WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

Worksheet author(s)

James Tibballs

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Clinical question.

In pediatric patients with in-hospital cardiac or respiratory arrest (P), does use of EWSS/response teams/MET systems (I) compared with no such responses (C), improve outcome (eg, reduce rate of cardiac and respiratory arrests and in-hospital mortality) (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? Intervention

State if this is a proposed new topic or revision of existing worksheet: new topic

Conflict of interest specific to this question

James Tibballs is co-publisher of 2 studies which showed reductions in preventable cardiac arrest and death in a pediatric hospital.

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?

See above.

Search strategy (including electronic databases searched).

Electronic data base searches: with the following databases and terms:

Medline (1950 to Jan 2010):
  “medical emergency team” 135 articles
  “rapid response team” 76 articles
  “critical care outreach” 63 articles

Embase (1980 to Jan 2010):
  “paediatric AND medical AND emergency AND team” 82 articles
  “rapid AND response AND team” 356 articles
  “critical AND care AND outreach” 370 articles

Cochrane database: (Jan 2010)
  “medical emergency team” 2 articles
  “rapid response team” 7 articles
  “critical care outreach” 1 article

Search of journal articles: 1 article

7 articles concerned pediatric patients

State inclusion and exclusion criteria

Articles were included if they if they included paediatric patients and the use of early warning /rapid response/medical emergency team systems and they analysed incidence of cardiac arrest and/or respiratory arrest and/or mortality

Articles were excluded if: they did not provide outcomes or if outcomes were provided without a control; they were case reports; they were based solely on admission to intensive care or area of high dependence were excluded.

Number of articles/sources meeting criteria for further review:

7 were exclusively pediatric.
# Summary of evidence

**Evidence Supporting Clinical Question**

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Evidence Supporting Clinical Question</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tibballs (2009)*, B,F,G</td>
</tr>
<tr>
<td><strong>Fair</strong></td>
<td>Tibballs (2005),F Brilli (2007) E,F</td>
</tr>
<tr>
<td><strong>Poor</strong></td>
<td>Mistry (2006) B,F</td>
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<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
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**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Decreased rate of respiratory arrest  
F = Decreased rate of cardiac arrest  
G = Decreased rate of hospital-wide mortality

*Italics = Adult studies*

* Continuation of Tibballs 2005.
### Evidence Neutral to Clinical question

<table>
<thead>
<tr>
<th>Good</th>
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<th>Hunt (2008) F</th>
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<tbody>
<tr>
<td>Poor</td>
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<td>Zenker (2007) B,F</td>
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### Evidence Opposing Clinical Question

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REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

All 7 pediatric studies have been comparisons of patient outcomes before and after introduction of a Medical Emergency Team (MET) or Rapid Response Team (RRT) system (No randomised pediatric study has been reported). All except one study reported reductions in cardiac arrest, respiratory arrest, unexpected death or total hospital death. In six of these articles the reductions were significant. The findings of the seven studies are summarized in the following table. Adult studies were not considered because warning signs of cardiac arrest may differ from those in children.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Hospital</th>
<th>Pre-MET/RRT period</th>
<th>Post-MET/RRT period</th>
<th>Rapid Response system</th>
<th>Main findings (per 1000 admissions/discharges)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brilli et al (2007)</td>
<td>Children’s Hospital</td>
<td>15 months</td>
<td>8 months</td>
<td>Two-tiered Doctors &amp; Nurses (MET attend &lt;15 minutes)</td>
<td>Codes (Cardiopulmonary arrests + respiratory arrests) decreased from 1.54 to 0.62/1000 admissions RR 0.41, 95% CI 0-0.86, p=0.02 and cardiac arrests from 0.56 to 0.24/1000 admissions (RR 0.43, 95% CI 0-1.6)(NS) Mortality decreased from 0.43 to 0.24 (RR 0.55, 95% CI 0-2.1)(NS)</td>
</tr>
<tr>
<td>Hunt et al (2008)</td>
<td>Tertiary academic hospital</td>
<td>12 months</td>
<td>12 months</td>
<td>One-tiered Doctors &amp; Nurses</td>
<td>Cardiac arrests decreased from 2.1 to 1.1/1000 discharges (IRR 0.49, 95% CI 0.18-1.20) (NS) Respiratory arrest decreased from 1.46 to 0.40/1000 discharges (IRR 0.27, 95% CI 0.05-1.01)(p=0.04)</td>
</tr>
<tr>
<td>Mistry et al (2006)</td>
<td>Children’s Hospital</td>
<td>6 months</td>
<td>5 months</td>
<td>One-tiered</td>
<td>Non-PICU deaths decreased 12% (P=0.004), non-PICU cardiac arrests decreased 58% (p=0.001) and deaths from these decreased 48% (p=0.005)</td>
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<tr>
<td>Sharek et al (2007)</td>
<td>264 bed pediatric hospital</td>
<td>56 months</td>
<td>19 months</td>
<td>One-tiered Doctors &amp; nurses</td>
<td>Total mortality decreased 10.1 to 8.3/1000 discharges (18% reduction, CI 5-30%)(p=0.007) Code rate (cardiac/respiratory arrest) decreased from 2.45 to 0.69/1000 admissions (0.29 fraction, 95% CI 0.10-0.65)(P=0.008)</td>
</tr>
<tr>
<td>Tibballs et al (2005)</td>
<td>215 bed paediatric hospital</td>
<td>41 months</td>
<td>12 months</td>
<td>One-tiered Doctors &amp; nurses</td>
<td>Total mortality decreased from 0.12 to 0.06/1000 admissions (NS). Total cardiac arrest decreased from 0.19 to 0.11/1000 admissions (NS) ‘Preventable’ cardiac arrest reduced from 0.16 to zero/1000 admissions (RD 0.16, 95% CI 0.09-0.24) (p = 0.016) ‘Preventable’ death reduced from 0.11 to zero/1000 admissions (RD 0.11, 95% CI 0.05-0.18) (p = 0.043)</td>
</tr>
<tr>
<td>Tibballs et al (2009)</td>
<td>215 bed paediatric hospital</td>
<td>41 months</td>
<td>48 months</td>
<td>One-tiered Doctors &amp; nurses</td>
<td>Total hospital mortality decreased 4.38 to 2.87/1000 admissions (RR 0.65, CI 0.57-0.75)(p&lt;0.0001) Average mortality reduction: 34/annum. Ward unexpected deaths decreased 0.12 to 0.04/1000 (RR 0.35, CI 0.13-0.92, p=0.03) but unexpected cardiac arrest did not change (0.19 to 0.17/1000). Three unexpected deaths prevented/annum, 1 every 72 MET calls. Ward preventable cardiac arrest decreased from 0.16 to 0.07/1000 admissions (RR 0.45, 95% CI 0.20-0.97, p=0.04) and death from 0.11 to 0.01/1000 admissions (RR 0.13, 95% CI 0.03-0.56, p=0.001)</td>
</tr>
<tr>
<td>Zenker et al (2007)</td>
<td>Children’s Hospital</td>
<td>23 months</td>
<td>12 months</td>
<td>Two-tiered Nurses</td>
<td>Cardiac/respiratory arrest decreased from 8.0 to 5.1/1000 discharges (36%) (NS). Mortality was unchanged from 4.3 to 4.5/1000 discharges (NS)</td>
</tr>
</tbody>
</table>
Acknowledgements:

Citation List
(Brilli, Gibson et al. 2007; Hunt, Zimmer et al. 2008; Mistry et al., 2006; Sharek, Parast et al. 2007; Tibballs, Kinney et al. 2005; Tibballs & Kinney 2009; Zenker, Schlesinger et al. 2007).

Brilli, R. J., R. Gibson, et al. (2007). "Implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit.[see comment]." Pediatric Critical Care Medicine 8(3): 236-46.

Worksheet author comments:
1. Two-tiered system (Code team for cardiac/respiratory arrest + MET required to attend within 15 minutes).
2. Small number of MET calls - 27 times over 8 months of post MET implementation (41/annum)
3. Significant decrease (65%, p=0.02) in Codes (respiratory + cardiopulmonary arrest, p) but no decrease in cardiac arrest.
4. LOE 3, quality fair


Worksheet author comments:
1. One-tiered system, 88 calls per annum
2. Significant reductions in respiratory arrest (73%, p=0.03), no change in cardiac arrest
3. Severity of illness same before and after implementation of MET
4. LOE 3, quality good


Worksheet author comments:
1. Single-tiered system, approximately 2 activations/month (24 calls/annum)
2. Admissions not provided, little data provided, absolute data only provided.
3. No details of patients activating system.
4. Significant decreases in non-PICU cardiac arrest (58%, p=0.001) and deaths (48%, p=0.005)
5. Very high number of baseline non-PICU cardiac arrests (63/6 months)
6. LOE 3, quality poor.


Worksheet author comments:
1. One-tiered system, 143 activations over 19 months (90/annum)
2. Significant reductions (72%, p=0.008) in Codes (respiratory + cardiorespiratory arrest)
3. Significant reductions (18%, p=0.007) in hospital-wide mortality
4. LOE 3, quality good


Worksheet author comments:
1. Single tier system, 184 activations /annum
2. Non-significant decreases in all ward cardiac arrest and death
3. Elimination of preventable cardiac arrest (p=0.016) and death (p=0.043)
4. LOE 3, quality fair (note conflict of interest)

Tibballs J, Kinney S. (2009)."Reduction of hospital mortality and of preventable cardiac arrest and death with increased survival on introduction of a pediatric medical emergency team". Pediatric Critical Care Medicine 10(3); 306-312.

Worksheet author comments:
2. Significant reductions in hospital-wide death (34%, p<0.0001), 34 lives saved per annum.
3. Significant reductions in preventable cardiac arrest (55%, p=0.04) and death (87%, p=0.001)
4. Not severity adjusted before and after implementation of MET.
5.LOE 3, quality good (note conflict of interest)


Worksheet author comments:
1. Two-tiered system (nurses only), 150 calls/annum
2. Non-significant decrease in respiratory and cardiac arrest (36%, p=0.19)
3. Non-significant increase in mortality
4. LOE 3, quality poor