



## Do crises criteria detect risk?

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### The elements of a rapid response system

- A mechanism by which team responses are triggered;
- A team of clinicians that responds to an event;
- A governance/administrative structure responsible for team staffing, education, and implementation; and
- Quality improvement elements to evaluate the event and the effectiveness of the RRS to identify underlying quality of care issues, and promote hospital process improvement to prevent future events.

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### Different calling criteria (1)

Staff member is worried about the patient

**Airway**

- Noisy breathing / stridor

**Breathing**

- Acute change in respiratory rate to < 8 or > 30 breaths / min
- Acute change in pulse oximetry saturation to < 90% despite oxygen administration


**Circulation**

- Acute change in heart rate to < 40 or > 130 beats / min
- Ischemic chest pain †
- Acute change in systolic blood pressure to < 90 mmHg
- Acute change in urinary output to < 50 mL in 4 hrs.

**Conscious state**


- Acute change in conscious state
- Multiple seizures†

† Indicates criteria specific for The Northern Hospital

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### Different calling criteria (2)

<p><b>Airway</b></p> <ul style="list-style-type: none"> <li>Respiratory distress</li> <li>Threatened airway</li> </ul> <p><b>Breathing</b></p> <ul style="list-style-type: none"> <li>Respiratory rate &gt;30/min</li> <li>Respiratory rate &lt;6/min</li> <li>SaO2 &lt;90% on oxygen</li> <li>Difficulty speaking</li> </ul> <p><b>Circulation</b></p> <ul style="list-style-type: none"> <li>Blood pressure &lt;90 mm Hg despite treatment</li> <li>Pulse rate &gt;130/min</li> </ul>	<p><b>Neurology</b></p> <ul style="list-style-type: none"> <li>Any unexplained decrease in consciousness</li> <li>Agitation or delirium</li> <li>Repeated or prolonged seizures</li> </ul> <p><b>Other</b></p> <ul style="list-style-type: none"> <li>Concern about patient</li> <li>Uncontrolled pain</li> <li>Failure to respond to treatment</li> <li>Unable to obtain prompt assistance</li> </ul>
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### Different calling criteria (3)

	Threatened
<b>Airway</b>	
<b>Breathing</b>	All respiratory arrests Respiratory rate < 5 Respiratory rate > 36
<b>Circulation</b>	All cardiac arrests Pulse rate < 40 Pulse rate > 140 Systolic blood pressure < 90
<b>Neurology</b>	Sudden decrease in level of consciousness (decrease in GCS of > 2 points) Repeated or prolonged seizures
<b>Other</b>	Any patient you are seriously worried about that does not fit the above criteria


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### Testing the criteria, Subbe et al

Intensive Care Med (2007) 37:419-424  
DOI 10.1007/s12013-006-0756-8 ORIGINAL


Christian F. Subbe  
Hiljem Gao  
David A. Harrison

**Reproducibility of physiological track-and-trigger warning systems for identifying at-risk patients on the ward**

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### Testing the criteria, Subbe et al

- Physiologic observations were evaluated using
- MET, medical emergency team call-out criteria
- MEWS, modified early warning score
- ASSIST, assessment score of sick-patient identification and step-up in treatment
- Inter-rater and intra-rater reliability were assessed

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### Testing the criteria, Subbe et al

- Reliability was a function of simplicity:
- MET achieved a higher percentage of agreement than ASSIST, and ASSIST higher than MEWS
- Intra-rater reliability was better than inter-rater reliability


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### Testing the criteria, Creitkos et al

Resuscitation (2007) 71, 42-72



CLINICAL PAPER




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#### The objective medical emergency team activation criteria: A case-control study<sup>1</sup>


Michelle Creitkos<sup>1\*</sup>, Jack Chen<sup>2</sup>, Ken Hillman<sup>3</sup>, Rinaldo Bellomo<sup>4</sup>, Simon Finfer<sup>5</sup>, Arthas Flabouris<sup>2</sup>

the MERIT study investigators<sup>1</sup>

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### Testing the criteria, Creitkos et al

- Cases=adverse events = unexpected cardiac arrests, unplanned ICU-admissions and unexpected death (n=450)
- Matching controls (n=520)
  - Journals of cases and controls were scrutinized, -24hours
  - Resp rate, heart rate, BP, GCS, seizures, threats to airway
- The MERIT MET-criteria:
  - Sensitivity 49.1%, specificity 93.7%, PPV 9.8%
- Modified MET-criteria (RR≥28, HR≥140, syst BP≤85, decrease in GCS >2)
  - Sensitivity 59.6%, specificity 93.7%, PPV <16%

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### Testing the criteria, Creitkos et al

- The study shows that in combination, a high HR, low systolic BP, and a decrease in GCS score are specific predictors of cardiac arrest, unplanned ICU admission and unexpected death
- The MERIT MET-criteria had a low sensitivity and low positive predictive value for the adverse events (within 24h) studied
- After modification the best positive predictive value was 15.7%, with a sensitivity of 53.6%
- Even modified criteria will thus result in a high proportion of false positive calls (84%), and a number of patients at risk remain unidentified


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### Testing the criteria, the Karolinska study

Resuscitation (2006) 70, 66-73



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#### Prevalence and sensitivity of MET-criteria in a Scandinavian University Hospital<sup>1,2</sup>

Max B. Bell<sup>1\*</sup>, David Konrad<sup>2</sup>, Fredrik Granath<sup>2</sup>, Anders Ekbohm<sup>2</sup>, Claes-Roland Martling<sup>2</sup>


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### Testing the criteria, the Karolinska study

- Bell M et al. *Prevalence and sensitivity of MET-criteria in a Scandinavian University Hospital Resuscitation* 2006;70:66-73
- The study took place at two separate occasions, December 10th 2003 and March 24th 2004
- With the help of 50 nursing students from the Red Cross Nursing School, we set out to record *prevalent physiological data* on all adult patients treated in the hospital, excluding the intensive care- and psychiatric wards
- 1097 patients were treated at the wards during the two study periods
  - 81.6 % were included
- 40 patients (4.5%) fulfilled the study criteria
- 42 patients had a DNAR

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### Testing the criteria, the Karolinska study

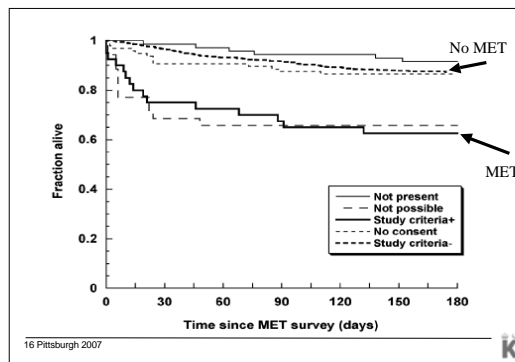
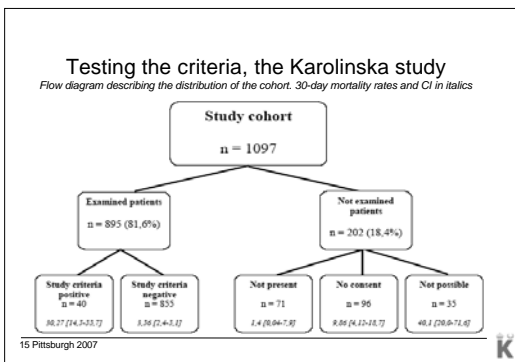
**The MET criteria**

- Acute change in respiratory rate to <8 or >30 breaths/min
- Acute change in pulse oximetry saturation to < 90%, despite oxygen administration
- Acute change in heart rate to <40 or >130/min beats/min
- Acute change in systolic blood pressure to <90 mm Hg
- Acute change in conscious state as measured by a fall of GCS >2
- Staff member is worried about the patient

**Study Criteria**

- Respiratory rate of <8 or >30 breaths/min
- Heart rate of <40 or >130/min beats/min
- Systolic blood pressure of <90 mm Hg

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### Testing the criteria, the Karolinska study

**The extended criteria**

- Respiratory rate of  $\leq 10$  or  $> 28$  breaths/min
- Heart rate of  $< 50$  or  $> 120$ /min beats/min
- Systolic blood pressure of  $< 100$  mm Hg


**The restricted criteria**

- Respiratory rate of  $\leq 6$  or  $> 32$  breaths/min
- Heart rate of  $< 35$  or  $> 140$ /min beats/min
- Systolic blood pressure of  $< 80$  mm Hg

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### Testing the criteria, the Karolinska study

- 4,5% (40) of the scored patients fulfilled the study criteria
  - 30-day mortality: 25% (CI 12.7-41.2)
- The patients *not* fulfilling the study criteria
  - 30-day mortality: 3.5% (CI 2.4-5)
- Extended criteria** resulted in 13.8 % of the cohort (123) fulfilling these criteria
  - 30 day mortality: 14.6 % (CI 8.9-22.1)
- Restricted criteria:** 2,2 % (20) fulfilled these criteria
  - 30 day mortality: 20 % (CI 5.7-43.7)

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In conclusion

- Do crisis criteria detect patients at risk?
- Well, yes, but are our criteria good enough? Are they optimized?
- Trade-off: work load vs risk of missing patients?
- Trade-off: simplicity vs sensitivity?

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