Unit 4: Introduction to Human Factors in Patient Safety

Objectives

- Define human factors and ergonomics (HFE) is and its objectives
- Introduce human factors ergonomics (HFE) and discuss the role of HFE in patient safety

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What is Human Factors Ergonomics?

The International Ergonomics Association defines human factors (ergonomics) as

"the scientific discipline concerned with the understanding of <u>interactions</u> among humans and other elements of a system, and the profession that applies <u>theory, principles, data and methods</u> to <u>design</u> in order to <u>optimize</u> human well-being and overall system performance."

IEA

Goal(s) of HFE

- Making the human interaction with systems one that
  - Enhances performance
  - Increases safety
  - Increases user satisfaction

> There are trade-offs between multiple goals.

HFE is NOT

- Common sense
- Checklists or guidelines
- Limited to correct labeling or design of a device
- Designing solutions based on only what users say they need

Domains of Specialization in HFE

- <u>Physical ergonomics</u>: human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity.
- <u>Cognitive ergonomics</u>: mental processes, e.g., perception, memory, reasoning, and motor response, as they affect interactions among humans & other system elements
- <u>Organizational (macro)ergonomics</u>): optimization of sociotechnical systems, including their organizational structures, policies, & processes.

Physical Ergonomics

- Relevant topics:
  - Working postures, material handling
  - Repetitive movements, work-related musculoskeletal disorders
  - Workplace layout
- Health Care examples:
  - Preventing back injuries among nurses
  - Designing work stations for optimal human performance
- Patient Safety examples:
  - Designing patient rooms to facilitate and support safe patient care
  - Designing drug labels for readability

Cognitive Ergonomics

- Relevant topics
  - Mental workload
  - Decision-making
  - Human-computer interaction
  - Training
- Health Care examples
  - Usability of HIT & medical devices
  - Designing training systems
- Patient Safety examples
  - Designing an event reporting system
  - Creating & implementing incident analysis processes

Organizational Ergonomics

- Relevant topics:
  - Communication
  - Crew resource management, teamwork
  - Job design, participatory design
- Health Care examples:
  - Designing health care jobs to reduce burnout & improve satisfaction
  - Implementing improvement activities that consider teamwork & participation
- Patient Safety examples:
  - Implementing crew resource management training in surgery teams
  - Designing work schedule to reduce fatigue

Scope of HFE

- Human- Information Display/ Machine interaction
- Human – Environment interaction
- Human – Job Interaction
- Human – Organization Interaction

Ergonomics and Workflow

Image: Johns Hopkins Quality & Safety Research Group

Ergonomics and Workflow

Image: Johns Hopkins Quality & Safety Research Group

Why do Errors Happen?

- Person approach
  - Blame the individual for forgetfulness, inattention, weakness
  - Countermeasures: write another procedure, disciplinary measures, threat of litigation, retrain, blame, shame.
- System approach
  - Multiple faults that occur together in an unanticipated interaction create chain of events in which faults grow and evolve.
  - Countermeasures: based on assumption that though we cannot change the human condition, we can change the conditions under which humans work (e.g., system defenses).

Image: Amazon.com

What is a Poorly Designed System?

- One that
  - Does not match the needs of a human being or task
  - Does not take into account human limitations (perception, memory, anthropometrics).

System approach

- Two principles:
  - Same set of circumstances can provoke similar errors, regardless of the people involved.
  - Safety is seriously impeded if an organization does not seek out and remove the error provoking properties within the system at large.

Human error

- What is an error?
  - Failure of a planned action to be completed as intended (error of execution) or use of a wrong plan to achieve an aim (error of planning).
- Active failures (sharp end)
  - Occur at the level of the frontline operator
  - Effects are felt almost immediately.

Image: MS Clipart

- Latent conditions (blunt end)
  - Tend to be removed from the direct operator control
  - Result in two kinds of adverse events:
    - Error provoking conditions within the local workplace (e.g., time pressure, understaffing, inadequate equipment, fatigue, inexperience)
    - Create long-lasting holes in defenses (e.g., design deficiencies, untrustworthy alarms, unworkable procedures)
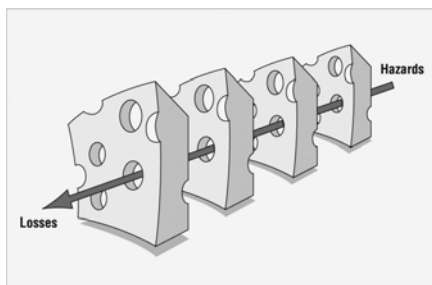
Human error

Example:

Active error: The pilot crashed the plane.

Latent error: A previously undiscovered design malfunction caused the plane to roll unexpectedly in a way the pilot could not control and the plane crashed.

Reason's Swiss Cheese Model

Reason, J. BMJ 2000;320:768-770

Error Management

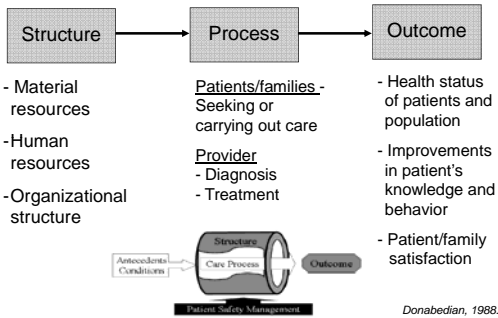- Limiting errors
- Creating more error-tolerance
- High reliability organizations capable of…
  - Performing exacting tasks under pressure
  - Carrying out activities with low incident rates
  - Good organizational design and management
  - Organizational commitment to safety
  - High levels of redundancy
  - Strong organizational culture
  - Converting occasional setbacks into enhanced resilience of the system.

To Err is Human- Building a Safer Health System, Committee on Quality of Health Care in America, Institute of Medicine, 2000.

Donabedian's Model

Structure	Process	Outcome
- Material resources -Human resources -Organizational structure	Patients/families - Seeking or carrying out care Provider - Diagnosis - Treatment	- Health status of patients and population - Improvements in patient's knowledge and behavior - Patient/family satisfaction

Donabedian, 1988.

System Engineering Initiative for Patient Safety (SEIPS) Model

Carayon et al., 2006
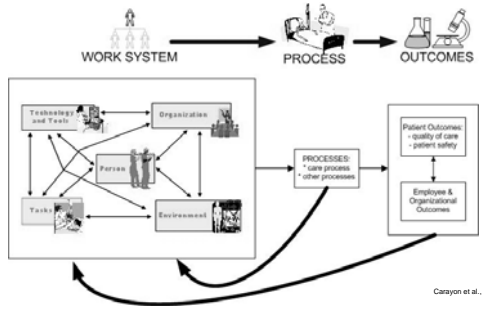
Components and Elements of SEIPS Model

Person
- Education, skill, knowledge
- Motivation and needs
- Physical characteristics
- Psychological characteristics

Environment
- Layout
- Noise
- Lighting
- Temperature, humidity, air quality
- Work station design

Organization
- Teamwork
- Coordination, collaboration, communication
- Organizational culture, safety culture
- Work schedules
- Social relationships
- Supervisory/management style
- Performance evaluation, rewards, incentives

Components and Elements of SEIPS Model

Technologies and tools
- Various information technologies: electronic health record, computerized provider order entry, bar coded medication administration
- Medical devices
- Human factors characteristics of technologies & tools (e.g., usability)

Tasks
- Variety of tasks
- Job content, challenge & utilization of skills
- Autonomy, job control & participation
- Job demands (e.g., workload, time pressure, cognitive load, need for attention)

Components and Elements of SEIPS Model

- Processes
  - Care processes
  - Information flow, purchasing, maintenance, cleaning
  - Process improvement activities
- Employee and organizational outcomes
  - Job satisfaction and other attitudes
  - Job stress and burnout, turnover
  - Employee safety and health
  - Organizational health (e.g. profitability)
- Patient outcomes
  - Patient safety and Quality of care
  - Healthcare acquired infections

Individual and the SEIPS model

- Design/ redesign health care systems to
  - enhance performance of individual
  - minimize the negative consequences on the individual, hence the organization
- Goal:
  - (Re)design a health care system to make it "easy to do things right and hard to do things wrong."

Application of the SEIPS Model to IT

- Assess health care systems, processes, and outcomes to develop system redesign interventions
  - Open-ended questions to staff
  - Shadowing of care providers
  - Review of hardware
  - Review of training
  - Review of error reports
- Design intervention(s) using a participatory approach and evaluate

Staff Questionnaire

- What do you think are the main issues related to patient care quality and safety in your use of HIT?
- Think of instances in the past year when you felt your performance was challenged or below par due to problems in HIT "system". Briefly explain the situation and what you think caused it?
- Think of instances in the past year when you felt your performance was exceptional. Briefly explain the situation and what you think caused it.

Patient Shadowing

A two dimensional log:
- List chronological sequence of steps clinicians performed
- Record observations according to the work system component(s)

Nurse & physician using the HIT system
- Task: prescribe medications, document.
- Environment: open; noisy and distracting interactions between staff in hallway.
- Tools/technology: drop down menu, confusing screen
- Organization: production pressures to get patients discharged

Summary

- An understanding of human factors and ergonomics (HFE) and its objectives will help the work of HIT professionals.
- HFE is closely tied to patient safety.
- It is important to go to the work of clinicians to understand their challenges and needs.

References

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