Human Factors Engineering and the Science of Safety

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Goal

View patient safety through the different lenses of Safety Science

- The Systems Approach
- Human Factors
- Just Culture
- Primary, Secondary, and Tertiary Prevention

Twitter Discussion: #HF safety

![Chart Credit: Modified from L. Leape

![Total lives lost per year

![Number of encounters for each fatality

![Dangerous (>1/1,000)

![Ultra Safe (<1/100,000)
The Problem
USA's Institute of Medicine (IOM) Report: 2000
- Govt: 50% less error in 5 years
- Funding, Regs, High Focus
15 Years later....
ESSENTIALLY NO CHANGE
WHY? Focus still on individual performance
Solutions inconsistent with safety science

Adverse Event Rates
- 1991 New York: 3.7%
- 2000 Utah and Colorado: 2.9%
- 2010 North Carolina: 5.7%
- 2010 Medicare Beneficiaries: 13.1%
- 2011 IHI Global Trigger Tool: 33.2%

Why No Change?
1. Preoccupation with Human Error...
   ...Instead of reducing HARM
2. Ineffective solutions
“Systems Approach”

Is the goal: “Eliminate Human Error?”

→ NO

Human Error cannot be eliminated
  – Futile goal; misdirects resources/focus
  – Causes culture of blame and secrecy
    • “name, blame, shame, and train” mentality

It is about reducing HARM

Human Factors Engineering

“We don’t redesign humans; We redesign the system within which humans work”
Complex Adaptive Systems

WORK AS IMAGINED
How managers believe work is being done (rules)

GAP

WORK AS PERFORMED
Every-day work: How work IS being done

Adapted from: Ivan Papadily

809M airline passengers/yr....
...30,000 flights per day

Pilots & ATC:
2 errors per hour

Example: Defibrillator Case
Defibrillator Case

- VF cardiac arrest
- nurse with patient
- charges unit...
- clears patient...
- presses “on” button
- Machine powers down
  – 2-3 minute delay in shock

Huh?

<table>
<thead>
<tr>
<th>Knowledge-Based</th>
<th>Contactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvisation in unfamiliar environments</td>
<td>TRAIL &amp; ERROR</td>
</tr>
<tr>
<td>No routines or rules available</td>
<td>A MISTAKE GOOD ROAD BUT NOT GOOD WAY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rule-Based</th>
<th>Skill-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocolled behavior</td>
<td>Automated Routines</td>
</tr>
<tr>
<td>Process, Procedure</td>
<td>Require little conscious attention</td>
</tr>
</tbody>
</table>

Figure adapted from Embrey D. Understanding Human Behaviour and Error, Human Reliability Associates. Based on Rasmussen’s SRK Model of cognitive control, adapted in context by Reason (1990, 2008).
Slips and Lapses: Common Policies, Discipline, Training, Vigilance

Defibrillator Case #2

- 32 year old healthy man
- Presents to ED with sustained SVT & chest pain
- Primary interventions unsuccessful
- Synchronized shock @50j → refractory
- Try again @ 100j → VF Arrest
- 45m resuscitation attempt → patient dies
- Investigation reveals that MD failed to put device in SYNC mode for second shock

Defibrillator Usability Study

- Fourteen expert participants
- Four tasks: 2 routine, 2 emergent
- Two defibrillator models
- SimMan™ patient simulator
- 50% of participants inadvertently delivered an unsynchronized countershock for SVT
- 71% of participants never aware

[See also associated editorial: Karsh and Scanlon, Oct 2007; 50(4): 433-435]
Response #1

“Physician should have taken time to ask ED staff for an operator’s manual for the defibrillator and read it after he arrived in the ED to perform a cardioversion”


Response #2

“the preventative or corrective action is provided in the device labeling”

Defibrillator Case= COMMON ERROR

Trend found in EMS Reporting system
Simulation study (Denmark)
- 72 physicians
- 5 of 192 defib attempts – Turned it off
- Measurable delay in shock
- Devices turn off even if charged and ready


Why is a culture of safety so important?

- 1 serious or major injury
- 10 minor injuries
- 30 property damage injuries
- 600 incidents with no visible damage or injury

1,753,498 accidents from 297 companies, 21 different industries
Safety Attitudes

“The single greatest impediment to error prevention in the medical industry is that we punish people for making mistakes.”

—Lucian Leape, Testimony to congress

US Airways Non-Reprisal Policy

“US Airways will not initiate disciplinary proceedings against any employee who discloses an incident or occurrence involving flight safety...”

“This policy excludes events known or suspected to involve criminal activity, substance abuse, controlled substances, alcohol, or intentional falsification.”

Airline Safety Approaches

“It is vastly more important to identify the hazards and threats to safety, than to identify and punish an individual for a mistake.”

“We exchange the ability to reprimand an individual for the ability to gain greater knowledge.”

—Jeff Skiles, Miracle on Hudson first officer, On airline safety philosophy
Too soft, you say?

Reckless Behavior
Conscious disregard of unreasonable risk
Manage through:
• Remedial action
• Punitive action

At‐Risk Behavior
A choice: risk not recognized or believed justified
Manage through:
• Removing incentives for At‐Risk Behaviors
• Creating incentives for healthy behaviors
• Increasing situational awareness
• Re‐examining environment

Normal Error
Inadvertent action: slip, lapse, mistake
Manage through changes in:
• Processes
• Procedures
• Recurrent training
• Design
• Environment

Support Coach Sanction

Prevention of Heart Disease
Primary Prevention
Secondary Prevention
Tertiary Prevention

Healthy Lifestyle
Don't Start Smoking
Screening for Risk Factors
Control of Risk Factors (HTN, DM)
CAD: Management After Heart Attack
Optimizing Management of Heart Failure

Adapted from: David Marx, Just Culture. Outcome Engineering 2008: www.JustCulture.org

Alternative Perspective: Just Culture: Balancing Safety and Accountability, Sidney Dekker (2008)
Indiana: 5 nurses

We See... What We Expect To See
Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttae in wahn ordr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rght pclae. The res can be a toatl mses and you can stll rd it wouthit a porbelm. Tlhs is bcueseae the huamn mnid deos not raed ervy lteter by istlef, but the wrod as a wlohe.
“Skills-Based Error”
= Slips and Lapses
= “Automaticity” Errors
⇒ HUGE OPPORTUNITY ⇐

“Fallibility is part of the human condition;
We cannot change the human condition;
But we can change the conditions under which people work”

--James Reason, PhD

Video showing impact on the safety culture (Annie’s story)

https://www.youtube.com/watch?v=zeldRvu-3DpM
15 years later....

Why No Change?
– Focus on the INDIVIDUAL
– Focus on EVENTS
– Focus on OUTCOME
– Culture of Blame
– Lack of a true systems approach

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