

Applying Human Factors to the Design of Safe Systems | Clinical Excellence Commission, The Mint, Sydney, Australia; August 6, 2015

Human Factors Engineering and the Science of Safety

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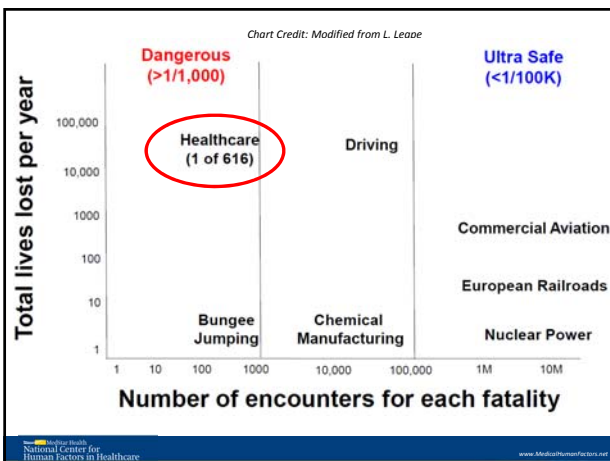
Goal

View patient safety through the different lenses of Safety Science

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

Twitter Discussion: #HFsafety

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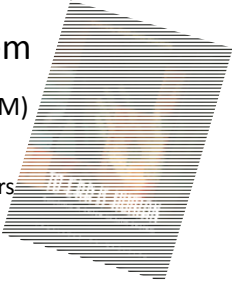
The Problem

USA's Institute of Medicine (IOM)
Report: 2000

- Govt: 50% less error in 5 years
- Funding, Regs, High Focus

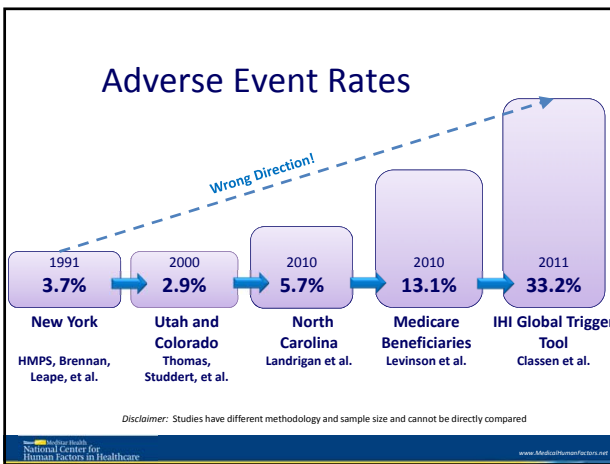
15 Years later....
ESSENTAILY NO CHANGE

WHY? → Focus still on *individual* performance
→ Solutions inconsistent with safety science




Leape AL, Brennan TA. Five years after To Err is Human: what have we learned? JAMA. May 18 2005;293(19)
Wachter RM. The end of the beginning: Patient Safety Five Years After 'To Err is Human'. Health Aff. 2004;23
Wachter RM. Patient Safety At Ten: Unimprovable Progress, Troubling Gaps. Health Aff. 2010;29(2)
Lewigens, Perry, et al. Temporal Trends in Rates of Patient Injury Resulting from Medical Care. Med Care 33(3/2): 2000
Shattell, Pronovost, et al. Advancing the science of patient safety. Ann Int Med 154(10): 2011

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Why No Change?

- Preoccupation with Human Error...
...Instead of **reducing HARM**



- Ineffective solutions

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“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”



Cognitive
Science
(how we think)

Industrial and
Organizational
Psychology
(how we collaborate)

Work
Analysis
(how we work now)

System Safety
Engineering
(how we manage risk)

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

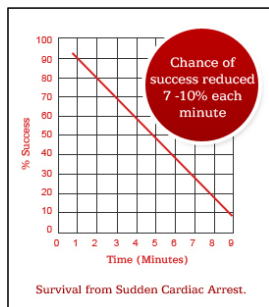
Adapted from: Ivan Pupulidy

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

Pilots & ATC:
2 errors
per hour

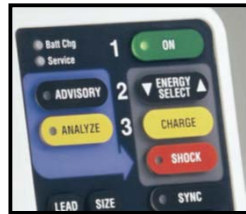


Example: Defibrillator Case

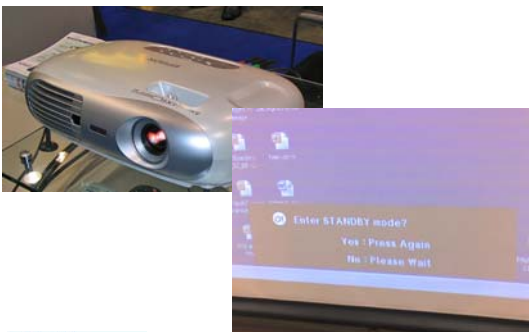


Defibrillator Case

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



Huh?



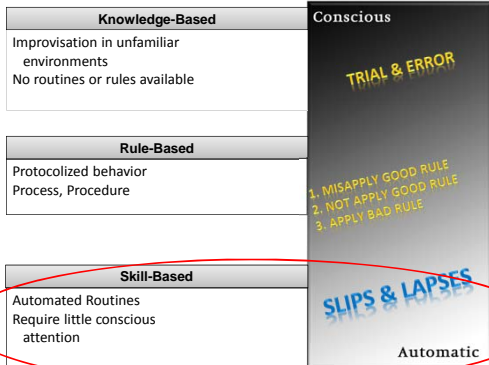


Figure adapted from: Embrey D. Understanding Human Behaviour and Error, Human Reliability Associates
 Based on Rasmussen's SRK Model of cognitive control, adapted to explain error by Reason (1990, 2008)

Slips and Lapses: Common

Policies, Procedures, Discipline, and Guidance

TO ERR IS HUMAN

BUILDING A SAFER HEALTH SYSTEM

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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**

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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**

► Fairbanks RJ, Caplan SH, et al. Usability Study of Two Common Defibrillators Reveals Hazards. *Annals of Emergency Medicine*. Oct 2007; 50(4): 424-432.
[See also associated editorial: Karsh and Scanlon, Oct 2007; 50(4): 433-435]

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Response #1

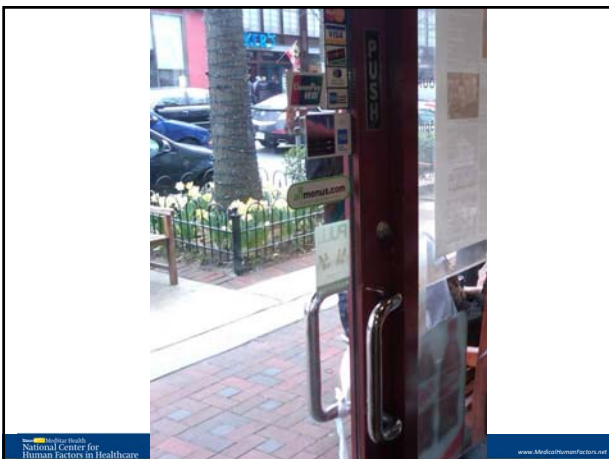
“Physician should have taken time to ask ED staff for an operator’s manual for the defibrillator and read it after he arrived in the ED to perform a cardioversion”

Fairbanks RJ and Wears RL. Hazards With Medical Devices: the Role of Design. *Annals of Emergency Medicine* Nov 2008; 52(5): 519-521.

Response #2

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

Fairbanks RJ and Wears RL. Hazards With Medical Devices: the Role of Design. *Annals of Emergency Medicine* Nov 2008; 52(5): 519-521.





Defibrillator Case= COMMON ERROR

Trend found in EMS Reporting system

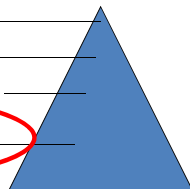
Simulation study (Denmark)

- 72 physicians
- 5 of 192 defib attempts – Turned it off
- Measurable delay in shock
- Devices turn off even if charged and ready

*Hoyer, Christensen, et al. Annals of Emergency Medicine 2008; 52(5): 512-514.
Fairbanks and Wears. Annals of Emergency Medicine 2008; 52(5): 519-521.*

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



Bird, 1969

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

Slide acknowledgment: Robert Panzer, MD

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?



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SECOND EDITION 

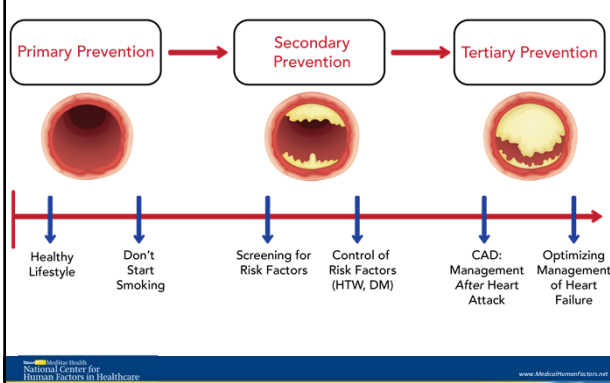


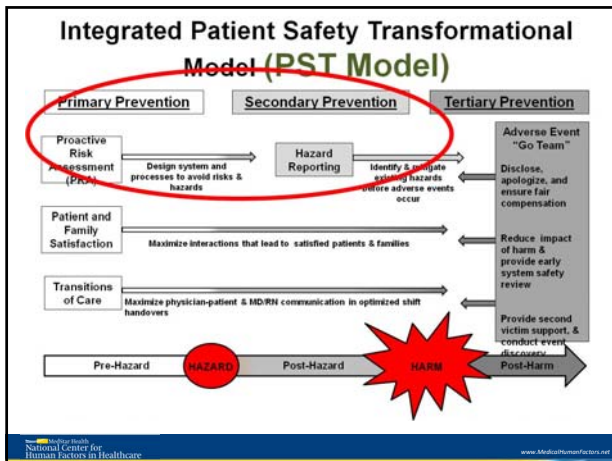
JUST CULTURE
Balancing Safety and Accountability
SIDNEY DEKKER
Griffith University

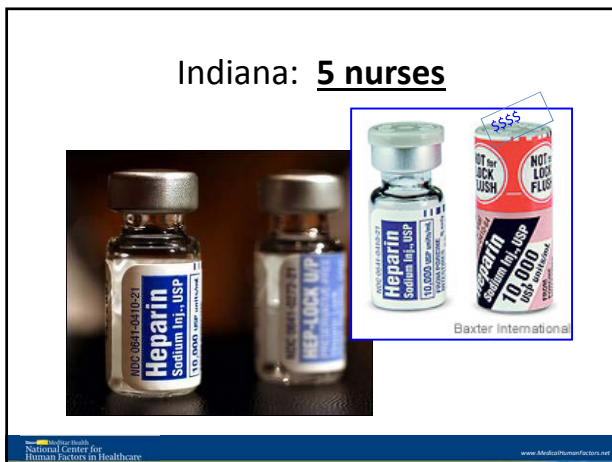
Adapted from: David Marx, *Just Culture: Outcome Engineering 2008* www.JustCulture.org
Alternative Perspective: *Just Culture: Balancing Safety and Accountability*, Sidney Dekker (2008)

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Prevention of Heart Disease







We See...
What We Expect To See

Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttar in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

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The diagram illustrates the Skill-Based Error model with three levels: Knowledge-Based (top), Conscious (middle), and Automatic (bottom). The Conscious level is highlighted with a red oval and contains the text: "TRIAL & ERROR", "1. NOT APPLY KNOWLEDGE", and "2. NOT APPLY KNOWLEDGE". The Automatic level is labeled "Automatic". The text "Skills-Based Error" is written in large, bold letters across the Conscious level. Below it, it says "= Slips and Lapses" and "= 'Automaticity' Errors". At the bottom, a red oval contains the text "→ HUGE OPPORTUNITY ←".

Figure 3 adapted from Endsley, D. W. (1988). Human Error and Error: Human Factors. *Accidents and Error Factors in Human-Computer Interaction*. London: Taylor & Francis.

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"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

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

<https://www.youtube.com/watch?v=zeldVu-3DpM>

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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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