



## Evidence-Based Medicine Journal Club

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Journal club critique

# Demonstrating the benefit of medical emergency teams (MET) proves more difficult than anticipated

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## Expanded Abstract

### Citation

Hillman K, Chen J, Cretikos M, Bellomo R, Brown D, Doig G, Finfer S, Flabouris A: Introduction of the medical emergency team (MET) system: a cluster-randomised controlled trial. *Lancet* 2005, 365:2091-2097 [1].

### Background

Patients with cardiac arrests or who die in general wards have often received delayed or inadequate care. Medical emergency teams (METs) are trained medical professionals that respond quickly to a change in a patient's condition based on the premise that early intervention may prevent further deterioration and/or death. We investigated whether implementation of a medical emergency team (MET) system could reduce the incidence of cardiac arrests, unplanned admissions to intensive care units (ICU), and deaths.

### Methods

**Design:** Prospective cluster-randomized controlled trial.

**Setting:** Twenty-three hospitals in Australia. All hospitals had > 20,000 admissions per year, an emergency department and ICU, and did not currently have a MET system. Participating hospitals were heterogeneous and ranged from large, urban academic centers to small, community hospitals.

**Intervention:** After collecting baseline data over 2 months, hospitals were randomly assigned to receive standardized MET implementation or control. Control hospitals did not receive any education about MET at any time and their cardiac arrest teams continued unchanged. During a 4-month implementation period in MET hospitals, the medical and nursing staff were introduced to MET calling criteria, the need to call quickly if these criteria arose, and how to

activate MET. Education methods included lectures, videotapes, booklets, but did not include education on the treatment of critically ill or unstable patients. A list of MET calling criteria were attached to all ID badges and displayed on posters throughout the intervention hospitals. Staff awareness was maintained by use of regular reminders until the first day of the study period. The staff designated to form the MET varied between participating centers because of local circumstances. The study protocol required that the MET to be at least the equivalent of the pre-existing cardiac arrest team and consist of at least one doctor and a nurse from the emergency department or ICU. A 6-month study period followed the 4-month implementation period, during which individual hospitals had the responsibility for maintaining staff awareness.

**Outcomes:** The primary outcome was a composite index of the incidence (events divided by the number of eligible patients admitted to the hospital during the study period) of: cardiac arrests without a pre-existing do-not-resuscitate (DNR) order; unplanned ICU admissions; and unexpected deaths without a pre-existing DNR order taking place in general wards. Secondary outcomes were the incidence of each of these individual endpoints.

### Results

Twelve hospitals were allocated to MET and 11 hospitals to control. Introduction of the MET increased the overall calling incidence for an emergency team (3.1 vs 8.7 per 1000 admissions,  $p=0.0001$ ). The MET was called to 30% of patients who fulfilled the calling criteria and who were subsequently admitted to the ICU. During the study, there were no differences in the incidence of the composite primary outcome between the control and MET hospitals (5.86 vs 5.31 per 1000 admissions,  $p=0.640$ ), nor were there differences for the individual secondary outcomes

(cardiac arrests, 1.64 vs 1.31,  $p=0.736$ ; unplanned ICU admissions, 4.68 vs 4.19,  $p=0.599$ ; and unexpected deaths, 1.18 vs 1.06,  $p=0.752$ ). A reduction in the rate of cardiac arrests ( $p=0.003$ ) and unexpected deaths ( $p=0.01$ ) was seen from baseline to the study period for both groups combined.

### Conclusion

The MET system greatly increases emergency team calling, but does not substantially affect the incidence of cardiac arrest, unplanned ICU admissions, or unexpected death.

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### Commentary

Previous studies have suggested that MET systems reduce the incidence of unplanned ICU admission, cardiac arrests, and deaths [2-5]. Though these were small, single-center, or non-randomized studies, there is significant face-validity to their findings that early identification and intervention improves outcomes. Yet, in this ambitious, first-ever RCT of MET, Hillman and colleagues failed to demonstrate benefit [1]. Why might this be?

Assuming that MET systems *are* effective, we are left with several possible explanations for the failure of this study to demonstrate a benefit for MET. The mostly likely explanation was that the study was underpowered. The initial power and sample size calculations were based on the best available data and suggested that 18 hospitals would give 90% power to detect a 30% reduction in the primary endpoint. Unfortunately, the incidence rate for the primary outcome was much smaller than anticipated while inter-hospital variability and intra-class correlation were much larger than anticipated. These factors significantly reduced the power of the study. Based on their findings, the authors estimate that more than 100 hospitals would be needed to show the 30% difference they sought.

MET systems are highly complex and inadequate or incomplete MET implementation may have reduced the likelihood of demonstrating a benefit. After the education period, the maintenance of the MET system was left to the local hospital. No efforts were made by the investigators to reinforce MET concepts or to assess how well the MET concept was implemented. Furthermore, the MET was called in only 30% of cases when criteria for activating the MET were fulfilled, suggesting that many opportunities for early intervention were missed. Like the trauma systems that preceded them [6], demonstrating a clear benefit for MET may take longer than the 6-month period of this study. Contamination of control hospitals also may have been an issue. Though they did not receive the study-based educational intervention, control hospitals may have been exposed to MET concepts through coverage in the literature. Similarly, existing cardiac arrest teams at these hospitals may have essentially functioned as METs.

### Recommendation

Though underpowered, the results of this study provide a reliable basis for the design of future studies. While we

cannot definitively say that MET systems improve outcomes, it seems self-evident that the goal of identifying and treating patients early in the course of their illness is preferable to waiting until more serious signs and symptoms have developed. Certainly, at the University of Pittsburgh Medical Center where the MET concept has been implemented for more than five years, there is widespread agreement among the physicians and nurses that this approach saves lives and improves the care of our patients.

### Competing interests

The authors declare that they have no competing interests.

### References

1. Hillman K, Chen J, Cretikos M, Bellomo R, Brown D, Doig G, Finfer S, Flabouris A: **Introduction of the medical emergency team (MET) system: a cluster-randomised controlled trial.** *Lancet* 2005, **365**:2091-2097.
2. Bellomo R, Goldsmith D, Uchino S, Buckmaster J, Hart GK, Opdam H, Silvester W, Doolan L, Gutteridge G: **A prospective before-and-after trial of a medical emergency team.** *Med J Aust* 2003, **179**:283-287.
3. Bristow PJ, Hillman KM, Chey T, Daffurn K, Jacques TC, Norman SL, Bishop GF, Simmons EG: **Rates of in-hospital arrests, deaths and intensive care admissions: the effect of a medical emergency team.** *Med J Aust* 2000, **173**:236-240.
4. Buist MD, Moore GE, Bernard SA, Waxman BP, Anderson JN, Nguyen TV: **Effects of a medical emergency team on reduction of incidence of and mortality from unexpected cardiac arrests in hospital: preliminary study.** *BMJ* 2002, **324**:387-390.
5. DeVita MA, Braithwaite RS, Mahidhara R, Stuart S, Foraida M, Simmons RL: **Use of medical emergency team responses to reduce hospital cardiopulmonary arrests.** *Qual Saf Health Care* 2004, **13**:251-254.
6. Nathens AB, Jurkovich GJ, Cummings P, Rivara FP, Maier RV: **The effect of organized systems of trauma care on motor vehicle crash mortality.** *JAMA* 2000, **283**:1990-1994.