



JOHNS HOPKINS
M E D I C I N E

Health IT Design and Implementation

A Human Factors and Systems Engineering Perspective

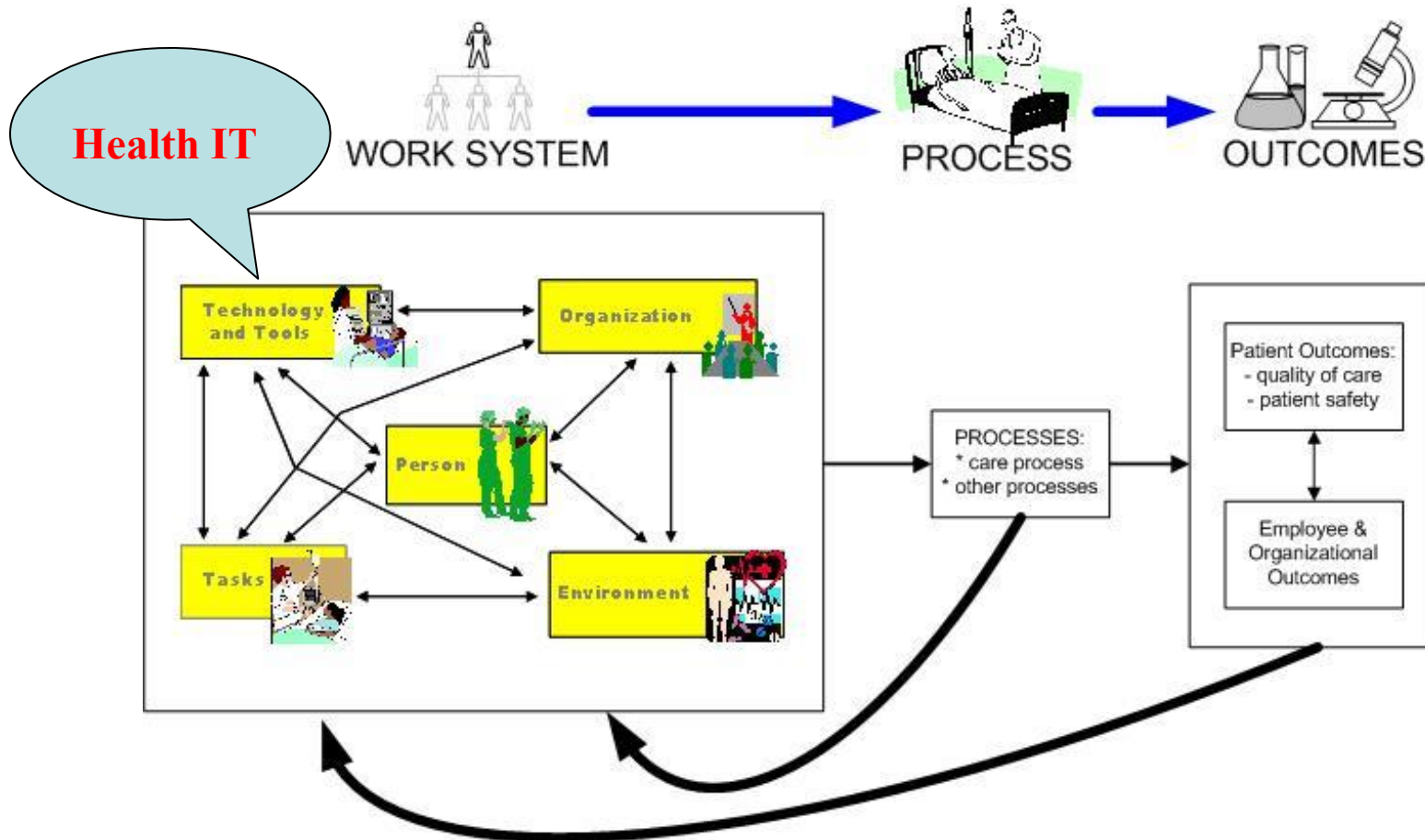
Ayse P. Gurses, PhD, MS, MPH

Associate professor
Armstrong Institute for Patient Safety and Quality
Schools of Medicine, Bloomberg Public Health, Whiting Engineering

Key Points

- Sociotechnical Systems Approach to Health IT Design and Implementation
 - Support individual and team cognition
 - Fit to workflow
 - View health IT implementation as both episodic and continuous change
 - Develop and continuously update health IT design requirements
- Evolving Nature of Medicine, Health Care Delivery, Technology
 - Role of Human Factors and Ergonomics (HFE)
- Need for collaboration across various stakeholders and disciplines

Health IT as a Component of Sociotechnical Work System



Carayon, P., Hundt, A.S., Karsh, B.-T., Gurses, A.P., Alvarado, C.J., Smith, M. and Brennan, P.F. "Work System Design for Patient Safety: The SEIPS Model", *Quality & Safety in Health Care*, 15 (Suppl. 1): i50-i58, 2006.

User-Designed Tools to Support Cognition: What are the Implications for Design?

Nurse coordinators' job: "Make sure that there is a staffed bed appropriate for each patient based on the level of care he or she needs"



Constraints

NAME	TYPE	STC #	MRN #	Location	Physician	TEAM
[redacted] N, [redacted]	ARead Y	21	1 [redacted] 7	5S Rm 22/Bed 1	[redacted], [redacted], MD	B

Opportunities

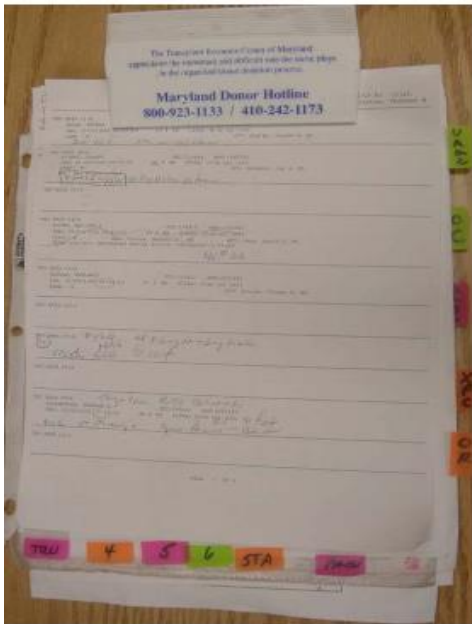
NAME	TYPE	STC #	MRN #	Location	Physician	TEAM
[redacted], [redacted] <i>sitter</i>	<i>10/0 PE</i> Prim Y	39	1 [redacted] 0	6N Rm 04/Bed 1	[redacted], [redacted]	C

Exceptions

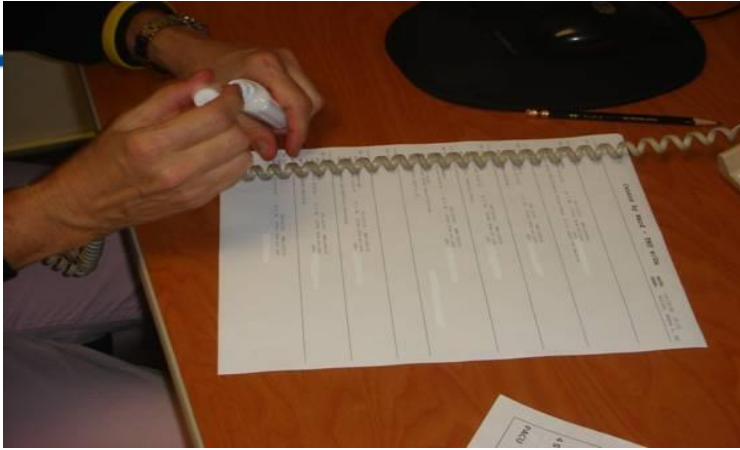
NAME	TYPE	STC #	MRN #	Location	Physician	TEAM
[redacted], [redacted] <i>VIP</i>	Read Y	9	1 [redacted] 0	4N Rm 01/Bed 1	[redacted], [redacted]	B

Things-to-do

NAME	TYPE	STC #	MRN #	Location	Physician	TEAM
[redacted] <i>N 1st 5. [redacted]</i>	Prim Y	7	1 [redacted] 0	5N Rm 10/Bed 1	[redacted], [redacted]	Soft



Nurse Coordinator Preparing the Clipboard



Whitening out non-essential items



Cutting out unnecessary parts



Taping print-outs of two adjacent units



Transferring information from the old clipboard

HIT to Support Pediatric Trauma Teamwork and Care Transitions

Funded by AHRQ R01 HS23837 PI: Gurses

- **How to design** health IT to support **team cognition and team work?**
 - Substantial literature on teams exist
 - Limited understanding of how teams and team of teams actually function given the realities of care delivery systems
 - Need for **in-depth understanding of teams in the wild**
- Pediatric trauma care relies on effective coordination and transitions of care
 - Within a team
 - Among multiple teams
 - Across time and ‘state of care’
 - Across locations

Methodology

- Multi-site: MD (Gurses), WI (Carayon), FL (Chandler)
- Review of institutional policies and protocols
- Series of interviews with clinician research team members
 - PICU attending, peds surgery, peds ED, peds trauma nurse
- Semi-structured interviews with clinicians and patients*
- Contextual inquiry/ Observations*
- Pediatric trauma registry data analysis



**Contextual
Design**

* Planned

Problems with the “Problem List” Functionality

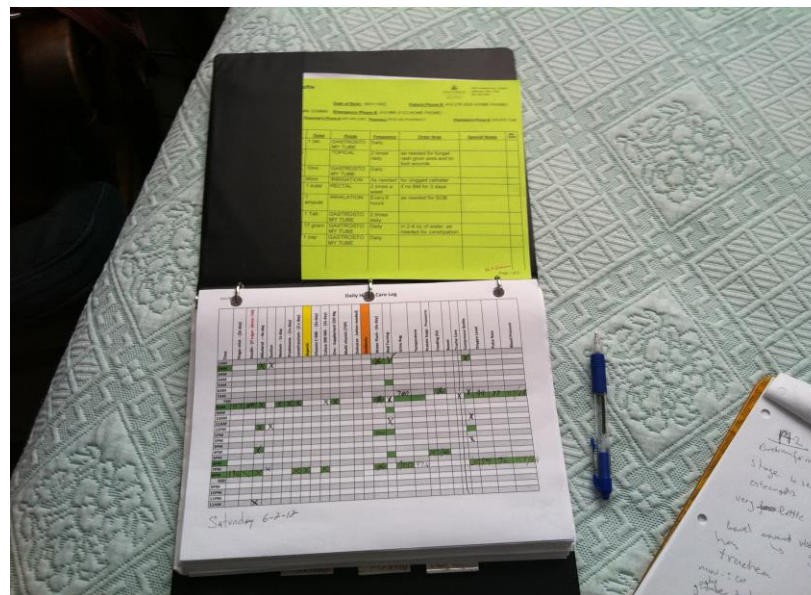
- ‘Problem list’ not adequately supporting individual and team cognition and teamwork
 - Most convenient items, rather than **the most reflective of patient condition**, are selected.
 - No degree of **uncertainty** tied to a piece of information
 - **Linkage** between actions/ treatments and ‘problems’ not easy to view

*” you should at least put down **everything you need to deal with**, everything you need to understand. So you need to understand if the abnormal chest x-ray is aspiration or pneumonia or blood and until you've got a **degree of precision**, you shouldn't be typing pulmonary contusion in because that's going to force people down-- that's going to **lock people's mindset into the wrong...**”*

Health IT to Support Home Care Team



Home Care Team: patient, wife, two adult daughters, one son, multiple home care nurses



Funded by AHRQ
 (K08 PI: Arbaje; R01 PI: Xiao, sub-PI: Gurses)

Evolving Nature of Medicine, Health Care Delivery, Science and Technology

- Precision Medicine
 - Human-centered design of multi-gene sequencing panel reports for non-expert clinicians*
- Predictive modeling
 - Pilot testing a CDS for predicting septic shock in an ICU**
- Increasing focus on
 - diagnostic safety
 - patient-centered care



* Cutting et al, JBI 2016; ** JHU Discovery Award (PI: Gurses)

Conclusions and Future Directions

- Understand and describe the ‘realities of work’ adequately (e.g., peds trauma team work, patient work) and develop HIT design requirements accordingly
 - Who to design for?
 - What to support?
- Design and innovate through health IT **WHILE** actively managing HIT related safety risks
 - Proactive risk management
 - Retrospective risk management (e.g., learning from HIT-related safety incidents and near misses)
 - Develop and continuously improve evidence-based health IT design recommendations



Questions/ Comments?

Ayşe P. Gurses
agurses1@jhmi.edu