The Sydney paediatric trauma system and the effect of the discontinuation of the HIRT case identification process

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The Sydney paediatric trauma system

Background

- Two thirds of severely injured children in Sydney went to an adult trauma hospital before transfer to a children’s hospital
- Children receiving definitive care in an adult trauma centre were three times more likely to die

Head Injury Retrieval Trial (HIRT) and paediatric trauma response

HIRT commenced operations in May 2005

**HIRT system**

- At the request of the funding insurance company, the HIRT system responded to all children likely to have severe head injuries from the beginning of the trial
- From 2008 HIRT responded to all severely injured & drowned children
Advent of the Rapid Launch Trauma Coordinator

NSW Ambulance partially replicated the trial case identification system and began tasking their physician staffed medical teams to the same cases from the end of 2007.

NSW Ambulance management stated that:
- They believed that there was already sufficient evidence to mandate physician prehospital care as routine for severely injured patients;
- They had a duty of care to dispatch physicians and the area in which the trial operated could not be exempted.

Note: the 2013 NSW Reform Plan for Rotor Wing Retrieval Services endorsed physician prehospital care as the standard and it has since been introduced on all NSW HEMS services for prehospital response.
Parallel dispatch systems for children

**HIRT**
A member of the crew continuously monitored a web based link (Visinet) to the ASNSW CAD system.

**RLTC**
A paramedic based at the MRU continuously monitored the same screens

**When either dispatch system identified an appropriate paediatric case they immediately notified the other and HIRT was dispatched.**

**Natural experiment**
Both systems were looking for the same cases in parallel to each other

Provided a unique opportunity to directly compare two tasking systems
Direct transport to a PTC was more likely to occur when the HIRT system was available than when it was not available (RR 1.81, 95% CI 1.20-2.73)
HIRT available versus unavailable

Excluding the child who died at the ATC before transfer, the median time (minutes) to arrival at the PTC was significantly shorter ($P<0.01$) when the HIRT system was available (92, IQR 50-261) than when the HIRT system was unavailable (296, IQR 84-583).
Identification system

Of the 44 cases occurring during the HIRT available periods, 21 were not identified for physician team response, 3 were identified by the RLTC and 20 were identified by the HIRT system, \( P < 0.001 \) for the observed proportions if it is assumed that both dispatch systems are equally effective at identifying severe trauma cases.

There were no deaths among the children that were not identified by the HIRT dispatch system.
Conclusion for study 1

The HIRT system had significantly greater sensitivity than the RLTC and did not miss any cases where the child was severely injured enough to die.

When HIRT was available two thirds of severely injured patients went directly to a PTC. When HIRT was unavailable this number reverted to the historic norm.

Patients arrived at a PTC a median of 3.5 hours faster when HIRT was available.

What could go wrong?
Cessation of enrolment in HIRT – March 2011

The HIRT dispatch process was discontinued by the NSW Ambulance at cessation of randomisation in March 2011

- Access to the CAD screens by CareFlight was withdrawn by Ambulance
- All tasking since then has been by the RLTC only
Study 2: (HIRT and RLTC in parallel) vs (RLTC alone)

**Objective**
Compare the accuracy of the parallel HIRT and RLTC case identification system used prior to March 2011 with the RLTC operating in isolation since then.

**Design**
Retrospective, registry based comparison

**Inclusion criteria**
Cases were abstracted from the ITIM Statewide trauma registry if they met the following inclusion criteria:

- Age < 16 years.
- Incidents within the Sydney coordination area of the NSW Ambulance.
- Injury Severity Score (ISS) > 15
- Incident notification occurred via 000
- Incidents occurred between 24th May 2008 and 13th March 2011 (period 1; 33 months) or 14th March 2011 and 30th September 2014 (period 2; 54 months)
Differences between the time periods

No other system changes occurred between the two time periods.

Only times when the CareFlight (HIRT) helicopter was available to be tasked were considered to ensure that system configuration was the same between periods.
<table>
<thead>
<tr>
<th></th>
<th>HIRT + RLTC (n=71)</th>
<th>RLTC alone (n=126)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR) age, years</td>
<td>6 (2-12)</td>
<td>8 (3-13)</td>
<td>0.232</td>
</tr>
<tr>
<td>Median (IQR) ISS</td>
<td>22 (17-25)</td>
<td>25 (19-29)</td>
<td>0.012</td>
</tr>
<tr>
<td>Mechanism of injury (n, %)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Drowning</td>
<td>12 (16.9)</td>
<td>15 (11.9)</td>
<td>0.206</td>
</tr>
<tr>
<td>Fall</td>
<td>20 (28.2)</td>
<td>42 (33.3)</td>
<td></td>
</tr>
<tr>
<td>MVA</td>
<td>6 (8.5)</td>
<td>6 (4.8)</td>
<td></td>
</tr>
<tr>
<td>MBA</td>
<td>1 (1.4)</td>
<td>10 (7.9)</td>
<td></td>
</tr>
<tr>
<td>Pedal cyclist</td>
<td>3 (4.2)</td>
<td>5 (4.0)</td>
<td></td>
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<tr>
<td>Pedestrian</td>
<td>14 (19.7)</td>
<td>28 (22.2)</td>
<td></td>
</tr>
<tr>
<td>Hanging/suffocation</td>
<td>2 (2.8)</td>
<td>8 (6.3)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>13 (18.3)</td>
<td>12 (9.5)</td>
<td></td>
</tr>
<tr>
<td>ICU admission (n, %)</td>
<td>44 (62.0)</td>
<td>76 (60.3)</td>
<td>0.819</td>
</tr>
<tr>
<td>Median (IQR) ICU LOS, days</td>
<td>1 (0-6)</td>
<td>1 (0-3)</td>
<td>0.357</td>
</tr>
<tr>
<td>Median (IQR) hospital LOS, days</td>
<td>7 (1-15)</td>
<td>6 (2-19)</td>
<td>0.657</td>
</tr>
</tbody>
</table>
Percentage of cases identified for physician response

P < 0.001

![Bar chart showing the percentage of cases identified for physician response. The chart compares HIRT + RLTC against RLTC alone. The percentage identified for HIRT + RLTC is 62%, and for RLTC alone is 31%. The difference is statistically significant (P < 0.001).]
Percentage of fatal cases not identified

P < 0.001
Percentage with direct transport to paediatric trauma centre

P = 0.076
Median time to final hospital (mins)

![Bar chart showing median time to final hospital for different dispatch models.]

- **HIRT + RLTC**
  - Median time: 67 mins
- **RLTC alone**
  - Median time: 82 mins

Significance:

P = 0.034
Median time to reach paediatric trauma service (mins)

P = 0.003
Transporting team and destination (%)

P < 0.001
Treating prehospital team (%)

P < 0.001
Limitations

• Registry data; prospectively collected but not for this purpose

• Before and after design; factors unknown to us may have changed
Conclusions

Physician response to severe trauma patients in NSW is system policy and accepted standard of care. However, since cessation of HIRT when the trial dispatch system was discontinued:

• For severely injured children in the Sydney region, the rate of physician prehospital care has halved

• Time to arrive at the final hospital and at a Paediatric Trauma Centre has significantly increased

• More than half of children who are severely injured enough to die do not now have a physician response activated, whereas all fatalities had a physician response when the HIRT system was operational
Editorial comment