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

Worksheet author(s)
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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 (e.g. 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: Revision

Conflict of interest specific to this question
Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? NONE

Search strategy (including electronic databases searched).

PUBMED (MEDLINE search) – Using keywords
A search strategy using: (rapid response team OR medical emergency team OR Pediatric Early Warning System) AND (pediatric) retrieved a list of 230 references. 219 were eliminated by reading titles and/or abstracts (not relevant articles). This left 11 articles of which 3 discussed a pediatric early warning system, 6 were studies on rapid response teams or medical emergency teams, and two were 2-3 page articles published in health improvement journals and were not accessible. Reviewed all references in each of these papers for other studies that might have been missed in primary search and found no articles that evaluated the impact of either medical emergency team/rapid response teams or early warning systems on patient outcomes). Two of the articles addressing early warning systems were studies validating the score but did not address patient outcomes; the third was a review/commentary on early warning systems and not a study. This left six studies for final inclusion.

COCHRANE Database of Systematic Reviews:
Search Strategies:
Medical Emergency Team AND Pediatric: 32 hits None relevant
Rapid Response Team AND Pediatric: 18 hits None relevant
Patient Care Team AND Pediatric: 112 hits None relevant
Medical Care Team AND Pediatric: 1 hit Not relevant

Summary: 0 Relevant Systematic Reviews in Cochrane Database

ECC Endnote Master Library – No pediatric papers identified using same search strategy

• State inclusion and exclusion criteria
EXCLUSIONS: Single case reports, commentaries and descriptions/validation of severity of illness tools. Also excluded were studies which included some children but for whom the mean age indicated that the group was adult (e.g. mean age of 60 yr). Excluded papers dealing only with adults, since there are now pediatric studies.

INCLUDED: Six papers that dealt exclusively with pediatric/child rapid response teams/MET teams. One paper is a preliminary report of data from the same study. (Tibbals 2005, 2009)

• Number of articles/sources meeting criteria for further review:
SIX
## Summary of evidence

### Evidence Supporting Clinical Question

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<thead>
<tr>
<th>Good</th>
<th>Hunt 2008  E Sharek 2007 (E + F)*, G Tibballs 2009 B, ,F, G</th>
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<tr>
<td>Fair</td>
<td>Brilli 2007 (E + F)</td>
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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 resp arrest
- **F** = Decreased rate of cardiac arrest
- **G** = Hospital Mortality Rate

*Italics = Animal studies

* = E+F = combined rates
### Evidence Neutral to Clinical question

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<tr>
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<th>Hunt 2008 F</th>
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<td>Fair</td>
<td>Tibballs 2005 F, G</td>
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<td>Poor</td>
<td>Zenker 2007, C(E+F), G</td>
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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 resp arrest  
F = Decreased rate of cardiac arrest

*Italicics = Animal studies*

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### Evidence Opposing Clinical Question

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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 = Other endpoint

*Italicics = Animal studies*
There are now six LOE 3 studies available assessing the benefit of a pediatric rapid response/medical emergency team. However, one of these studies (Tibballs 2005) is a preliminary publication of one year’s worth of data and is subsumed under a subsequent publication (Tibballs 2009) four years later, describing further compilation of data over the next three years. One study is of poor quality (Zenker 2007). Thus, conclusions on this question are based on the four remaining studies (Brilli 2007, Sharek 2008, Hunt 2008, Tibballs 2009). In all studies there was a statistically significant decrease in respiratory arrest, in either cardiac or respiratory arrest (not separated out in the study), or in preventable cardiac arrest rates. In one of the best studies (Hunt 2008), a statistically significant benefit is seen only in the prevention of respiratory arrests, but not cardiac arrests. In another study (Brilli 2007) no benefit was shown in cardiac arrests by itself, but when coupled with respiratory arrests, there was a benefit. The most recent study (Tibballs 2009) corroborates that there was no decrease in unexpected cardiac arrests on the general wards; however, there was a decrease in the subset of preventable cardiac arrests as well as a statistically significant decrease in ward unexpected deaths. Two studies (Sharek 2007, Tibballs 2009) also demonstrated a significant decrease (18% and 35% in hospital wide mortality rate after the MET was implemented, although only one of them was case mix adjusted before and after implementation (Sharek 2007).

In no study was any risk demonstrated in having a pediatric rapid response team. In one study there was also a statistically significant decrease in hospital wide mortality rate (18%) with a trend shown in another (Tibballs)

Given the benefits demonstrated without evidence of patient risks, the implementation of a medical emergency team/rapid response team in a general inpatient setting appears to be desirable.

Acknowledgements:

Citation List


Comment: Retrospective, historical cohort study in a single, large children's hospital. Study measures the impact of a METon rates of respiratory and cardiac arrest (codes) on the general inpatient units. Study also defines MET preventable arrests, and the impact of the MET only on them. First study to include both respiratory and cardiac arrests. Likely that the decrease in respiratory arrests resulted in the statistically significant decrease in all MET preventable codes. LOE: 3; Quality: Fair (not case-mix adjusted although attempts are made by looking at LOS and rate of ICU cardiac arrests as a proxy for case mix/severity adjustment). Direction: supportive for MET preventable codes (respiratory+cardiac arrests); not supportive (not statistically significant) for only cardiac arrests, although a trend present) Outcomes: E (respiratory arrest rate), F (cardiac arrest rate)


Comment: Single institution, small pre-, post interventional observational study. Populations controlled for case-mix (no difference in pre and post intervention patients) with a standardized severity score based on administrative data. No implementation period between pre and post intervention data collection. Also assessed preventability of cardiac arrests.
17% (2) were felt to be preventable; the remaining 83% were felt to be non-preventable. LOE 3. Quality: good. Direction: supports clinical question that a MET can decrease number of respiratory arrests (by 73%); neutral on statement that METs can decrease cardiac arrests. Although not statistically significant, during the time of the MET, there was a also trend towards improved survival from cardiac arrests. Outcomes: E (respiratory arrest rate), F (cardiac arrest rate)


Comment: Single institution, cohort study with historical controls. Populations were case-mix adjusted for severity using standard CMS criteria (no difference) and excluded patients in ICUs, OR/PACU, nursery, intermediate ICUs. Clear call criteria were used to call the RRT/MET. Pre-intervention period was 6.25 yr, Post-intervention period was 19 months). No separate implementation period. RRT/MET resulted in 71-2% decrease in code rates outside of ICU. A code was defined as tracheal intubation, cardiac compressions or both. Unfortunately, there is no separation of respiratory and cardiac arrest data to determine whether which type of arrest is the main contributor to the difference. LOE 3. Quality: Good. Direction: Supports statement Outcomes: E + F (combined respiratory and cardiac arrest rate), G (hospital mortality rate).


Comment: Retrospective, historical cohort study. This is an extension of the data reported in Tibballs 2005 study. The latter reported on the impact of a pediatric MET over a 12 month period after implementation. This study reports further data over 4 years of implementation and includes MET calls initiated by parents. Case mix severity was not measured either before or after implementation of MET. Excluded: NICU/PICU/OR and DNR patients. Only cardiac arrests and deaths measured. No comparison of respiratory arrests. LOE: 3 Quality: Good – comparison groups were well defined, outcomes measured in the same way, and both time (41 mo. vs. 48 mo) and # of admissions (104,780 vs. 138,424) in the pre and post MET times were very similar. Case mix severity was not measured and could be a confounding variable. However, the rate of preventable cardiac deaths would not be affected by case mix severity. Direction: positive with a decrease in preventable cardiac arrests, deaths and hospital mortality rate. Outcomes: B (Survival of event), F (cardiac arrest rate); G (hospital mortality rate)


Comment: Observational study using retrospective historical controls. No measurement of case-mix/severity in before and after time period. No assessment of respiratory arrests. Did exclude DNR patients. LOE: 3 Quality: Fair Direction: neutral (although a trend toward benefit, MET did not statistically improve cardiac arrest and death rate). Outcomes: F (cardiac arrest rate), G (hospital mortality rate)


Comment: Observational intervention study of a rapid response team (nurse-respiratory therapists) done for quality improvement purposes using retrospective data for comparison. There was no control for case-mix or severity of illness, no clear calling criteria mentioned. Also, the opening of an intermediate care unit during the post-intervention phase may have significantly confounded results. Although there seemed to be a trend towards decreased incidence of respiratory and cardiac arrests, there was no statistically significant change in either the rate of combined arrests (8.0 vs. 5.1/1000 admissions) or mortality rate (4.3 vs. 4.5/1000 admission) after implementation of the RRT. LOE 3. Quality - poor (did not control for case mix/severity of populations pre and post; also no clear calling criteria mentioned. Direction of Support - neutral, no effect, Outcomes: E + F (rate of respiratory and cardiac arrests; G = hospital mortality rate.