Development of a human factors classification framework for patient safety

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Background

• Estimated 16.6% of admissions associated with an adverse medical event in Australia (Wilson et al 1995)

• In 2004, NSW Patient Safety & Clinical Quality Program launched

• Electronic Incident Information Management System (IIMS) implemented – for both clinical and corporate incidents

• Severity Assessment Code (SAC) assigned
Background

- SAC 1 (Clinical) serious clinical consequences:
  - Death unrelated to natural course of illness; suicide; homicide; wrong patient; wrong body part; retained instruments or material; medication error; intravascular gas embolism; haemolytic blood transfusion; maternal death; infant discharge to wrong family; + patient fall in hospital

- Must be reported to Health Dept. within 24 hours

- RCA conducted and final report within 70 days
Background

• Root Cause Analysis investigation
  – RCA teams – fundamental knowledge about care processes in area where event occurred
  – Statutory privileged investigation
  – Generally 3 meetings – flow chart; cause & effect; causation statements; recommendations
  – Feedback to staff

• Approx 500 RCAs conducted each year in NSW for SAC 1 events
• RCA report & recommendations
  – Often more policies, procedures
• Need additional information on events
• Approached UNSW

Modified from ‘Cycle of Error’; Cook, 1993
Aims

• Develop a framework for human factors analysis of adverse medical events

• Assess framework reliability in identifying the contribution of human factors and error to these events
Method

• Multi-staged process:
  – Systematic review of frameworks used to classify the human factors contribution to adverse medical events

• Numerous taxonomies developed eg.
  – Purpose-specific (e.g. medication errors)
  – Setting-specific (e.g. GP; ED)
  – WHO International Classification for Patient Safety (2009)

• Existing taxonomies
  – Do not consider temporal sequence of events
  – Often categories are not mutually exclusive
  – Often do not assess reliability
Human Factors framework

- Records information in 6 content areas
- up to 3-level hierarchical structure for incident precursors and contributing factors
Example of sub-categories of precursors

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
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</thead>
<tbody>
<tr>
<td>3. Human action – staff</td>
<td>3.2. Medical task failure</td>
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<td></td>
<td>3.2.1. Skill-based</td>
<td>3.2.1. Skill-based</td>
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<td>3.2.2. Rule-based</td>
<td>3.2.2. Rule-based</td>
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<td>3.2.3. Knowledge-based</td>
<td>3.2.3. Knowledge-based</td>
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<td>3.2.4. Violation</td>
<td>3.2.4. Violation</td>
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</tbody>
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Precursors and contributing factors

Precursors (PE)

1. Medical equipment eg. 1.1 lack of equipment; 1.2 equipment failure
2. Work environment eg. 2.1 light; 2.2 temperature; 2.3 noise
3. Human action – staff eg. 3.1 communication/teamwork; 3.2 medical task failure; 3.3 monitoring - inadequate; 3.4 delay; 3.5 misdiagnosis
4. Human action – patient

Contributing factors

- Medical equipment
- Work environment
- Human action – staff
- Patient factors
- Organisational factors
- Complexity
- Individual factors (staff)
- Other
A cardiothoracic surgeon performed mitral valve repair on a patient with congestive heart failure and arterial fibrillation. To test the competency of the repaired mitral value, the bevelled end of a soft rubber tubing was inserted into the left ventricle. The tubing was inserted too far and caused a perforation in the ventricle and the patient died as a result of haemorrhage.

Precursors and contributing factors

Patient death

3. human action; 3.2 medical task failure; 3.2.1 skill-based error

1. Medical equipment; 1.3 medical equipment nec

Contributing factors

- 4. Patient; 4.1 physical health, pre-existing disease
- 5. Organisational factors; 5.3 resources & supplies; 5.3.2 medical supplies
In progress – inter-rater reliability

- Publically available coronial findings
  - Trialing and modifying classification system
- Random sample of 20 RCA reports (n=4 coders)
- Precursor subcategories:
  - Level 1: range 55% to 85% agreement
  - Level 2: range 25% to 70% agreement
  - Level 3: range 20% to 55% agreement
- Disagreements between coders:
  - Temporal sequence of precursors
  - Rule or knowledge-based error
Issues and limitations

- RCA reports – pre-processed information
- Same coding; different meaning
- Different coding; same meaning
- To enhance inter-rater reliability:
  - More refinement of precursor and contributing factor classification options
  - Tightening of precursor and contributing factor classification definitions
Conclusion and next steps

- Is a reliable temporal sequence possible?
- Further refinement should improve reliability
- Involvement of clinical expert working group
- Examination of inter-rater reliability:
  - 100 RCA reports
  - Comparison with other human factors classification systems
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