Monitoring: Advanced Technology in ICU

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Declarations

Unlicensed medical devices

Funding Health Foundation & UKCLRN (GBP 110k)
Specialist Children’s Hospital
220 beds & 32,000 admissions pa
26-31 PIC beds & 1,300 PIC admissions pa
8% of UK PIC
Challenges
Intensive Care Unit
Review ALTEs, unplanned extubation & sepsis

- Infrequent observations miss deterioration
- Continuous data & understanding is lost
- Pattern recognition limited
- Predictable = preventable?
Patient specific

- Heart rate 163/min
- SpO2 76%

Normally abnormal
Technology to support clinical decisions
Adaptive

Model comparing with population and learning this patient’s patterns
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
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<tbody>
<tr>
<td>HR</td>
<td>151.0000</td>
<td>133.3518 bpm</td>
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<tr>
<td>Pulse</td>
<td>150.0000</td>
<td>133.4854 bpm</td>
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<tr>
<td>SpO2</td>
<td>45.0000</td>
<td>65.6574%</td>
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<tr>
<td>Resp</td>
<td>31.6291</td>
<td>rpm</td>
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<tr>
<td>ARTs</td>
<td>57.0000</td>
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<td>ARTm</td>
<td>46.0000</td>
<td>65.7545 mmHg</td>
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<tr>
<td>ARTd</td>
<td>38.0000</td>
<td>49.4859 mmHg</td>
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<tr>
<td>Bed Label</td>
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<tr>
<td>CVPm</td>
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<td>27.5263 mmHg</td>
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<tr>
<td>etCO2</td>
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<tr>
<td>NBPm</td>
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<tr>
<td>NBPd</td>
<td>98.5000 mmHg</td>
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<tr>
<td>NBPd</td>
<td>38.0000 mmHg</td>
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</table>

SpO2 Model Distance

PEWS Continuous, modified
Intuitive displays
T21 child with pulmonary hypertension

First warning at 5.26
Wakes up at 6.26
Unplanned extubation at 7.06

Not visible with bedside monitoring but could we predict this in future?
Scalable: 3 months in 26 bedded PICU = 1 race car in 1 hour

Real-time: sees and alerts deviations as they happen

Reliable: sanity checks - cross-checking characteristic relationships

Cost-effective: software solution, wireless sensors
What should we do now?

- Look.... predictable & preventable event...
- Warning
  - sensitive and specific
  - Whole hospital surveillance
  - ‘@ risk patients’
  - unstructured & structured data
  - Human computer interactions
  - Prediction........where is the tipping point
Life can only be understood looking backwards but needs to be lived forward

Soren Kierkegaard
Thank you

Acknowledgements

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