MULTI-CENTER IMPLEMENTATION OF A RAPID RESPONSE SYSTEM IN FOUR PEDIATRIC ACADEMIC HOSPITALS DEMONSTRATING EFFECTIVENESS

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On Behalf of the Ontario Pediatric Critical Care Response Team Collaborative
Review the history of the Ontario Pediatric Critical Care Team Collaborative

Describe Methods

Describe Data Collection

Report Results

Report Expansion of concept

Limitations
Ministry of Health and Long Term Care - Critical Care Strategy for the province of Ontario

2006 funded the development and implementation of a rapid response system into 4 academic pediatric hospitals
Objectives

- **Primary**
  Determine effect of PMET on rate of code blue Events

- **Secondary**
  Determine the effect of the PMET on rate of:
  - PICU Readmission within 48 hours of discharge
  - Urgent PICU admissions
  - Mortality
Methods – Study Design

- Prospective observational study

- Prospective Data Collection

Compared to

- Retrospective Data Collection
  - Administrative Databases
  - October 31, 2004 – October 31, 2006
Methods - Setting

- Province of Ontario
- 13 million people
- 98% of all critically ill children admitted into one of the 4 academic tertiary pediatric hospitals
## Methods - Setting

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Hospital Beds</th>
<th>PICU Beds</th>
<th>Cardiac Program</th>
<th>ECPR</th>
<th>Transplants</th>
</tr>
</thead>
<tbody>
<tr>
<td>SickKids</td>
<td>300</td>
<td>32</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>CHEO (Ottawa)</td>
<td>166</td>
<td>10</td>
<td>✔</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>MCH (Hamilton)</td>
<td>120</td>
<td>8</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>LHSC (London)</td>
<td>60</td>
<td>8</td>
<td>✗</td>
<td>✗</td>
<td>✔</td>
</tr>
</tbody>
</table>
### Method-Development

#### Phase 1 Development
- Project development, recruitment of site champions and MET providers, training of MET providers, development of marketing strategy and promotion of RRS, retrospective data collection.

#### Phase 2 Initiation
- MET piloted 8hrs/day, 5 dlwk on-going RRS promotion.

#### Phase 3 Full Implementation
- MET available 24 hours per day, 7 days per week.
- Quality improvement, data collection, ongoing promotion of the RRS
- Education program for ward health care providers.

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# Methods - Data Collection

<table>
<thead>
<tr>
<th>Activation</th>
<th>A new referral to the PMET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow up Activation</td>
<td>Follow up visit to a patient triaged to remain on the ward</td>
</tr>
<tr>
<td>Follow up PICU Discharge</td>
<td>Follow up visit of a patient discharge from the PICU</td>
</tr>
<tr>
<td>Total Unplanned PICU Admission</td>
<td>Urgent + Readmission to PICU</td>
</tr>
<tr>
<td>Urgent PICU Admission</td>
<td>Activation leading to PICU admission</td>
</tr>
<tr>
<td>PICU Readmission</td>
<td>Patient readmitted to PICU within 48 hours of PICU discharge</td>
</tr>
<tr>
<td>Total Code Blue Events</td>
<td>Any activation of the Code Blue System</td>
</tr>
<tr>
<td>Differentiated Code Blue Event</td>
<td>If CPR or PPV &gt;30 sec or intubation or IV epinephrine</td>
</tr>
</tbody>
</table>
Results - Activity

- 2476 Activations
- Activation rate 40/1000 hospital admissions
- 7300 patients followed after PICU Discharge
Results - Activity

### Activating Profession
- RN 57%
- MD 37%
- RT 2%
- Family 1%
- Other 3%

### Activating Trigger
- 46% Respiratory Trigger
- 21% CVS Trigger
- 18% Health Care Provider Concern
- 11% Neurologic Trigger
- 3% Other
## Results – Code Blue Events

<table>
<thead>
<tr>
<th></th>
<th>Pre- PMET</th>
<th>During PMET</th>
<th>Rate/1000 hospital admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Code Blue Events</strong></td>
<td>210</td>
<td>150</td>
<td>4 vs 3 p &lt; 0.0001</td>
</tr>
<tr>
<td><strong>Differentiated Code Blue</strong></td>
<td>69</td>
<td>66</td>
<td>1.9 vs 1.8 p = 0.68</td>
</tr>
<tr>
<td><strong>Undifferentiated Code Blue</strong></td>
<td>123</td>
<td>67</td>
<td>3.4 vs 1.9 P &lt; 0.0001</td>
</tr>
</tbody>
</table>
## Results - Admissions

<table>
<thead>
<tr>
<th></th>
<th>Pre PMET</th>
<th>During PMET</th>
<th>Rate/1000 hospital admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Admission</td>
<td>55469</td>
<td>55963</td>
<td></td>
</tr>
<tr>
<td>PICU Admission</td>
<td>7068</td>
<td>7227</td>
<td></td>
</tr>
<tr>
<td>Unplanned PICU Admission</td>
<td>951</td>
<td>1054</td>
<td>17 vs 18 p = 0.19</td>
</tr>
<tr>
<td>Urgent PICU Admission</td>
<td>751</td>
<td>891</td>
<td>13.5 vs 16 p = 0.19</td>
</tr>
<tr>
<td>PICU Readmission</td>
<td>200</td>
<td>163</td>
<td>3.6 vs 2.9 P &lt; 0.0004</td>
</tr>
</tbody>
</table>
## Results - Mortality

<table>
<thead>
<tr>
<th>Mortality</th>
<th>Pre PMET</th>
<th>During PMET</th>
<th>Rate/1000 hospital admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Hospital</td>
<td>553</td>
<td>540</td>
<td>10 vs 9.6, p = 0.65</td>
</tr>
<tr>
<td>Unplanned PICU Admission</td>
<td>86</td>
<td>68</td>
<td>1.6 vs 1.2, p = 0.02</td>
</tr>
<tr>
<td>Urgent PICU Admission</td>
<td>70</td>
<td>61</td>
<td>1.3 vs 1.1, p = 0.25</td>
</tr>
<tr>
<td>PICU Readmission</td>
<td>16</td>
<td>7</td>
<td>0.3 vs 0.1, p = 0.05</td>
</tr>
</tbody>
</table>
Conclusion

- 29% reduction in total Code Blue Events
- 20% reduction in PICU mortality secondary to unplanned admissions
- 57% reduction in PICU mortality secondary to PICU readmission
Where we are different

- Activation 40/1000
- PICU admission 30%
- Novel use of PMET to decrease PICU Readmission
No change in all cause hospital mortality
  - palliative care
No change in differentiated code blue events
  - low numbers
Hospital Interaction
  - consultants lower threshold to discharge with PMET “backup”
Future Goals

- Demonstrated a decrease in Total Code Blue events BUT only 40% with prior PMET involvement
  - PEWS
  - Mandatory Calling
- Determine the factors that are associated with readmission
- Examine the interventions the PMET instituted on patients that remained on the wards and prevented PICU readmission
- Examine whether PMET has altered the way deteriorating patients are managed by the ward teams