Rapid Response Teams and Early Warning Scores

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Saving children's lives...

Rapid Response Teams Saves Children's Lives at Pediatric Hospital, Study Shows

Sharek, assistant professor at Lucile Packard Children’s Hospital says “33 lives equivalent to an 18% reduction in monthly mortality rate were saved during the 19 month study period by RRT’s”
“Basically, despite the fact that RRT’s had never been shown to decrease mortality in hospitalized children , we decided to take a chance on this.”

New early warning system can predict life threatening events in hospitalized children
Duncan, paediatric intensivist at BCH, “early identification using a PEWS can be used to predict life threatening events in children.”

List goes on in favour of early warning systems and RRT’s, Brilli etc

Edwards – nobody in DGH “hold your horses”
If only GWB’s parents had an early warning system............
Introduction

• Suboptimal care may contribute to physiological deterioration of patients with major consequences on morbidity, mortality and requirement for intensive care

• Adult studies have shown that patients in hospital exhibit premonitory signs of cardiac arrest, which may be observed by nursing and medical staff but are frequently not acted upon
Always take note of the warning....

TOUCHING WIRES CAUSES
INSTANT DEATH

$200 FINE

Newcastle Tramway Authority
Introduction

• Modified Early Warning Score (MEWS) & Medical Emergency Team (MET)

• Adult scoring systems have been validated

• Can these concepts be transposed onto the paediatric population?
Study aims/objectives

• Design a tool for identifying children at risk of critical illness
• Design a new observational chart
• Educate staff in the use of new chart
• Determine feasibility of using C&VPEWS
• Validate the C&VPEWS
Ideal screening tool should be:

- Sensitive
- Inexpensive
- Minimal discomfort to patient
- Specific
- Easy to administer
- Results must be
  - Valid
  - Reliable
  - Reproducible
Investigational plan

• Overall study design
  – Prospective cohort study
• Setting
  – Admissions to all paediatric wards
• Patients
  – All paediatric patients (age 0-16 years)
• Exclusion criteria
  – Patients admitted directly to PICU & PHDU & cardiac arrest
Methodology

• C&VPEWS developed using physiological parameters based on APLS guidelines
• R&D and ethical approval obtained
• Nursing staff recorded the observations required on the new paediatric observation chart
• Data collated by research nurse and entered into a database for analysis
Outcome measures

• Critical illness measures
  – Respiratory arrest
  – Cardiac arrest
  – PHDU admission
  – PICU admission
  – Death
Data management

- Statistical methods for any abnormal measurement(s) on the C&VPEWS for detecting critical illness
  - Sensitivity
  - Specificity
  - Positive predictive value
  - Negative predictive value
Results

- 1000 patients
- 823/1000 triggered C&VPEWS
- 16/1000 defined as having adverse outcome
## Results – cut off >=2

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>95% CI</th>
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<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
<td>69.5%</td>
<td>59.0 – 78.4</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td>89.9%</td>
<td>89.8 – 90.0</td>
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<tr>
<td><strong>PPV</strong></td>
<td>5.9%</td>
<td>5.0 – 6.7</td>
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<tr>
<td><strong>NPV</strong></td>
<td>99.7%</td>
<td>99.6 – 99.8</td>
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Discussion - Adults

• Before & after studies have suggested RRT’s reduce cardiopulmonary arrests & mortality

• Only RCT did not demonstrate any benefit

• To date no paediatric RCT’s have been published & results from before & after studies are inconsistent

- No statistically significant reduction in cardiac arrest or death after introduction of a RRT
- Well defined, objective & easily reproducible triggering criteria that lead to activation of RRT on 184 occasions during 35, 892 hospital admissions

- No statistically significant reduction after introduction of RRT, in respiratory and cardiopulmonary arrests outside ICU’s
- Used more subjective criteria & less dependent on physiological – potentially less reliable
- RRT was activated 27 times during 9615 admissions

Cincinnati / Brighton tool

- Statistically significant reductions in both hospital–wide mortality rates, respiratory & cardiopulmonary rates outside ICU
- Criteria used were based on acute changes in physiological observations but actual values or size of change was not defined
- 143 triggering episodes in 7287 admissions following introduction of the RRT

Lucille Packard tool

- Claim to have demonstrated acceptable performance of trigger criteria – data validated
- Inappropriate methodology & analysis was used

- Most robust validation of a PEWS
- Area under ROC curve (0.90, 95% CI 0.83 – 1.0) in this study was similar to C&VPEWS (0.86, 95% CI 0.82 – 0.91)
- Sensitivity (78%) & specificity (95%) were similar to C&VPEWS (sensitivity - 70%, specificity - 90%)
- Activation rate of both C&VPEWS & Duncan system was greater than in three evaluation studies
- Difficult to use
C&VPEW Issues

• Low PPV of trigger criteria
• Large number of false positive triggers
• Most patients (823/1000) had ≥ 1 abnormal C&VPEWS criteria at some time during admission
• It is impossible to reconcile difference between higher numbers triggering C&VPEWS & low numbers in three evaluation studies without data to validate their activation criteria
What does the DGH need....

• Tool that is easy to use, reproducible
• Who should be in the PETS
  – Same people that do not recognise the critically ill child
  – Contact PICU
• Doesn’t tell me when and how to intervene
• Proven to be better than what we have now
• Crystal ball
Discussion

• Persistent issues that require further examination & debate include establishment of optimal trigger criteria to activate a paediatric RRT

• None of three evaluation studies validated their activation criteria
Outcome Measures

• Most objective outcome measure of critical illness is death
  – Rare in children
• Other outcome measures
  – HDU/PICU admission
  – Less reliable used in this study and other published research
  – Decision to call an arrest team
• Limitations in validity & reliability of outcome measures affect both research to validate trigger criteria & studies on effectiveness of RRT’s
Conclusion

• Scoring systems based on physiological parameters are appealing
• To date validation studies have not shown trigger criteria that have high sensitivity that is not at cost of low specificity
• If available trigger criteria were implemented completely RRT’s would be called frequently to children who would not go on to develop critical illness
• High grade evidence on effectiveness of RRTs i.e RCT’s is not available
• Practical difficulties implementing RRT’s in DGH’s
Conclusion

- The majority of these studies have introduced a period of intense education at the same time as trigger tool.
- Presence of abnormal parameters does not identify those children likely to develop critical illness nor tell the team when & how to intervene & whether intervention would improve clinical outcome.
Conclusion

• Identifying children likely to develop critical illness can be difficult

• C&VPEWS based on APLS guidelines “Recognition of the sick child” would frequently trigger the PETS team unnecessarily

• C&VPEWS appears sensitive but not specific

• It does not discriminate between unwell children and those who develop critical illness
Conclusion

• “Above all do no harm”
• No screening test should be introduced until it has been subjected to rigorous evaluation & meets strict criteria
• Further research to find optimum trigger criteria & a multi centre RCT to determine effectiveness of RRT’s is required before widespread implementation of an unproven intervention takes place
Future

• Education

• Teamwork & continuity

• Assess all other tools

• See if certain physiological parameters are more sensitive than others
A SMALL TRUTH TO MAKE LIFE 100% (Tempered by the realities of life)
From a strictly mathematical viewpoint …

What Makes 100%?
What does it mean to give MORE than 100%?
Ever wonder about those people who say they are giving more than 100%?
We have all been to those meetings where someone wants you to give over 100%.

How about achieving 103%?
What makes up 100% in life?

Here's a little mathematical formula that might help you answer these questions:
If

ABCDEFGHIJKLMNOPQRSTUVWXYZ

is equal to

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Hard Work
H+A+R+D+W+O+R+K
8+1+18+4+23+15+18+11 = 98%

Knowledge
K+N+O+W+L+E+D+G+E
11+14+15+23+12+5+4+7+5 = 96%
Love

L+O+V+E
12+15+22+5 = 54%

Luck

L+U+C+K
12+21+3+11 = 47%

( don't most of us think this is the most important ??? )
Then what makes 100%?

Is it **Money**? ... **NO ! ! !**

M+O+N+E+Y

13+15+14+5+25 = 72%

**Leadership**? ... **NO ! ! !**

L+E+A+D+E+R+S+H+I+P

12+5+1+4+5+18+19+9+16 = 89%
Every problem has a solution, only if we perhaps change our attitude.

To go to the top, to that 100%, what we really need to go further... a bit more...
ATTITUDE

A+T+T+I+T+U+D+E
1+20+20+9+20+21+4+5 = 100%

It is OUR ATTITUDE towards Life and Work that makes OUR Life 100% ! ! !
ATTITUDE IS EVERYTHING

Change Your Attitude ...
And You Change Your Life !!!
However

B-U-L-L-S-H-I-T
2+21+12+12+19+8+9+20 = 103%
AND, look how far ass kissing will take you.
A-S-S-K-I-S-S-I-N-G
1+19+19+11+9+19+19+9+14+7 = 118%
(A-R-S-E-K-I-S-S-I-N-G even further – 122%!)
So, one can conclude (with mathematical certainty) that while Hard Work and Knowledge will get you close, and Attitude will get you there, it's the Bullshit and Arse Kissing that will put you over the top.
Any Questions?

"Your pulse is very, very weak!"

"Well, it's not a _good_ sign, that's for sure ..."
• Franklin C. & Mathew J. (1994) Developing strategies to prevent in hospital cardiac arrest: analyzing responses of physicians and nurses in the hours before the event. Critical Care Medicine 22, 244-247.
• Goldhill D.R. (1997) Introducing the postoperative care team: additional support, expertise and equipment for general postoperative patients. British Medical Journal 314, 389