2012;40:98–103.
- Hillman K, Chen J, Cretikos M, *et al.* Introduction of the medical emergency team (Met) system: a cluster-randomised controlled trial. *Lancet* 2005;365:2091–7.
- Ranji SR, Auerbach AD, Hurd CJ, *et al.* Effects of rapid response systems on clinical outcomes: systematic review and meta-analysis. *J Hosp Med* 2007;2:422–32.
- Jones D. The epidemiology of adult rapid response team patients in Australia. *Anaesth Intensive Care* 2014;42:213–9.
- Allen J, Currey J, Jones D, *et al.* Development and validation of the medical emergency team-risk prediction model for clinical deterioration in acute hospital patients, at time of an emergency admission. *Crit Care Med* 2022;50:1588–98.
- Allen J, Orellana L, Jones D, *et al.* Associations between patient and system characteristics and met review within 48 H of admission to a teaching hospital: a retrospective cohort study. *Eur J Intern Med* 2019;66:62–8.
- Wijesundera P, See EJ, Robbins R, *et al.* Features, risk factors, and outcomes of older internal medicine patients triggering a medical emergency team call. *Acta Anaesthesiol Scand* 2022;66:392–400.
- Pritchard AL, Chin KL, Story DA, *et al.* The epidemiology of rapid response team activation amongst patients undergoing major gastrointestinal surgery. *Aust Crit Care* 2022.

- 22 Robertson M, Lim AKH, Bloom A, *et al.* Epidemiology and prognostic significance of rapid response system activation in patients undergoing liver transplantation. *J Clin Med* 2021;10:23.
- 23 Calzavacca P, Licari E, Tee A, *et al.* A prospective study of factors influencing the outcome of patients after a medical emergency team review. *Intensive Care Med* 2008;34:2112–6.
- 24 Adielsson A, Danielsson C, Forkman P, *et al.* Outcome prediction for patients assessed by the medical emergency team: a retrospective cohort study. *BMC Emerg Med* 2022;22:200.
- 25 Batterbury A, Douglas C, Coyer F. The illness severity of patients reviewed by the medical emergency team: a scoping review. *Aust Crit Care* 2021;34:496–509.
- 26 Batterbury A, Douglas C, Jones L, *et al.* Illness severity characteristics and outcomes of patients remaining on an acute ward following medical emergency team review: a latent profile analysis. *BMJ Quality & Safety* 2023:bmjqs-2022-015637.