Clinical deterioration in the condition of patients with acute medical illness in Australian hospitals: improving detection and response

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Medical Assessment Units (MAUs) have been introduced to Australian and New Zealand hospitals in recent years in response to an increasing demand for acute medical care. Most of these units accept patients from emergency departments (EDs) and aim to provide expert multidisciplinary care, often for a predefined time.[1]

Recent surveys of Australasian MAUs have shown considerable functional heterogeneity, but most are not designed to manage critically unwell patients.[2] A time-mandated target ("4-hour rule") within EDs might improve ED overcrowding and prevent hospital access block,[3] but such targets are likely to result in more rapid transfer from EDs of undiagnosed patients whose condition is potentially unstable, and this has obvious risk implications for the wards or units, such as MAUs, that will be required to accept these patients. In addition, some Australasian MAUs are accepting patients directly from the community (like their British counterparts[1]), and this has identical potential risk implications.

Track, trigger and response systems

The increasing number of patients presenting to hospitals in a potentially physiologically unstable condition argues for appropriate MAU facilities and for staff who are skilled in diagnosis and resuscitation.[4] However, studies have shown that hospital patients whose condition is unstable often receive suboptimal resuscitative care before their admission to critical care, and have highlighted problems in both prompt detection of patients whose condition is deteriorating, and the coordination and timely delivery of an appropriate response to that deterioration.[5] To solve these problems, track, trigger and response (TTR) systems aim to detect early physiological deterioration, and have been introduced internationally in an attempt to ensure timely intervention by skilled clinicians.[6] Repeated recording of vital signs "tracks" the patient and "triggers" a "response" when a predetermined threshold is reached. The simplest systems require only a single parameter to be reached,[7] while more complex systems assign an aggregated score (eg, an early warning score)[8] and trigger predefined, often graded, calling criteria. The response triggered can vary — from a mandated increase in the frequency of observations to a call for review by a medical emergency team, critical care outreach service or senior clinician. TTR systems can provide a tracking mechanism throughout a patient's hospital journey, and are designed to flag deterioration after initial assessment.

We propose that there is unrealised potential to develop an improved TTR system for Australian hospitals. In Australia, the most commonly used TTR system is a single-parameter trigger prompting a medical emergency team alert, which results in urgent review by appropriately skilled clinical staff, often from the critical care unit.[9-11] Most scores include physiological variables with cut-points that are defined by clinical experience rather than being derived scientifically. Single-centre studies have reported a decrease in the incidence of cardiac arrests after the introduction of a medical emergency team

ABSTRACT

- Medical Assessment Units (MAUs) provide an opportunity for multidisciplinary staff to manage recently admitted acutely unwell patients with complex medical illnesses.

- We propose concerted development of robust mechanisms for identifying and managing patients whose condition is unstable as they move through hospital departments.

- Track, trigger and response (TTR) systems (eg, medical emergency team calls and early warning scores) have been introduced to hospital practice, but evidence for their effectiveness is, so far, incomplete.

- The current variation in TTR systems within and between hospitals impairs intersite comparisons.

- A range of outcome measures, including risk of physiological deterioration, mortality and projected hospital length of stay, could be usefully investigated by future intersite collaborative research.

- More deliberate, systematic, evidence-based design of "response" in TTR systems may help in identifying patients who need early attention from skilled medical staff.

- We need more uniform TTR systems, more research on TTR systems and more multisite research; MAUs are ideally situated to address this important area.

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system,[10,12,13] but the only prospective randomised controlled trial found no statistical difference in clinical outcome between 12 hospitals with and 11 without a medical emergency team system.[7] In contrast to the situation in Australia, aggregate scoring systems predominate in the United Kingdom, and often involve critical care outreach nurses in their response.[14] Efforts have been made to derive and validate these scores scientifically.[15] High aggregate scores predict mortality and admission to critical care units, but scoring parameters and trigger points vary.[16-18]

Current role of Australasian Medical Assessment Units

A survey of the role and function of MAUs in Australia and New Zealand has recently been published.[2] MAUs, most less than 2 years old, care for a wide range of patients with general medical problems, most of whom are admitted from the ED. This survey showed that:

- Most units apply the Australasian Triage Scale (ATS; a system used to rate clinical urgency from 1 [most urgent] to 5 [least urgent][19]) as part of patient selection, and accept mainly patients rated ATS category 3 to 5; only 11.8% accept those rated ATS category 2, and no unit accepts those rated ATS category 1.

- Forty-five per cent of responding MAUs reported that they had a potential role in accepting physiologically unstable patients.

• Fifty per cent of units reported using an early warning score and only 71% of those units record the score on every patient on admission; a high early warning score generally triggers a medical emergency team call.

• The same early warning score system is used in the MAU and other inpatient wards in 93% of hospitals, but, in 50% of hospitals, a different system is used in the ED.

• Eighty-six per cent of MAUs have access to a medical emergency team.

• Members of the MAU team have a minimal presence on the medical emergency team, with only 37% of units reporting involvement of the medical registrar and 26% an MAU nurse.

• The reported frequency of a medical emergency team call to MAUs varies: 12% of units report an estimated average of one call per day, 48% report calls at least weekly and 40% have less than one call every fortnight.

Proposed new role for Medical Assessment Units

Considering its pivotal position in the care of newly admitted patients, the MAU is an ideal place to assess, compare and develop TTR systems. At present, MAUs do not generally provide critical care services, and this indicates that robust detection systems are vital to ensure patient safety. Intuitively, a successful TTR system should provide continuity and consistency across locations, within a hospital as well as more widely, both in detecting deterioration and in the response triggered. In addition, staff training in the use of TTRs should be uniform, thereby avoiding duplication and ensuring communication in a common language. A number of single-site studies have shown benefits of TTR systems, and these systems can help inexperienced staff to identify sick patients.[20] The actual response to a trigger is just as important to patient outcome as the trigger itself. However, the response times and the seniority (and profession) of the responder in TTR systems vary and are rarely reported.

Currently, MAU teams are not taking a lead in the response to patients whose condition is deteriorating.[2] This is an area worthy of development, given that physicians are often skilled in complex decision making involving level-of-care and end-of-life issues. Such decisions may complement the critical care skills provided by other team members. As our population ages and the complexity of medical care grows, such contributions will become increasingly valuable. Risk stratification of a diverse inpatient population appears beneficial, and some aggregate scores may allow this.[21] Aggregate scores can contain fixed components, such as age or function, and so have not been designed to "track" patients throughout their hospital stay. Scoring systems used on admission to alert senior medical staff to patients with a high risk of mortality have been used to discuss advanced end-of-life planning and resuscitation decisions.[21,22] The development and use of similar systems incorporating not just a patient's physiology, but diagnostic and functional information, is worthy of further investigation.

Although a range of outcomes have been investigated, mortality is often seen as the primary measure of efficacy of TTR systems.[15,16] This is unfortunate because measuring mortality in a cohort of patients for whom palliative care is deemed appropriate will not provide a reliable index of quality of care. Similarly, critical care unit admission rates should not include patients for whom critical care is deemed inappropriate (although such patients may still benefit from aggressive ward-based resuscitation or end-of-life care discussions). Outcomes such as "appropriate decision mak-

ing" are hard to agree on and even harder to define. Consensus is required on the definition of more useful outcomes that widely reflect the quality of hospital care for patients with general medical illnesses.

No meta-analysis on the impact of TTR systems has been possible because of both the heterogeneity of existing research and poor study design.[14] Greater reliability has been reported when using simpler scoring systems, such as the single-parameter trigger prompting a medical emergency team alert, rather than more complex systems such as early warning scores.[23] Also, the sensitivity and positive predictive value of early warning scores are generally poor.[24] Reliance on scores with a low sensitivity carries a real risk of missing patients who require clinical intervention. Although adjusting the cut-points of scoring systems can improve sensitivity, this would be at the expense of specificity, which has obvious implications for staff workload. The positive predictive value of a TTR score is dependent on the prevalence of instability in the population. As the systems of care at the front doors of our hospitals change, MAUs may care for a population of patients with a higher prevalence of clinical instability than exists in general inpatient wards. This will facilitate statistical assessment of the positive predictability of TTR systems. We believe MAUs are ideally placed to explore the value of adjusting score triggers to alert local unit staff to review patients before a medical emergency team call is placed. The identification of such patients and implementation of simple measures (or simply reviewing the appropriate care ceilings) may obviate unnecessary medical emergency team calls. Guidelines from the UK National Institute for Health and Clinical Excellence suggest that trigger thresholds should be set locally,[6] but this seems a compromise, based on both limited evidence and a disparate patient casemix. Intuitively, a multiple-parameter aggregate score should track patients more closely by triggering a response earlier than might occur if medical emergency team parameters were applied.[25]

The observation and care we provide for patients with acute medical illnesses whose condition is unstable require attention,[5] and further multisite work is needed before evidence-based recommendations can be made. This should not dissuade clinicians from implementing and developing TTR systems. Rather, we recommend a future in which clinicians share standardised data and develop an evidence base that facilitates comparisons between sites. As MAUs are established, they could profitably introduce data collection systems that promote collaborative research between MAUs, as well as between MAUs and other departments in the same hospital. Such collaboration should include investigating a range of outcomes for medical patients other than mortality. These should include projected length of stay and the need for complex decision making, as well as the risk of clinical deterioration. An MAU team could be pivotal in providing tracking, triggering and even response in managing patients at risk of clinical deterioration in hospital. This concept is worthy of further evaluation, as is the concept of standardised scores in the triage of patients to MAUs. The "perfect" score may well be elusive, but comprehensive use of TTR systems should do more to alert experienced clinicians to patients who require urgent additional intervention or decisions.

The establishment, currently underway, of both MAUs and the data systems to support them presents a timely opportunity for monitoring current practice and providing data to improve practice in the future. Any intervention that is safe and appears to

improve patient outcomes is worthy of attention, and we suggest that the time is ripe to enlist multisite collaboration to aid this enterprise. In 2007, the International Liaison Committee on Resuscitation issued guidelines for conducting research on track and trigger systems[26] and a structure for monitoring new track and trigger systems has been suggested by the first consensus conference of medical emergency teams.[11] Although current evidence does not define the best TTR system to use in an MAU, we now have an opportunity for cooperation in developing an MAU patient database that includes a diverse range of input variables incorporating more than just physiology, and a range of relevant outcomes, more extensive than mortality.

Competing interests

None identified.

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