Rapid Response Systems: The Impact of Delayed activation:

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Two forms of delay

- There are two forms of delay
- Extreme delay (non activation)
- Moderate delay (call made more than 30 minutes after the MET call criteria have been documented)
- Both have major consequences
- Both require discussion
METs: The “Afferent” Arm

• Weakest link in the chain
• Nurses **do not reliably monitor vital signs**
• When they do, they (and doctors) **do not understand their significance**
• When they do, they (and doctors) still **do not understand the need to act immediately**
Circadian pattern of activation of the medical emergency team in a teaching hospital

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Abstract

Introduction Hospital medical emergency teams (METs) have been implemented to reduce cardiac arrests and hospital mortality. The timing and system factors associated with their activation are poorly understood. We sought to determine the circadian pattern of MET activation and to relate it to nursing and medical activities.

Method We conducted a retrospective observational study of the time of activation for 2568 incidents of MET attendance. Each attendance was allocated to one of 48 half-hour intervals over the 24-hour daily cycle. Activation was related nursing and medical activities.

Results During the study period there were 120,000 consecutive overnight medical and surgical admissions. The hourly rate of MET calls was greatest during the day (47% of calls in the 10 hours between 08:00 and 18:00), but 63% of the 2568 calls occurred between 18:00 and 08:00 hours. MET calls increased in the half-hour after routine nursing observation, and in the half-hour before each nursing handover. MET service utilization was 1.25 (95% confidence interval [CI] = 1.11–1.52) times more likely in the three 1-hour periods spanning routine nursing handover (P = 0.001). The greatest level of half-hourly utilization was seen between 20:00 and 20:30 (odds ratio [OR] = 1.78, 95% CI = 1.26–2.48, P = 0.001) before the evening nursing handover. Additional peaks were seen following routine nursing observations between 14:00 and 14:30 (OR = 1.33, 95% CI = 1.07–2.17, P = 0.022) and after the commencement of the daily medical shift (08:00–08:30; OR = 1.43, 95% CI = 1.00–2.04; P = 0.049).

Conclusion Peak levels of MET service activation occur around the time of routine observations and nursing handover. Our findings raise questions about the appropriate frequency and methods of observation in at-risk hospital patients, reinforce the need for adequately trained medical staff to be available 24 hours per day, and provide useful information for allocation of resources and personnel for a MET service.
Medical and nursing activities (monitoring) dictate whether you are “sick” almost as much as pathophysiology.

Austin data over 4 years

(Jones D, Goldsmith D, Bellomo R et al. Critical Care 2005; 9: R303-R306)
Patient monitoring and the timing of cardiac arrests and medical emergency team calls in a teaching hospital

Abstract Objective: To describe the timing of cardiac arrest detection in relation to episodes of Medical Emergency Team (MET) review and routine nursing observations. Design and setting: Retrospective observational study in a university-affiliated hospital. Patients: 279 cardiac arrests involving ward patients. Measurements: In the year following introduction of the MET there were 162 cardiac arrests, 28% of which occurred shortly after an initial MET call. The odds ratio for risk of cardiac arrest during periods of lowest MET activation (24:00–08:00) when compared with periods of highest MET activation (16:00–24:00) was 2.26. Conclusions: Cardiac arrest
Why can’t we make these damn cardiac arrests disappear completely??

So much is about vigilance & monitoring

Less monitoring = More cardiac arrests
The “afferent arm” “sleeps on the job”
(no monitoring)

As MET calls go up cardiac arrests go down and vice-versa
Aim: To evaluate the ability of pre-defined clinical criteria to identify patients who subsequently suffer major AE (CA, death, ICU admission) within 24 hrs

Nested cohort (450 cases and 520 controls matched for age, sex, hospital ward) within multicenter study

7 hospitals not allocated to MET

Resuscitation 2007; 73: 62-72
The objective medical emergency team activation criteria: A case–control study

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Patients: all patients with an event over a 6-month period. Obtain data for 24 hr period before the event

Controls: chosen from patients admitted to same ward in 4 week period before the case event using age and sex matching. Obtain data during a random 24 hour period
Study Patients

- Patients: 450
  - Age: 68; sex: 58.7%
  - Events: 297 admit to ICU; 135 arrests; 18 unexpected death
  - Missing data in last 24 hr:
    - RR: 78; HR 5; BP: 6

- Controls: 520
  - Age: 68; sex: 57.5%
  - Events: None
  - Missing data in last 24 hr:
    - RR 123; HR: 1; BP: 6
Vital signs and *odds ratio* of CA/death/ICU admission

RR is king

<table>
<thead>
<tr>
<th>RR</th>
<th>HR Above 100 b/min</th>
<th>Systolic BP Below 100 mmHg</th>
</tr>
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<tbody>
<tr>
<td>10</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>6.3</td>
<td>20</td>
</tr>
<tr>
<td>10.5</td>
<td>Any 2 point decrease in GCS = 21</td>
<td></td>
</tr>
</tbody>
</table>
Choosing criteria

- Predictive model (one of these)
  - (GCS change, RR>24, BP<85, HR>140)
  - has sensitivity of 71.4% and a specificity of 88.8% (as good as CRP or pro-calcitonin for sepsis)
Continuous non-invasive monitoring for all would be wonderful.

However, even good ol’ intermittent monitoring (1853 Nightingale style) is not bad *(If people only used it!)*

Using something as simple as vital signs, we can identify the majority of at risk patients.
How do we fail?

- We do not reliably monitor patients by intermittent measurements (lack of monitoring)
- When we do, there is frequently no call for suitably trained and equipped help (lack of advice)
- When there is a call for such help, it is often dangerously late (lack of response)
- Consequently...people die
Question: could a hospital put a giant billboard at its entrance that says this?
“We guarantee that, for a week, if you have major surgery 1. we will monitor your vital signs at least once every 8 hours and document them, 2. a nurse will see you every 8 hours and document that and 3. a doctor will see you at least once a day and document that”
ABSTRACT

Objective: To describe the quality of postoperative documentation of vital signs and of medical and nursing review and to identify the patient and hospital factors associated with incomplete documentation.


Main outcome measures: Proportion of patients with complete documentation of medical review (each day) and nursing review and vital signs (heart rate, blood pressure, respiratory rate, temperature and oxygen saturation) (each nursing shift), and the proportion of available opportunities for medical and nursing review where documentation was incomplete. Univariate and multivariate odds ratios for the association between incomplete documentation and hospital and patient factors.

Results: During the first 3 postoperative ward days, 17% of medical records had complete documentation of vital signs and medical and nursing review. During the first 7 postoperative ward days, nursing review was undocumented for 5.6% of available shifts and medical review for 14.9% of available days. Respiratory rate was the most commonly undocumented observation (15.4% undocumented). Certain hospitals were significantly associated with incomplete documentation. Vital signs were more commonly undocumented in patients without epidural or patient-controlled (PC) analgesia, during evening nursing shifts, and during successive postoperative ward days. Nursing review was more commonly undocumented in the evening and for patients without epidural or PC analgesia. Medical review was more commonly undocumented on weekends.

Conclusion: Hospital and patient factors are associated with incomplete documentation of clinical review and vital signs after major surgery.
The hospital guarantee

- Let’s find out what happens
- Four teaching hospitals (Sydney & Melbourne) + One major metropolitan hospital
- 14 major operations (cardiac, GI, thoracic, vascular Sx)
- Three patients for each operation for one week in each hospitals
Findings of hospital guarantee study

- RR missing in 15.4%
- HR missing in 4.2%
- BP missing in 5.5%
- Sat missing in 6.7%
- Nurse notes missing in 5.5%
- Only 15% of patients got the “full package” each day for the first 3 days
The Other Failure: Delay

- Monitoring is poorly done
- Lack of monitoring stops MET activation
- No MET activation: adverse events

Next issue:
When the MET criteria are present do nurses and doctors activate METs immediately? Or are there delays?
Characteristics and outcomes of patients receiving a medical emergency team review for respiratory distress or hypotension

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Review of 200 MET calls at Austin

Delay = >30 min after documentation of MET criteria
Respiratory distress and low BP
Characteristics and outcomes of patients receiving a medical emergency team review for acute change in conscious state or arrhythmias*

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Objective: To describe the characteristics and outcomes of patients receiving a medical emergency team (MET) review for the MET syndromes of acute change in conscious state or arrhythmia and to assess the effect of delayed MET activation on their outcomes.

Design: Retrospective analysis of medical records.

Setting: University teaching hospital.

Patients: Two cohorts of 100 patients for each of the MET syndromes of acute change in conscious state or arrhythmia.

Interventions: None.

Measurements and Main Results: We collected information on patient demographics, comorbidities, and presence of sepsis, hypovolemia, cardiogenic shock, and patient outcome. We also documented the presence and duration of delayed MET activation. The median age for both syndromes was >70 yrs, and major comorbidities were present in >10% of patients. A history of ischemic heart disease ($p < .001$) and congestive cardiac failure ($p = .007$) was more common in patients with arrhythmias. Cardiogenic shock and sepsis were common underlying causes of the MET calls for the two groups. However, cardiogenic shock was more common in patients with arrhythmias ($p < .001$). Hospital mortality was 35% for patients with an acute change in conscious state, compared with 18% for patients with arrhythmias ($p = .01$). Delayed MET activation occurred in 35% of acute change in conscious state patients and in 24% of arrhythmia patients ($p = .09$) with a median duration of delay of 16 and 13 hrs, respectively. Delayed MET activation was associated with increased mortality (odds ratio 3.1, 95% confidence interval 1.4–6.6, $p = .005$).

Conclusions: An acute change in conscious state leading to a MET call carried a greater risk of death than activation due to arrhythmias. Delayed activation was common for both syndromes and was independently associated with an increased risk of death. (Crit Care Med 2008; 36:●●●●●●●)

Key Words: medical emergency team; conscious state; arrhythmia; delay; outcome; critical illness
Review of 200 MET calls at Austin

Delay = >30 min after documentation of MET criteria

GCS change
Tachycardia

P=0.09
Low GCS and Tachycardia
Duration of delay

P = 0.032

Hours

GCS change Tachycardia
Resp. distress
Low BP

P = 0.032

Delay
Delayed Emergency Team Calls and Associated Hospital Mortality: A Multicenter Study

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Design, Setting, and Participants: We used data from a 23-hospital cluster randomized trial (January 2004 to December 2004) of implementation of rapid response teams (intervention) versus standard practice with conventional cardiac arrest team-based responses to emergencies (control). We examined emergency calls in all hospitals. In intervention hospitals, we also examined such calls in the period before, during the introduction, and after the full implementation of a rapid response system. We studied the statistical association between such delayed calls and mortality.
Patients who were admitted to hospital within the study period (N=727153)

Patients who had at least one event (calls/ICU admission/ CA/death) (N=11268)

Patients who had no event

Patients who had at least an emergency call (N=3135)

Did the patient’s first call occur more than 15 minutes after the observed abnormality of calling criteria?

No

Patient’s first call is a “Not delayed call” (N=2188)

Yes

Patient’s first call is a “Delayed call” (N=947)
TABLE 1. Event Types and Patient Survival Outcome Associated With Calls, Stratified by Delay Status and Period

<table>
<thead>
<tr>
<th>Phase/Event/Outcome</th>
<th>Incidence of Events Associated With a First Call (5,253 Events for 3,135 Patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Delayed Calls (%)</td>
</tr>
<tr>
<td>Study period</td>
<td>n = 1,396</td>
</tr>
<tr>
<td>Event category</td>
<td></td>
</tr>
<tr>
<td>ICU</td>
<td>306 (21.9)</td>
</tr>
<tr>
<td>CA</td>
<td>353 (25.3)</td>
</tr>
<tr>
<td>Died</td>
<td>451 (32.3)</td>
</tr>
<tr>
<td>Call only</td>
<td>1,036 (74.2)</td>
</tr>
<tr>
<td>Patient outcome</td>
<td></td>
</tr>
<tr>
<td>Survived</td>
<td>945 (67.7)</td>
</tr>
<tr>
<td>Died</td>
<td>451 (32.3)</td>
</tr>
</tbody>
</table>
Conclusions: Among ward patients, emergency team activation in response to acute deterioration triggered more than 15 minutes after detection and documentation of instability is independently associated with an increased risk of ICU admission and death.
"I think we should call the doctor. This doesn't look good!"
Conclusions

- Monitoring (even intermittent) is important
- Like everything else in hospitals (hand washing, ACLS, Trauma care) it is highly imperfect
- We fail by not doing it, not understanding it, not calling for help or calling for help too late (delay)
Conclusions

- MET non activation kills people
- Delayed MET activation kills people
- We need more studies to understand why monitoring is the Cinderella of hospital activities
- We need more studies to understand the anthropology and pathogenesis of delayed MET activation
- This is a priority area