The Afferent Limb
Detecting crises and using technology to facilitate a response

Gary B Smith, FRCA, FRCP
Portsmouth Hospitals NHS Trust & University of Bournemouth

Problems with crisis detection and response activation

1. Afferent limb of rapid response system is responsible for detection and triggering of a response.
2. Rapid response system often fails because of failures in afferent limb.
3. Variables must be measured accurately and frequently.
4. There is a need to identify the important variables to measure.
5. Documentation must be accurate, timed, dated and legible.
6. For determining the appropriate trigger levels of trigger systems, all relevant variables must be measured every time a dataset is obtained.
7. Where aggregated trigger systems are used, there should be accurate calculation of early warning scores.
8. There should be an unambiguous, activation protocol for summoning a response.

How can technology improve the afferent limb of an RRS?

- Continuous monitoring and recording
- Large and rich database:
  - better definition of the problem
  - definition of "normal" vital sign ranges and their incidence
- Modelling of correct variables
- Designation of correct weighting and correct trigger levels
- Development of a valid robust EWS
- Permits use of more complex rules for calling criteria, e.g. trends
- Accurate and speedy calculation of EWS
- Automation leads to assured detection and alerting
- Ability to “push” and “pull” data
- Permits auditing of the response or failure of response

VitalPAC™
Accurate calculation of EWS and decision support

Patient history

Monitoring plan for each patient
- Baseline minimum observation
- Subsequent schedule based on EWS
- Clearly defined set of mandatory parameters

Graded, timely response

Laboratory tests

Radiology reports

PAS

Research

Outcomes
Cumulative PHT data March 2005 – December 2006 [MAU]

Pattern of vitals signs datasets in 24 hour period

Excludes patient’s first observation set

n = 20681

Portsmouth Hospitals NHS Trust vital signs database

Diurnal pattern of Medical Emergency Team activation

Pattern of respiratory rate

Modified from Galhotra et al. CCM 2006; 34: 1700-1706

Relationship of respiratory rate, age and in-hospital mortality

1st observation in patients staying beyond midnight or dying before midnight

n = 10051

Which variables are important?

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>RR</th>
<th>T</th>
<th>SBP</th>
<th>DBP</th>
<th>MBA</th>
<th>APV</th>
<th>Age</th>
<th>chi- square</th>
<th>C- statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.023</td>
<td>0.688</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.529</td>
<td>0.707</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.207</td>
<td>0.706</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.165</td>
<td>0.703</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.434</td>
<td>0.746</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.149</td>
<td>0.824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgements

Portsmouth Hospitals NHS Trust
- David Prytherch
- Paul Schmidt
- Peter Featherstone
- Debbie Knight
- Nursing staff of Portsmouth Hospitals NHS Trust

Shrewsbury & Telford NHS Trust
- Gill Clements
- Nursing staff of Shrewsbury & Telford NHS Trust

University of Birmingham
- Mohammed Mohammed

The Learning Clinic
- Roger Killen
- The staff of The Learning Clinic

http://www.microsoft.com/uk/nhs/vitalpac.mspx