Mayo Clinic
HFACS Evaluation of Surgical and Procedural Never Events

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Human Factors/Ergonomics In Surgery?

- Nearly half of all preventable health care death are related to surgery and procedures
- Human error is inherent in all human activities
- Operating room has been targeted for quality and safety improvement.
Significance of Human Factors in Medicine

Understanding the interactions among humans and with other elements of a system can increase patient safety.

Example: Never Events

<table>
<thead>
<tr>
<th>Retained foreign object</th>
<th>Wrong site/side surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong implant</td>
<td>Wrong patient/ Wrong procedure</td>
</tr>
</tbody>
</table>

Reoperation Rate 48%
Education intervention prior to HFACS

- Memo to all staff
- Special education session with front line staff
  - All Staff meeting
  - Special presentation
  - Online training
- Work with industry to re-engineer products
Top 3 JTC Root Causes for Sentinel Events from 2010 to Today

- Leadership
- Human Factors
- Communication

- Human Factors Analysis and Classification System (HFACS)
  - Identify common root causes
  - Adapted/validated in medicine
Methods for Example

- All surgical and procedural never events
- Single institution
- Prospectively collected
  - Using Human Factors Accident Classification System
- 5 year period
- 1.5 million procedures
- 70 Never Events
  - 69 HFACS Reviewed

Never Events by Type

- Operating Room (64%)
- Procedural Areas (36%)
- Major, 35%
- Minor, 61%
- MIS, 4%
Never Events by Type (n=69)

- Wrong side/site: 32%
- Retained Foreign Object: 26%
- Wrong implant: 6%
- Wrong procedure: 36%

HFACS: Preconditions for Actions

- Situational Factors: 3 (8%)
- Patient Factors: 35
- Personnel Factors: 69

HFACS categories with number of nano-codes by event type

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Actions</th>
<th>Organizational Influences</th>
<th>Oversight / Supervisory Factors</th>
<th>Preconditions for Actions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained foreign object</td>
<td>102</td>
<td>9</td>
<td>16</td>
<td>94</td>
<td>221</td>
</tr>
<tr>
<td>Wrong implant</td>
<td>24</td>
<td>1</td>
<td>5</td>
<td>32</td>
<td>62</td>
</tr>
<tr>
<td>Wrong procedure</td>
<td>78</td>
<td>6</td>
<td>12</td>
<td>99</td>
<td>195</td>
</tr>
<tr>
<td>Wrong side/site</td>
<td>56</td>
<td>9</td>
<td>14</td>
<td>71</td>
<td>150</td>
</tr>
<tr>
<td>Total</td>
<td>260</td>
<td>25</td>
<td>47</td>
<td>296</td>
<td>628</td>
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</table>


HFACS

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<td>296</td>
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# HFACS

## Unsafe acts or errors that caused the event.

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### Errors
- 87% (227)

### Compliance
- 13% (33)

- Bending the rules
- Breaking the rules

## Conditions that allowed the error to occur.

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### Environmental Factors
- (26%)

### Patient Factors
- (12%)

### Situational Factors
- (1%)

### Personnel Factors
- (23%)

### Conditions of the Care Provider
- (38%)
### Distribution of nano-codes per event type

<table>
<thead>
<tr>
<th>Event Type</th>
<th># Of Events</th>
<th>Maximum # of nano-codes per event</th>
<th>Average # of nano-codes per event</th>
<th>Median # of nano-codes per event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained foreign object</td>
<td>18</td>
<td>20</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Wrong implant</td>
<td>5</td>
<td>21</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Wrong procedure</td>
<td>24</td>
<td>18</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Wrong side/site</td>
<td>22</td>
<td>12</td>
<td>7</td>
<td>7</td>
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HFACS

**Human Factors Analysis and Classification System**

**Actions**
- Perceptual errors:
  - Visual illusions
  - Misinterpretation
- Confirmation bias
  - Spatial
  - Directional inattention
- Misperceived/understood communication
  - Accurate
  - Non-English speaking
  - Jargon
  - Interpretive bias
  - Emotionality

**Decisions errors**
- Inadequate procedure
- Inadequate experience for complexity of situation
- Inadequate assessment
  - Rely on patient provided information
  - Information in EHR not reviewed
- Inadequate diagnostic:
  - Incomplete
  - Inconsistent
  - Mixed
- Inadequate treatment:
  - Inadequate response to emergency

**Factors related to use of the system**
- Difficult to understand
- Difficult to process
- Difficult to interpret

**Preconditions for Actions**
- Cognitive Factors:
  - Loss of situational awareness
  - Distraction
  - Stress
  - Overconfidence
  - Inadequate vigilance
  - Short-term memory
  - Emotional or physical fatigue
  - Error proneness
  - Cognitive overloading
  - Inadequate or flawed equipment
  - Inadequate or flawed environment
  - Cognitive overload due to single focus

Physical/Mental Limitations:
- Visual limitations:
  - Limited visual acuity
  - Color blindness
- Age
- Limited hearing
- Insufficient reaction time
- Information overload
- Lack of critical information
- Language barriers
- Access to information
- Jargon specific to the area or discipline

**Physiological Factors**
- Medical illness
- Nervousness

Cognitive Factors:
- Failed to understand
- Confirmation bias
- Focus on a single issue

Balance cognitive workload & cognitive capacity

- Reduce cognitive workload (standardization, electronic tools)
- Pool cognitive capacity (team work)
Team Cognition
Can the OR team pool their cognition?

Established team function
- Team stability
- Shared mental model
- How much cognitive capacity can each member contribute

Ad hoc team function
- What are engagement rules for optimal performance
- How to share knowledge efficiently ad hoc

HFACS knowledge disseminated
- Engage Clinicians and Allied Health teams
- Engage HSE team
- Have joint Clinician, Nurse & HSE teams to examine systems issues identified
- Work with Supply Chain, IT, etc. to mitigate
We should spread use of prospectively
HFACS analysis of Sentinel Events

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