Observation and Categorization of Process Inefficiencies Related to Cardiopulmonary Bypass

Erin E. Pohl, B.A/Speaker
Embry-Riddle Aeronautical University
Daytona Beach, FL
Disclosures

- I have no disclosures
Overview

• Define Human Factors Psychology
• Process Inefficiencies in Systems
• Methods
• RIPCHORD Taxonomy
• Results
• Discussion
• Take Home Points
What is Human Factors Psychology?

- scientific discipline that studies the relationship between humans and technology
  - characteristics of human beings that are applicable to the design of systems and devices
  - improve human/system interaction by designing safe and effective systems using a blend of engineering and psychological principles
Process Inefficiencies in Systems

What are flow disruptions?

- deviations from the natural progression of a process \(^1,2\)
  - introduce unwanted distractions and open the door for errors to occur \(^3\)
  - provide both quantitative measures and qualitative detail about the processes that create inefficiencies and risk in healthcare systems \(^4\)
Process Inefficiencies in Systems

Why study flow disruptions?

• obtain a baseline measure for interruptions
  – gives us the ability to make comparisons before and after interventions are implemented
  – allows us to better develop evidence-based interventions
Methods

• Medical University of South Carolina
• prospective observation in real-time
• 10 cases in CVOR
• embedded in 3 specialties:
  – perfusion, circulating nurse, anesthesia
• classified flow disruptions using RIPCHORD taxonomy
RIPCHORD* Taxonomy
*Realizing Improved Patient Care through Human-centered Operating Room Design

- **Communication**
  - Ineffective Communication
  - Lack of Response
  - Confusion
  - Simultaneous Communication
  - Nonessential Communication
  - Environmental Noise
  - Lack of Sharing

- **Coordination**
  - Personnel Rotation
  - Personnel Not Available
  - Unknown Information
  - Protocol Failure
  - Charting/Documentation
  - Planning/Preparation

- **Layout**
  - Connector Positioning
  - Equipment Positioning
  - Furniture Positioning
  - Permanent Structures Positioning
  - Inadequate Space
  - Wires/Tubing

- **Usability**
  - Computer Design
  - Equipment Design
  - Surface Design
  - Barrier Design
  - Packaging Design
  - Data Entry Design

- **Interruptions**
  - Distractions
  - Teaching Moments
  - Searching Activity
  - Task Deviation
  - Alerts
  - Equipment/Supplies
  - Spilling/Dropping
  - Interaction with Biohazards

- **Equipment Issues**
  - Surgeon Equipment
  - Anesthesia Equipment
  - Perfusion Equipment
  - General Equipment
Results

• a total of 872 flow disruptions were identified during 10 observed cases per discipline in the CVOR
  – perfusion (261)
  – circulating nurse (298)
  – anesthesia (313)

• this translates to a total of 254 minutes (>4hrs) that perfusionists spent recovering from flow disruptions
Results

Frequency of Flow Disruptions by Major Category

- Communication: 48
- Coordination: 32
- Equipment Issues: 5
- Interruptions: 120
- Layout: 54
- Usability: 2
Results

Total Time of Flow Disruptions by Major Category (min)

- Communication: 25 min
- Coordination: 30 min
- Equipment Issues: 4 min
- Interruptions: 138 min
- Layout: 55 min
- Usability: 2 min
Results

Efficiency Ratio of Flow Disruptions by Major Category

- Communication: 1.92
- Coordination: 1.08
- Equipment Issues: 1.40
- Interruptions: 0.87
- Layout: 0.97
- Usability: 0.86
Results

*Interruptions* Flow Disruptions (%)

- Alerts: 2
- Distractions: 7
- Equipment/Supplies: 18
- Interactions with Biohazards: 4
- Searching Activity: 4
- Spilling/Dropping: 23
- Task Deviation: 28
- Teaching Moments: 13
Results

Layout Flow Disruptions (%)

- Connector Positioning: 0%
- Equipment Positioning: 22%
- Furniture Positioning: 4%
- Inadequate Space: 20%
- Permanent Structures Positioning: 7%
- Wires/Tubing: 46%
Results

Communication Flow Disruptions (%)

<table>
<thead>
<tr>
<th>Issue</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>8</td>
</tr>
<tr>
<td>Environmental Noise</td>
<td>4</td>
</tr>
<tr>
<td>Ineffective Communication</td>
<td>52</td>
</tr>
<tr>
<td>Lack of Response</td>
<td>19</td>
</tr>
<tr>
<td>Lack of Sharing</td>
<td>6</td>
</tr>
<tr>
<td>Nonessential Communication</td>
<td>8</td>
</tr>
<tr>
<td>Simultaneous Communication</td>
<td>2</td>
</tr>
</tbody>
</table>

53rd International Conference • April 14-18, 2015 • Marriott Tampa Waterside • Tampa, Florida
Discussion

- issues surrounding general interruptions, layout and communication may distract or otherwise impair the ability of perfusionists to perform at their best
- flow disruptions which occur at critical times during the surgery may pose a greater risk
- no “one-size-fits-all” solution
Take Home Points

- Benefits of Human Factors in CVOR
- Flow Disruptions
  - Interruptions/Layout/Communication
  - Frequency vs. Time: One-Size Doesn’t Fit All
  - System vulnerabilities/inefficiencies
- Next Steps/Recommendations
  - SME involvement in design and development of targeted interventions
References


