Human Factors Engineering 101

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“Nothing to Disclose”

What will not happen in 45 minutes?

• You will not become a human factors engineering expert
• You will not get all of the answers today
What is Human Factors/Systems Engineering?

- The study of how people interact physically and cognitively with the world around them, including environments, tools, processes, and procedures. It is “matching” the work system to the “person”.

SEIPS - Systems Engineering Initiative for Patient Safety

Person

- Capabilities and Limitations
- Musculo/skeletal
- Sensory
- Cognitive
Physical environment
• Sensory disruptions: make it difficult to carry out tasks
• Air quality: too hot, too cold, smells, stuffy air
• Noise: can increase blood pressure, negative mood
• Housekeeping
• Fatigue, stress

Tasks
(studied more than any element of the model)
• Lack of participation and control
• Skill/knowledge required
• Content considerations-repetitiveness and meaningfulness
• Overload and underload
• Paced work

Technology/Tools/Training
• Controls, displays - Cognitive skills
• Computers
• New technologies
• Bar coding; RFID
• Device design
• eMAR
• Hand Hygiene Products
Technology design

- Adding technology may be like adding another team member, but one who does not speak the same language or share the same cultural assumptions. (Woods 1996)
- That may lead to “technology surprises” - What is the technology doing now? Why is it doing that? What will it do next?

Organization - Local

- Training, new technology, time for acclimation, work schedules
- Pay and benefits - Motivation?
- Management and supervision
- Employee identification
- Corporate structure
- Corporate culture
- Organizational support
- Job growth

Organization - Global

- Federal laws, national guidelines, standards
- International guidelines, standards
- Accrediting organizations
- Professional organizations
What is Human Factors/Systems Engineering?

- Should be simple right? Everyone is interested in preventing bad outcomes such as HAI...to this end, our colleagues do everything we suggest!

How Our Colleagues Interpret Infection Prevention Policies and Procedures

“First, your return to shore was not part of our negotiations nor our agreement, so I must do nothing. And secondly, you must be a pirate for the pirate's code to apply and you're not. And thirdly, the code is more what you'd call "guidelines" than actual rules. Welcome aboard the Black Pearl, Miss Turner.”

Captain Hector Barbossa (or a nurse manager or physician)

“Pirates of the Caribbean - Curse of the Black Pearl”

Current Reality of Average HAI Program

- More isolation than integration and innovation
- No learning systems dedicated to clinical quality implementation science
- Lack of authority to implement change
- Poor understanding of economics of HAI
- Disbelief that zero can be achieved
- ICP is more “cop” than “coach”
- Staff see IP measures as a distraction or interruption to what they perceive as the actual task
Understand the “System”
  - Large scale issues in sociotechnical systems (STS)
  - Resilience...described as a “new view of human error” sees humans in system as primary source of resilience in creating safety. Our “old view” focuses on the elimination of risk rather than describing strategy that will cope and contain failure, as proposed by resilience
  - In IP we were trained to break the problem down into individual parts
  - But in complex STS Relationships between parts are far greater than the parts alone...

Examples
  - Termite hill
    - Can’t be reduced to the termites
    - Statistically emergent from termite
      - By the way there is no CEO termite or CNO-VP for patient services termite etc.. just termites that all know their places and tasks in the system

THE TERMITES HAVE A “SHARED MENTAL MODEL”
  We establish order and control through actions of a few top people in the organization and this may be the biggest factor holding back innovation and progress in our organizations

In a Complex System Relationships between parts are far greater than the parts alone...
So what do we do? The prevailing Infection Prevention system paradigm:

“Whac-a-Mole” is an Anticipatory Model

- This is an anticipatory model – based on prediction of problems occurring again...in the exact same way!
- You guess or try to “pattern match” (data) where the “mole will pop up”
- But...what is the problem with this model
  It is not a Systems/HF model!

Problems with an anticipatory model
“FROM JERUSALEM TO JERICHO*:  
A STUDY OF SITUATIONAL AND DISPOSITIONAL VARIABLES IN HELPING BEHAVIOR*  
JOHN M. DARLEY and C. DANIEL BRYSON  
Princeton University

The influence of several situational and personality variables on helping behavior was examined in an emergency situation suggested by the parable of the Good Samaritan. People going between two buildings encountered a visibly distressed person slumped by the side of the road. Subjects in a hurry to reach their destination were more likely to pass by without stopping. Some subjects were told to give a short talk on the parable of the Good Samaritan; others on a nonrelevant topic; this made no significant difference in the likelihood of their giving the victim help. Dispositional personality variables did not predict whether an individual would help the victim or not. However, if a subject did stop to offer help, the character of the helping response was related to the type of manipulability.

The Study

• Princeton University Seminary Students
• ½ were told to present sermon on the Good Samaritan; the other prepare a talk about seminary jobs
• Were told to go to one building then they changed the routes and building locations just prior to leaving
• Two groups were divided again: One group told to hurry they would be late; the others not to rush, take their time
• All groups’ routes had them come across a man slumped in a doorway who moaned and coughed as they passed...

Study Outcomes

• These were individuals bound for the ministry most everyone would stop.
• Those who were thinking about the “Parable of the Good Samaritan” would stop. Remember, walking to the new venue 50% of the seminarians had a sermon about the Good Samaritan in their heads.
• Those less hurried would stop. That is, the biggest predictor of helping would be the hurry-manipulation. Those who have the time will help. Those who don't have the time won’t.
• Overall, the single biggest factor in helping was the hurry manipulation. The relevant statistic (¾ who stopped):
• Low Hurry Condition: 63% offered aid
• High Hurry Condition: 10% offered aid

Most nights, unexpected contingencies unwound the tight choreography of the shift, diagrammed in hourly increments in the sprawling spreadsheets of patients' charts. I lurched from one task to the next, fulfilling all requirements, but little more. For a while, the electronic thermometers we used were in short supply, and the shift started with a mad dash to nab one. We made a joke of it, but behind the laughs, I heard the clock ticking. Infection control slows down all movement: Hands must be washed before and after every contact with a patient, and fresh gown and gloves donned every time one enters a patient room, to be discarded when exiting. A thermometer or any other piece of equipment moved from one room to another must be cleaned, too.

The question we must ask is: Is Infection Prevention the task? Or is it an interruption to what is perceived as the “real” task?

- A task has inputs → throughputs → outputs
- If it is a task, how can it be imbedded into other tasks and not remain a “stand alone task” with no clear and timely feedback?
- Remember a “stand alone task” can be worked around...or NOT DONE

SEIPS - Systems Engineering Initiative for Patient Safety
Remember Semmelweis?

- What is the model for the cause of puerperal fever?
  - Person
  - Task
  - Tools/Technology
  - Environment

Human Factors Task Analysis

- Societal/Organization factors - infected patients’ socioeconomic class causes placement in hospital vs. their home
- Physical Environment factors - water quality, patient bed linens, ventilation, and patient crowding
- Task factors - difficult or extended labors requiring more physician/medical student attention than normal deliveries left to the midwives
- Tools and Technology in use – comparing hospital and at home deliveries
- People – physician, medical student, midwife, patients.

Organization

- The cause was one of advancement in medical technology –
- in years prior, incidence of puerperal fever had been equally low in both wings of the hospital
- with emergence of forensic pathology and the opening of the new Institute of Anatomy, instructional autopsies came into academic fashion and were required of all physicians with patients that died in the hospital
- His analysis clearly describes a latent error in the system, placing the medical staff at the “sharp” of the infection transmission or medical error
Low-hanging fruit for human factors design in infection prevention—still too high to reach?
Lauren Clack, BSc, Stefan P. Kuster, MD, MSc, Heidi Giger, RN, Francesca Giuliani, PhD and Hugo Sax, MD
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Human factors design interventions have been suggested to mitigate infection risk in health care. Among such solutions, many are easily identified and theoretically simple and quick to realize. These are called low-hanging fruit. We present a case of infection risk associated with syringe manipulation that could easily be solved by introducing user-centered design solutions. Yet, organizational complexity makes implementation of such solutions hardly reachable. We therefore advocate embedding human factors macroergonomic expertise on an organizational level.

"It's what you learn after you know it all that counts."
~Attributed to Harry S Truman
Thank you!
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