AHRQ-National Resource Center for HIT

Web Conference

Socio-Technical Aspects of Health IT

March 28, 2007

Presenters:
Pascale Carayon, Ph.D., University of Wisconsin
Ben-Tzion Karsh, Ph.D., University of Wisconsin
Ross Koppel, Ph.D., University of Pennsylvania

Moderator:
Michael I. Harrison, Ph.D., AHRQ

AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

SEIPS Systems Engineering Initiative for Patient Safety

THE UNIVERSITY of WISCONSIN MADISON

Sociotechnical (HIT) System

Pascale Carayon, Ph.D.
Center for Quality and Productivity Improvement
Department of Industrial and Systems Engineering
University of Wisconsin-Madison

email: carayon@engr.wisc.edu / tel: 608-265-0503
http://www.engr.wisc.edu/ie/faculty/carayon_pascale.html

http://www2.fpm.wisc.edu/seips/

Presented by: Pascale Carayon, Ph.D.

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

What is a Sociotechnical System? - 1

SOME SOCIAL AND PSYCHO-LOGICAL CONSEQUENCES OF THE LONGWALL METHOD OF COAL-GETTING [1]

An Examination of the Psychological Situation and Defences of a Work Group in relation to the Social Structure and Technological Content of the Work System

E. L. TRIST AND K. W. BAMFORTH [2]

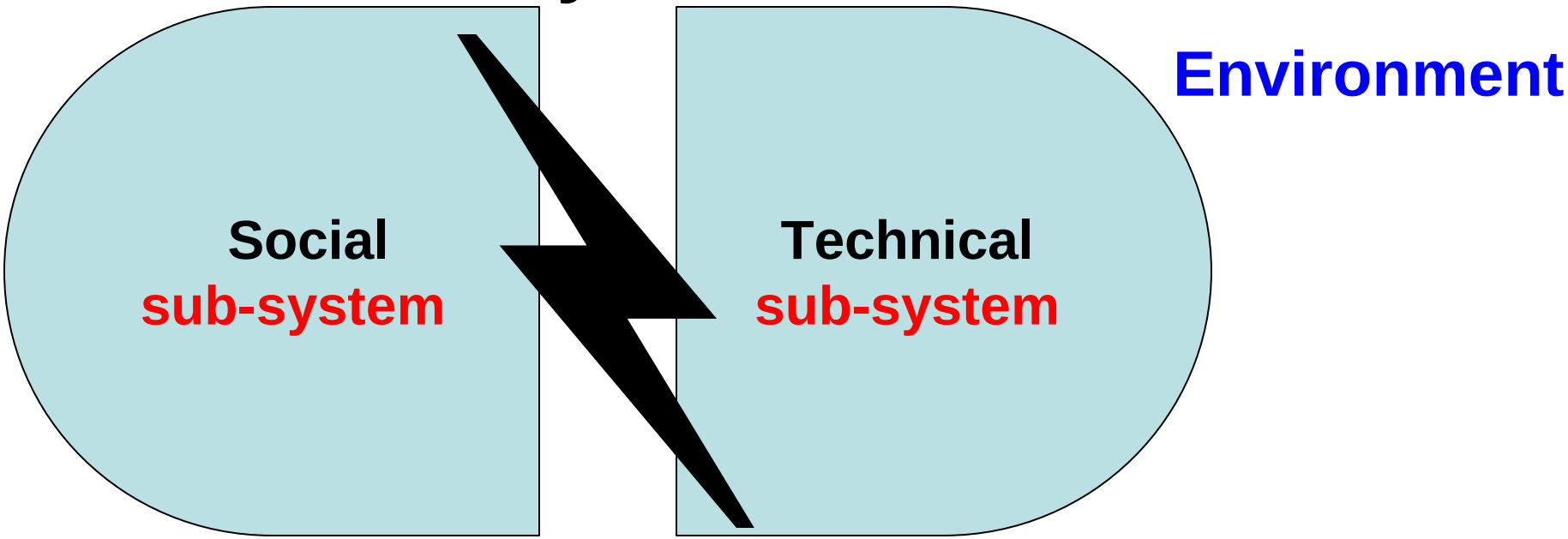
Published in Human Relations - 1951

THE UNIVERSITY of WISCONSIN MADISON

Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

What is a Sociotechnical System? - 2



Principles:

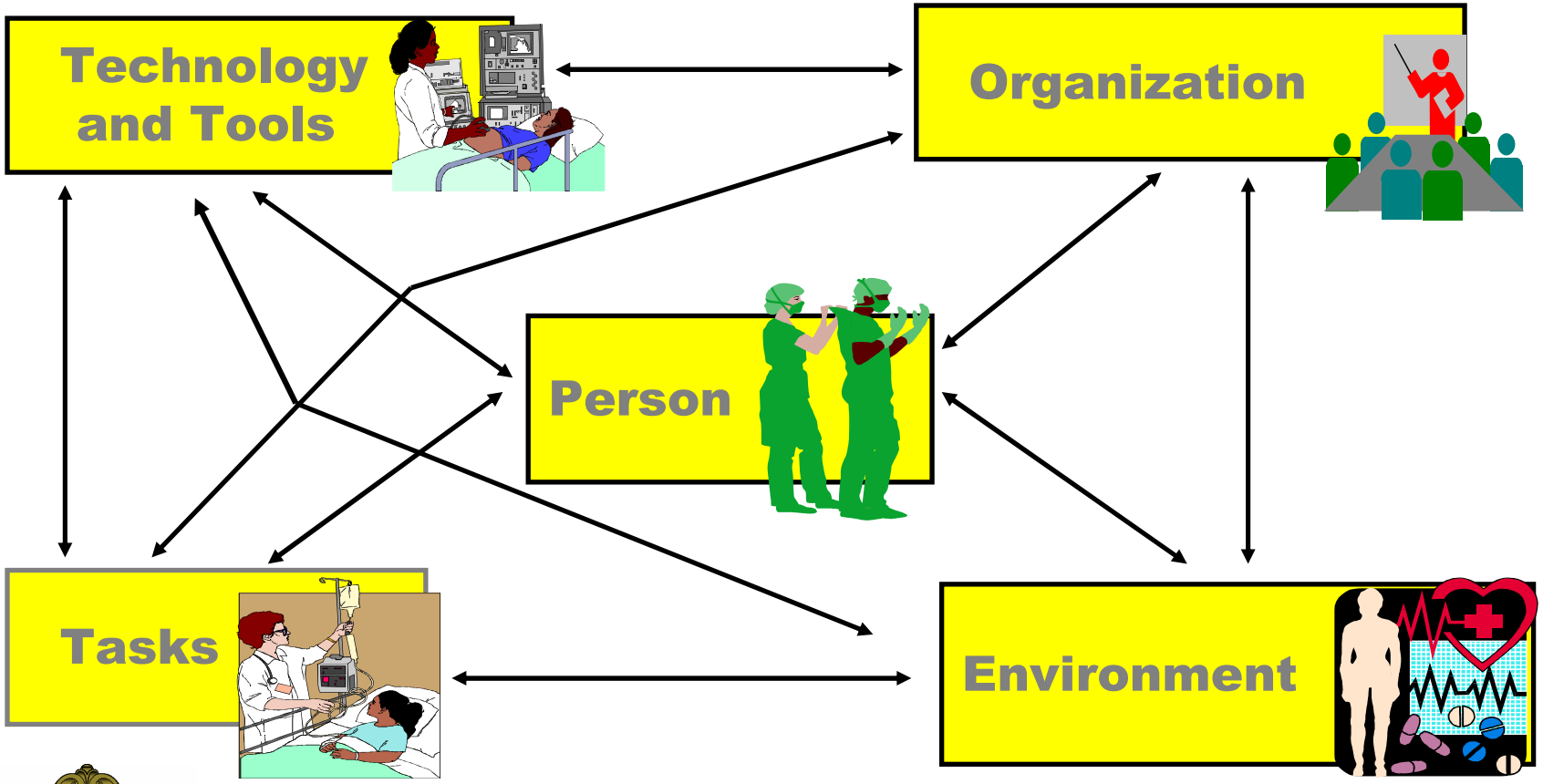
** joint optimization/design*

** humanized approach ….*

(Cherns, 1987; Clegg, 2000; Hendrick & Kleiner, 2001)

Work System (or a sociotechnical system)

(Balance Theory; Smith and Carayon, 1989; Carayon and Smith, 2000)



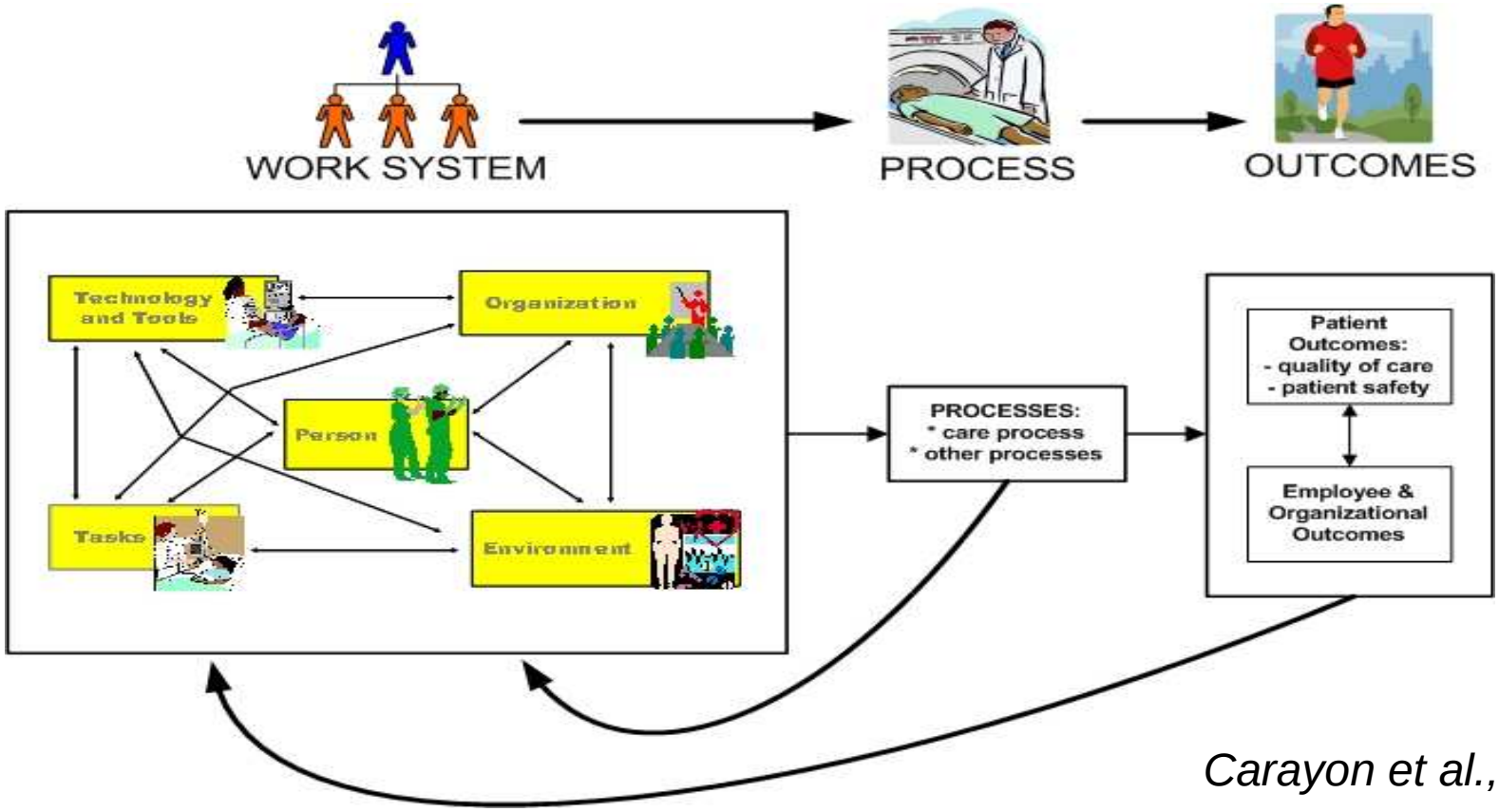
THE UNIVERSITY of WISCONSIN MADISON

Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

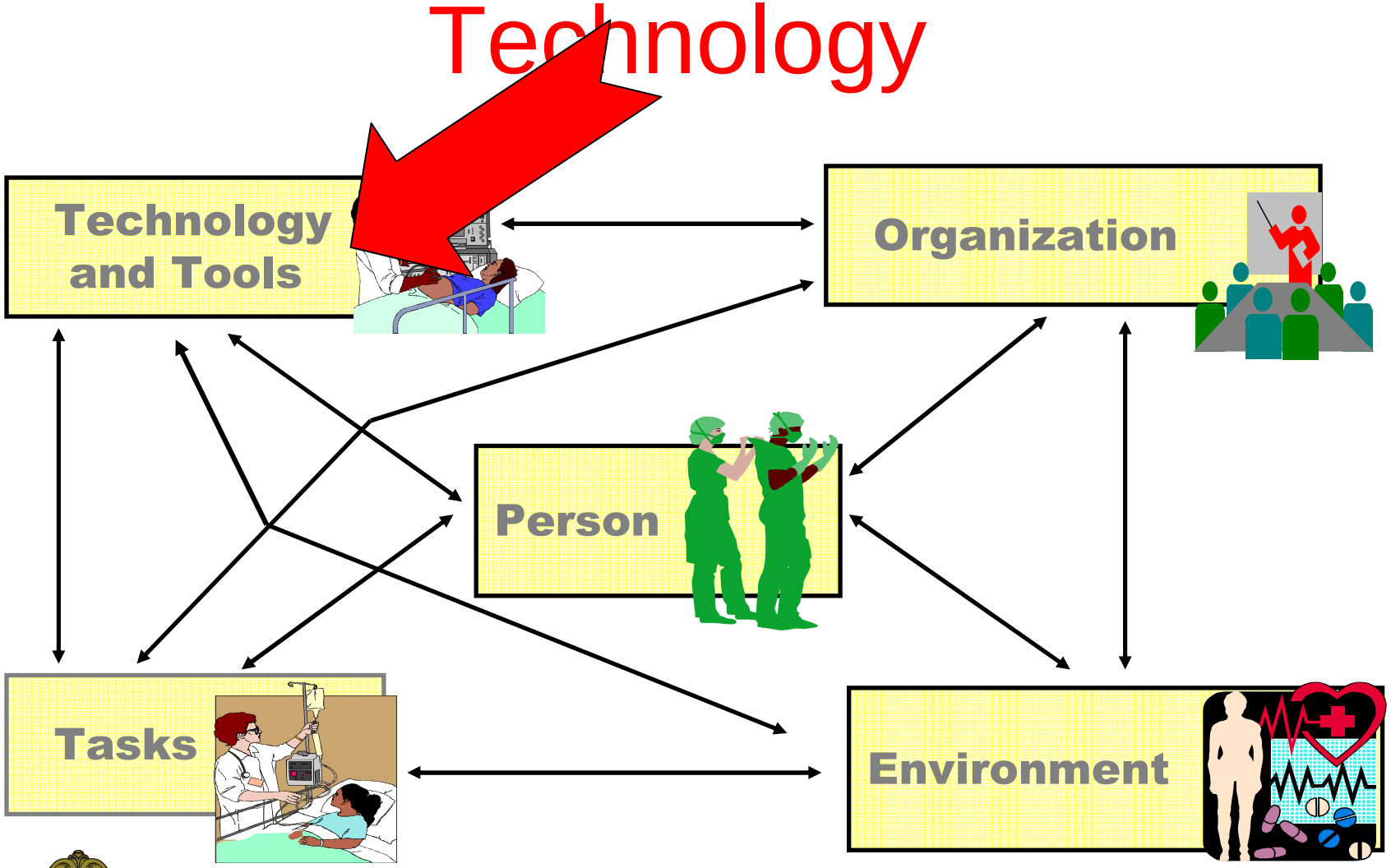
SEIPS Model of Work System and Patient Safety

SEIPS = System Engineering Initiative for Patient Safety



Carayon et al., 2006

Healthcare Information Technology

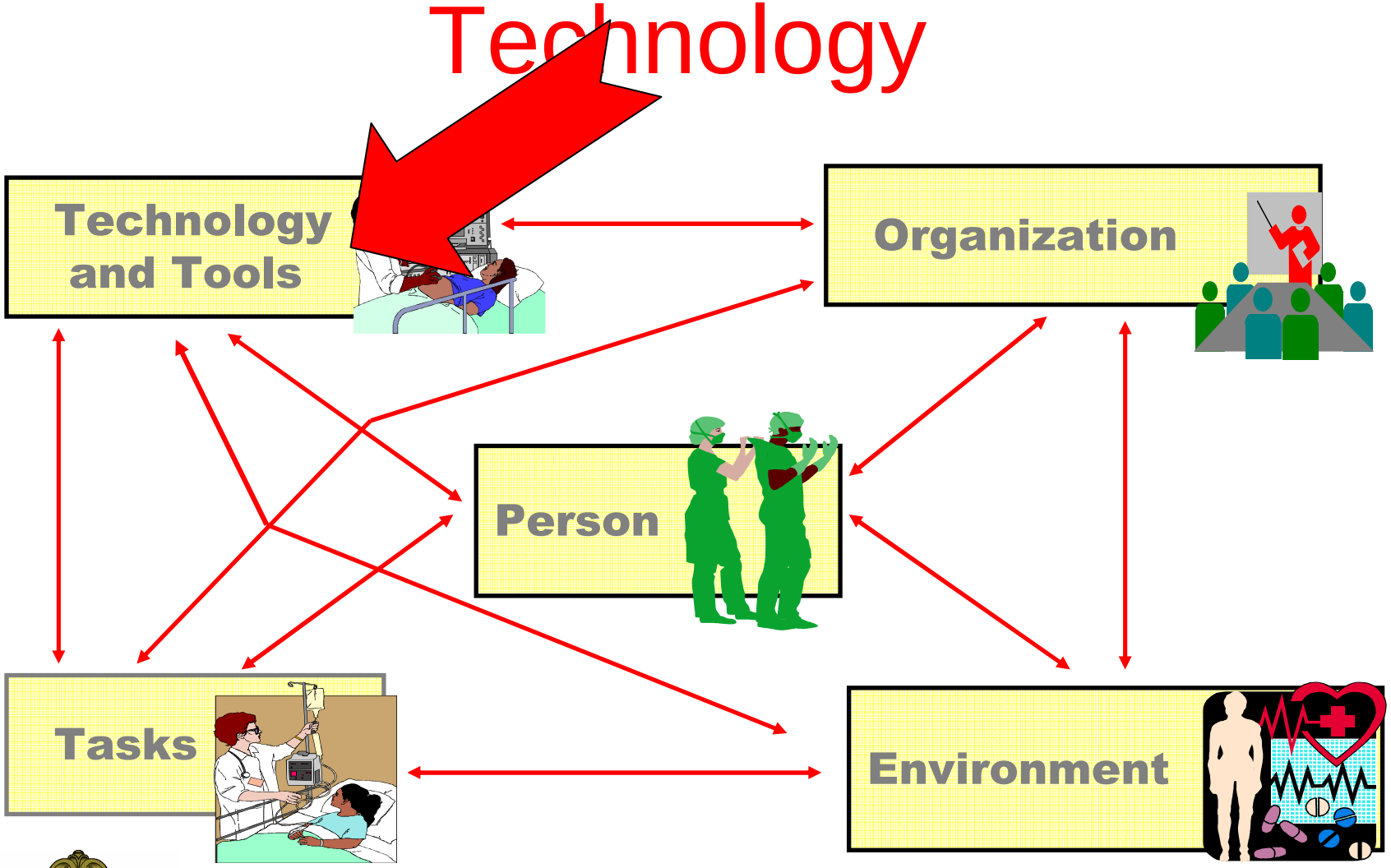


THE UNIVERSITY of WISCONSIN MADISON

Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Healthcare Information Technology

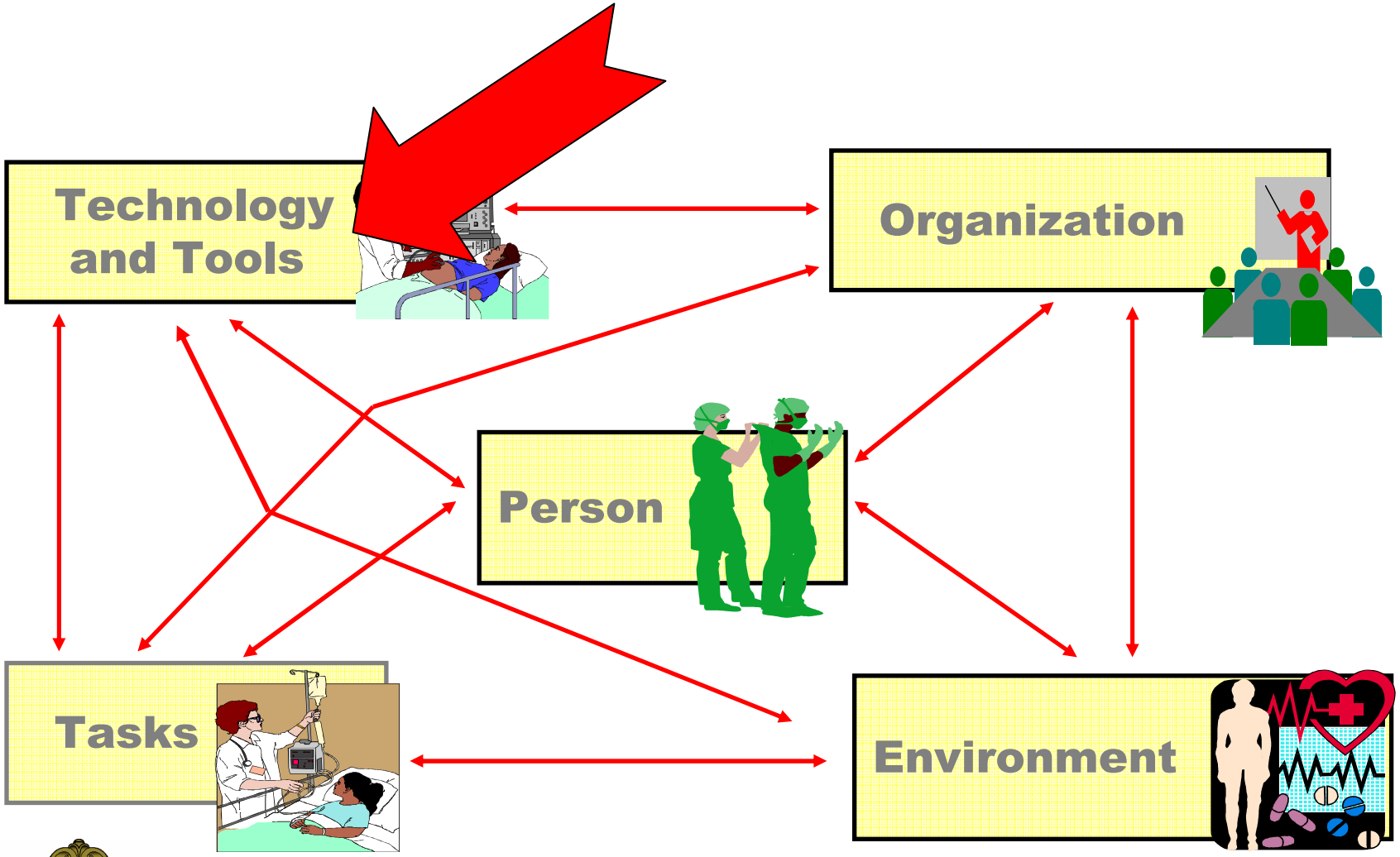


THE UNIVERSITY of WISCONSIN MADISON

Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

CPOE

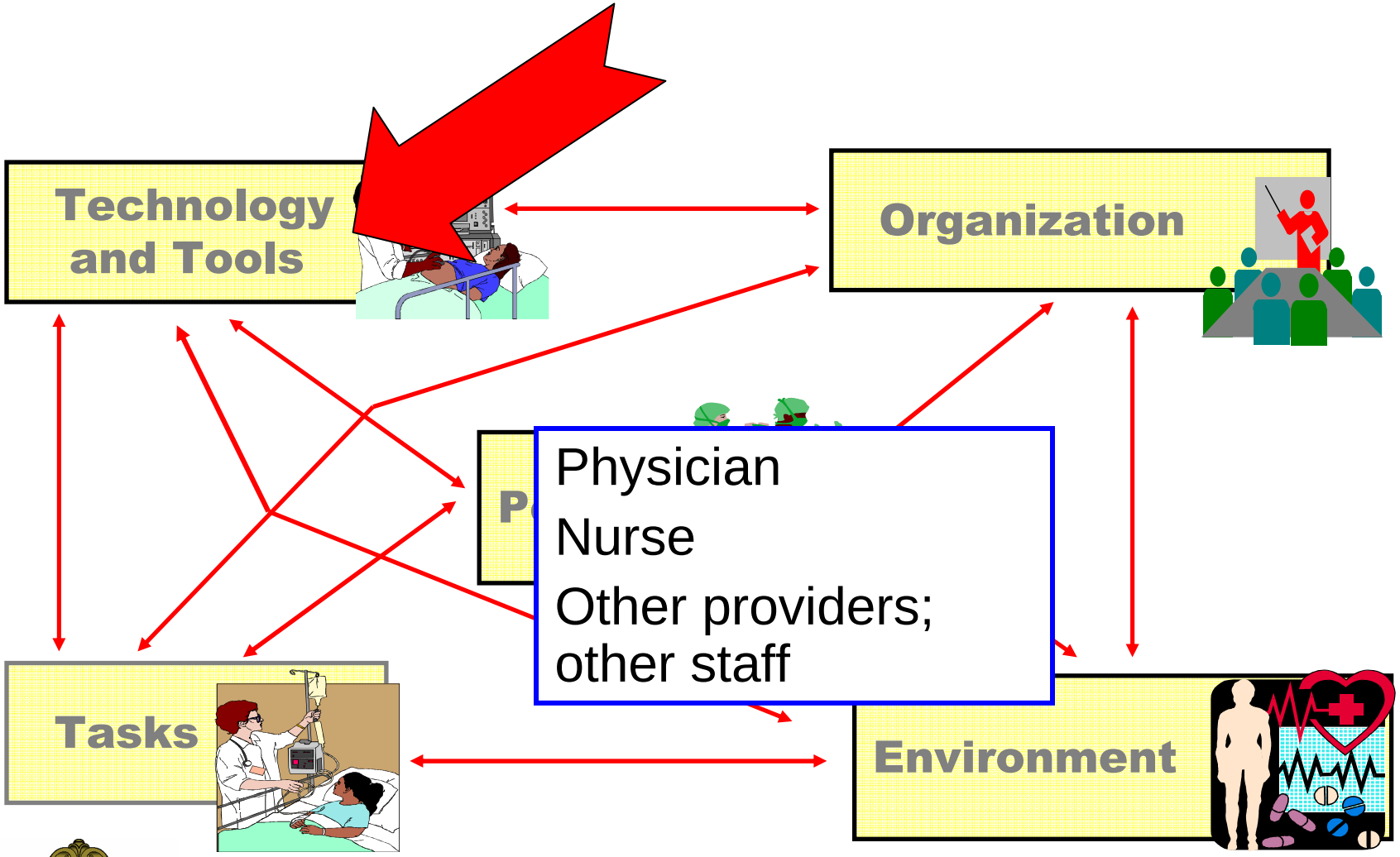


THE UNIVERSITY of WISCONSIN MADISON

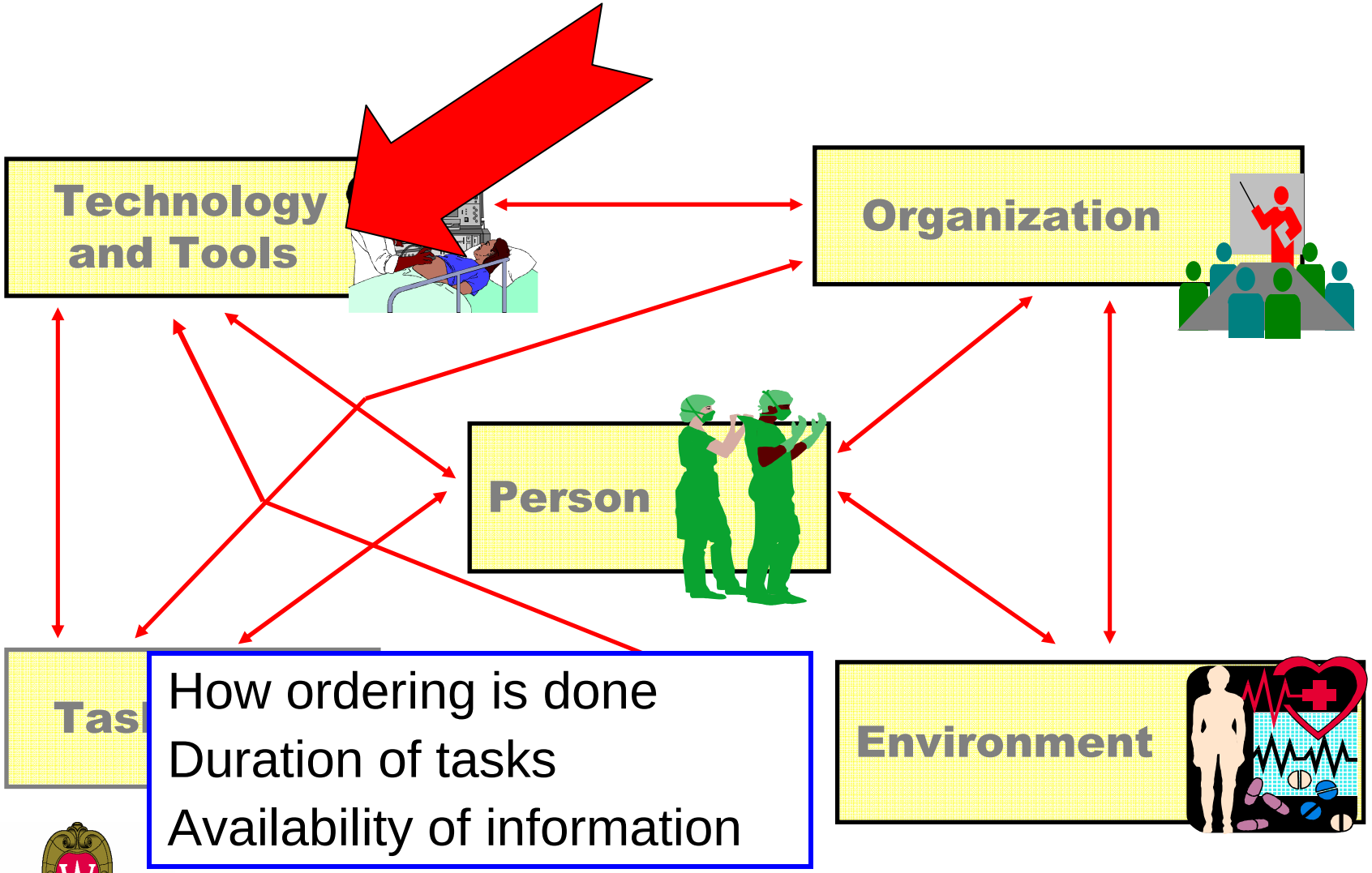
Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

CPOE

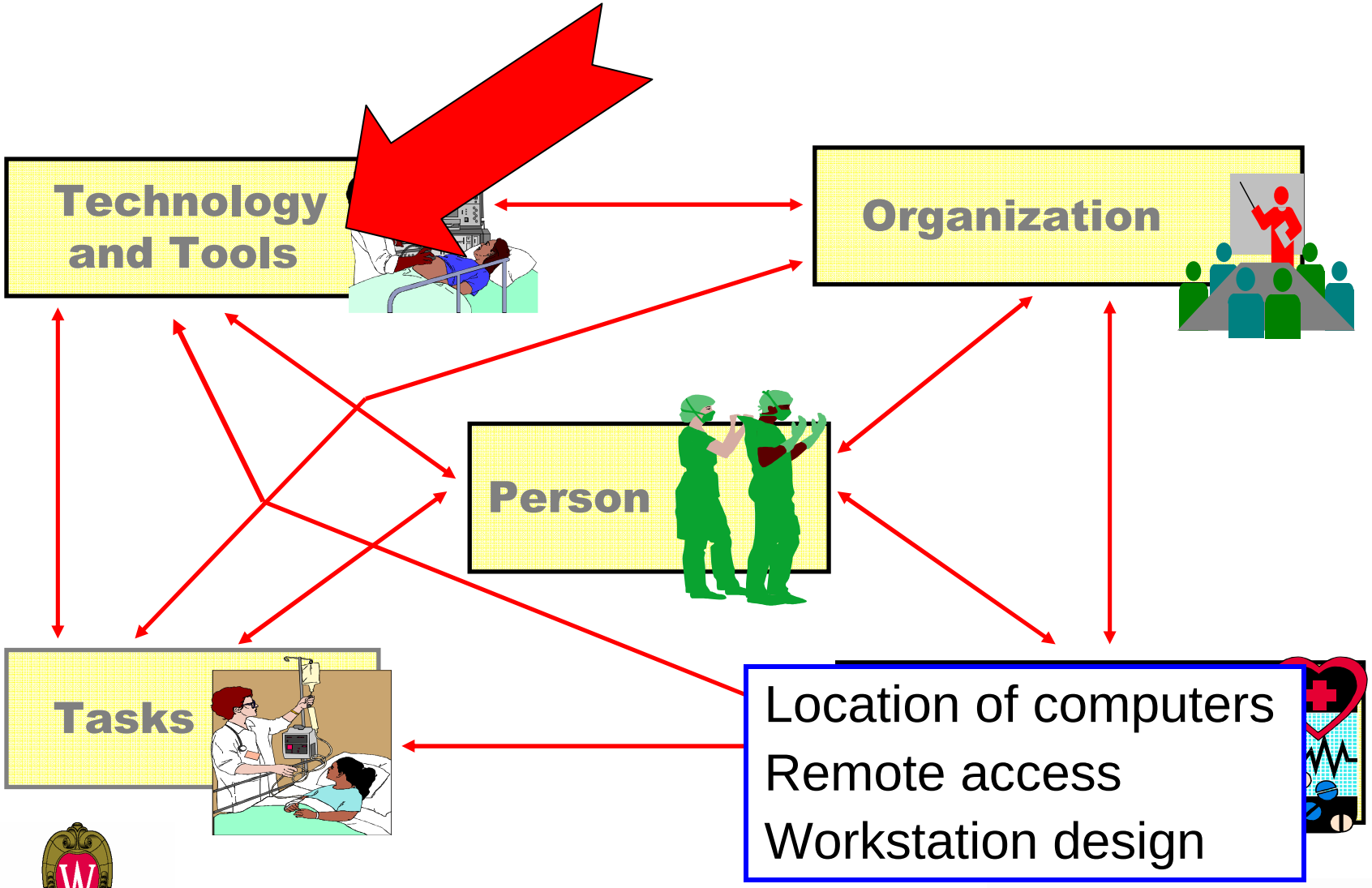

Technology and Tools
Organization
Tasks
Environment
Physician
Nurse
Other providers; other staff

CPOE



How ordering is done
Duration of tasks
Availability of information

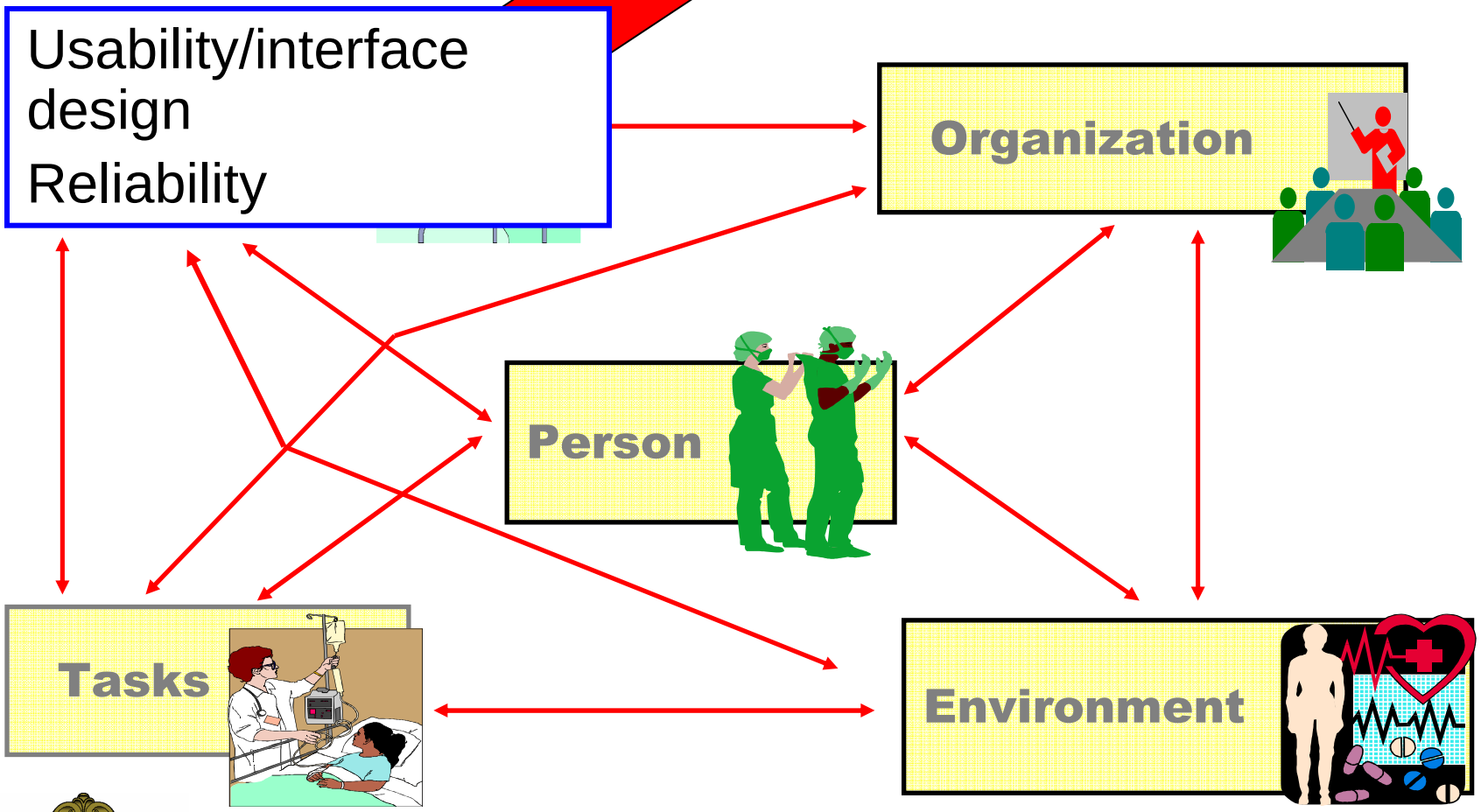
CPOE


Technology and Tools
Organization
Person
Tasks
Location of computers
Remote access
Workstation design

CPOE

Usability/interface design

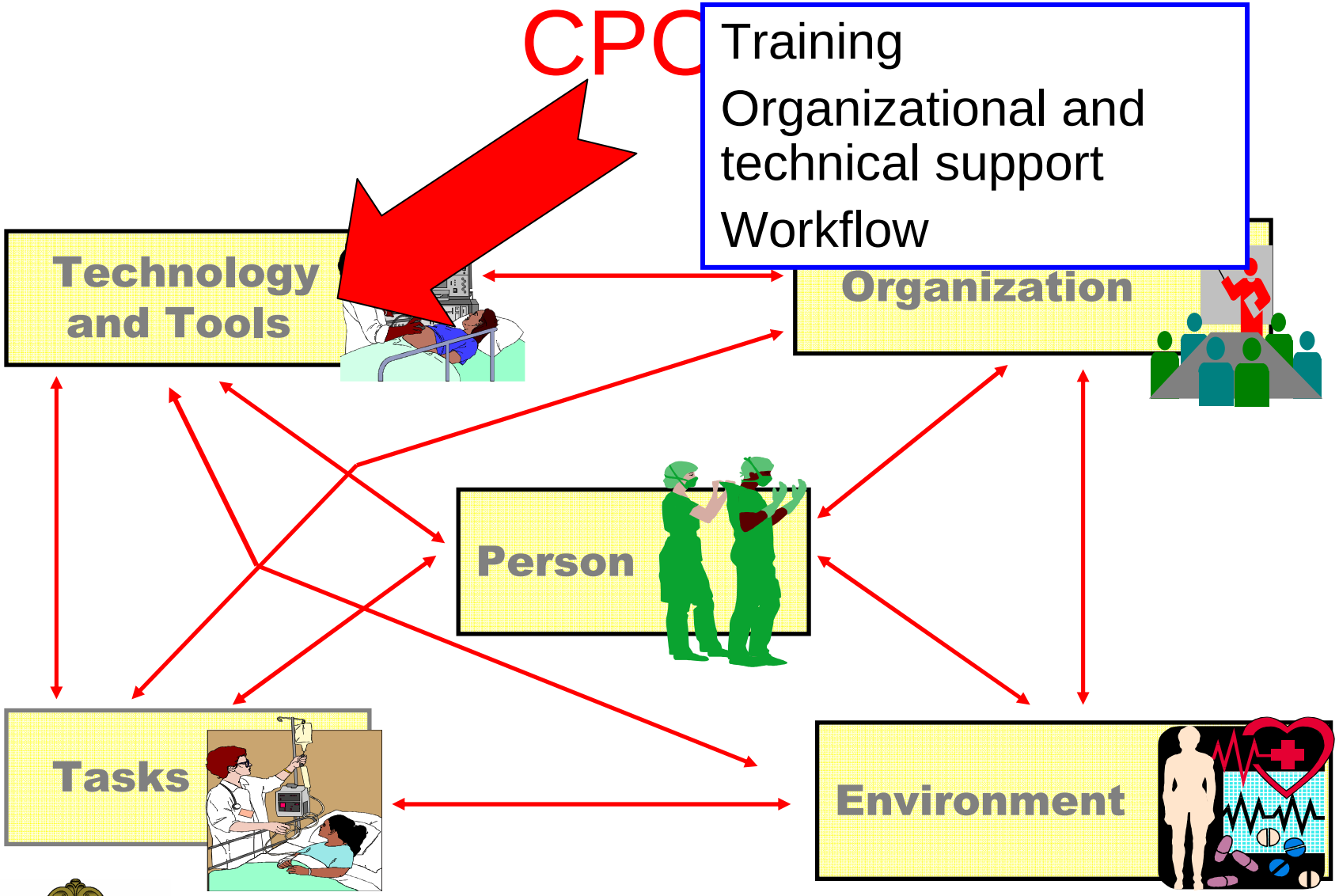
Reliability

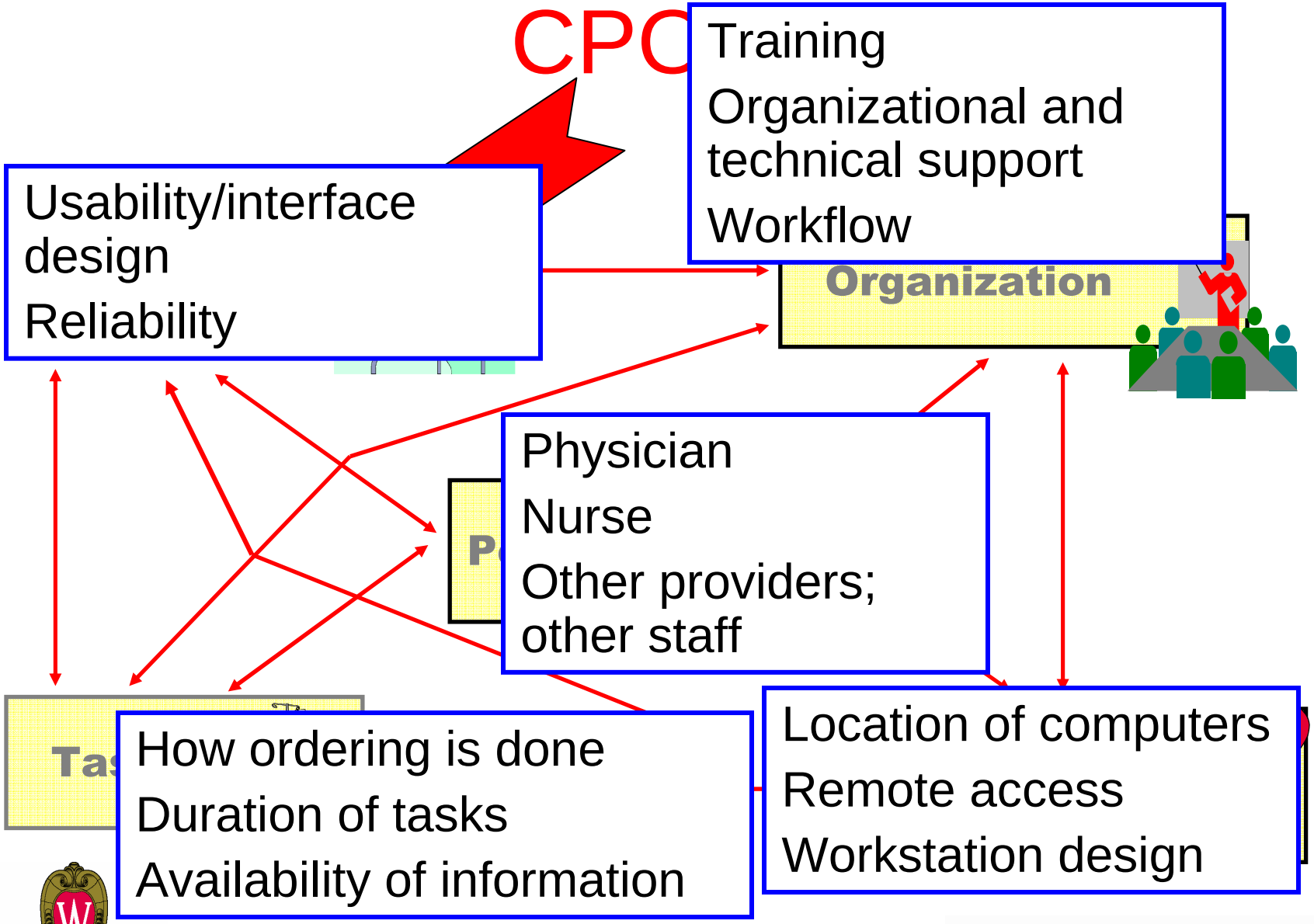


THE UNIVERSITY of WISCONSIN MADISON

Presented by Pascale Carayon, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

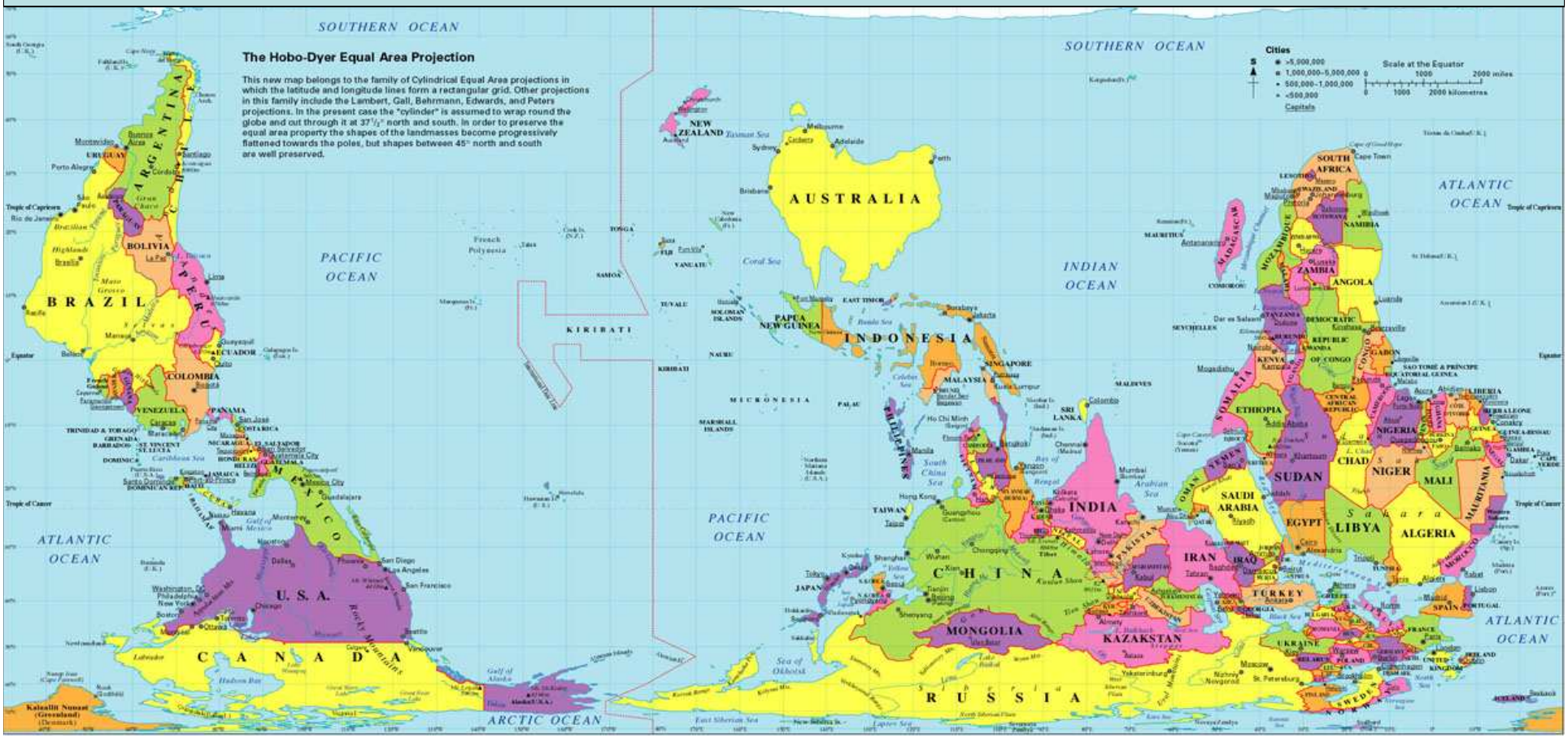

CPC
Training
Organizational and technical support
Workflow
Technology and Tools
Organization
Person
Tasks
Environment


CPO
Training
Organizational and technical support
Workflow
Usability/interface design
Reliability
Organization
Physician
Nurse
Other providers; other staff
How ordering is done
Duration of tasks
Availability of information
Location of computers
Remote access
Workstation design

Design of the Sociotechnical (HIT) System

- Human factors and ergonomics:
  - Interface design, layout, workstation, task/job design,…
- Methods and tools:
  - Analysis of existing work systems and processes
  - Prospective analysis
- Beyond design…
  - Implementation
  - Use [continuous change]…

The world upside down!



Presented by Pascale Carayon, PhD

THE UNIVERSITY of WISCONSIN MADISON

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Pascale Carayon, Ph.D.
Center for Quality and Productivity Improvement
Department of Industrial and Systems Engineering
University of Wisconsin-Madison

email: carayon@engr.wisc.edu / tel: 608-265-0503

THANK YOU

Hidden Issues In Implementing Technology: A Summary of IT Implementation Science

Ben-Tzion Karsh, PhD
Associate Professor
Industrial and Systems Engineering
University of Wisconsin-Madison
http://www.engr.wisc.edu/ie/faculty/karsh_ben-tzion.html

THE UNIVERSITY of WISCONSIN MADISON

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

DEPARTMENT OF Industrial Engineering
College of Engineering University of Wisconsin-Madison

SEIPS Systems Engineering Initiative for Patient Safety

“Like many facilities our IS department has acquired modules, software etc. based on separate departments individual requests. For instance, laboratory's system becomes outdated and IS has let that department pick the system of their choice usually with little regard as to how it will interface with the main system used for patient registration, entering orders, etc. Each department insists on buying the program that is best for their specialty and they are usually under time constraints.

I have seen sentinel events and near misses occur time and time again based on lack of communication due to poor interfacing systems. For example, it is difficult for ancillary departments to receive isolation or allergy information that is kept in the main database. (Forgive me if I label anything wrong in the IS part as I am a nurse.)

The very computer systems we have installed to try and improve productivity and communication have created new safety problems and frustrated staff. Recommendations from RCAs have led to begging IS for customizations to our main system. Each customization has been complex for IS staff and very expensive for the organization.

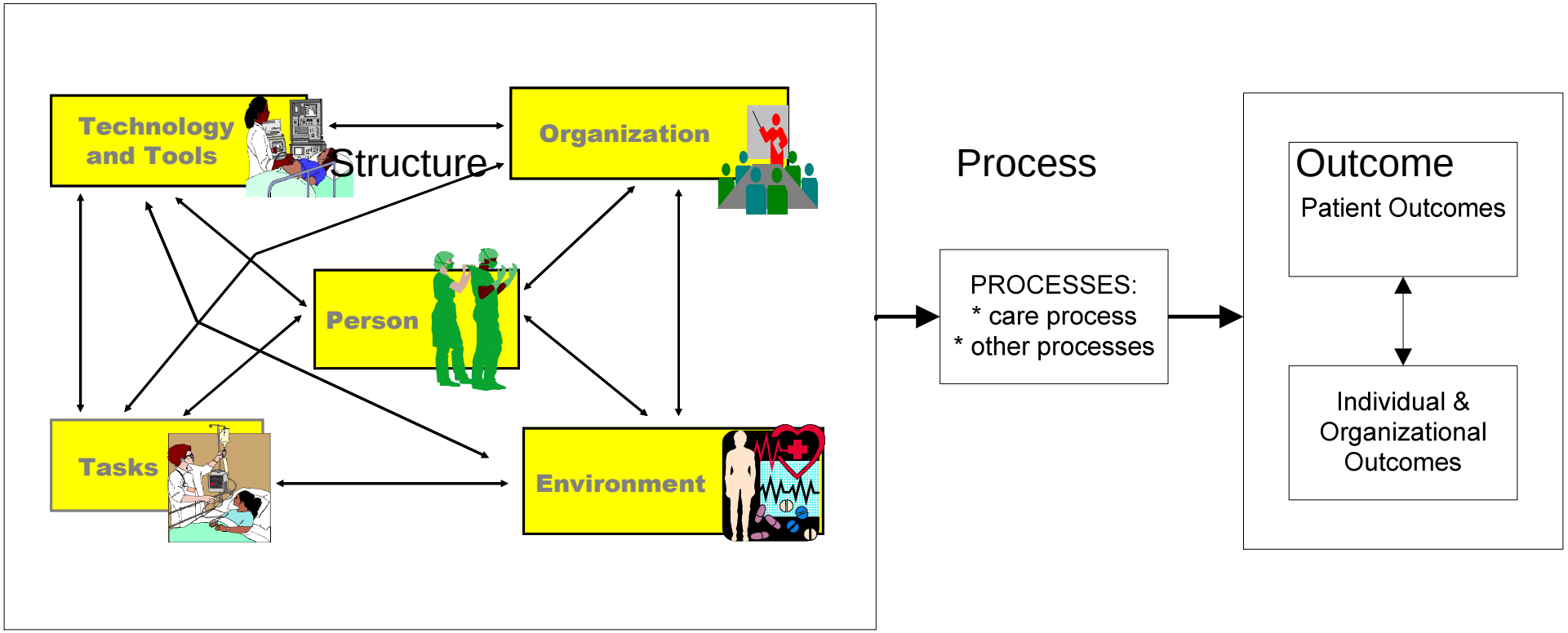
To make matters more complex IS is off campus so to most staff the computer system and its support staff are a big mystery. Staff feel they have little input into the system until enough problems occur and administration takes notice. The system was purchased in a great hurry due to Y2K issues. I can only assume after using it for three years as a nurse that little staff input was used in selection.

I have an interesting perspective on the interaction between the IS system because I was in patient care until 5 months ago. Never did I look at the relationship between the human side of my work and the computer system I used daily. Only after acquiring my new role did I discover the critical interaction that occurred constantly between these two systems”

The hidden issue…

- ***A technology change is tantamount to an organizational change***
  - Implementing a technology will change the organization structure and culture
  - Implementing a technology may require organizational changes to accommodate the technology
  - Implemented technologies may have to be designed to better accommodate the organization

SEIPS System Model

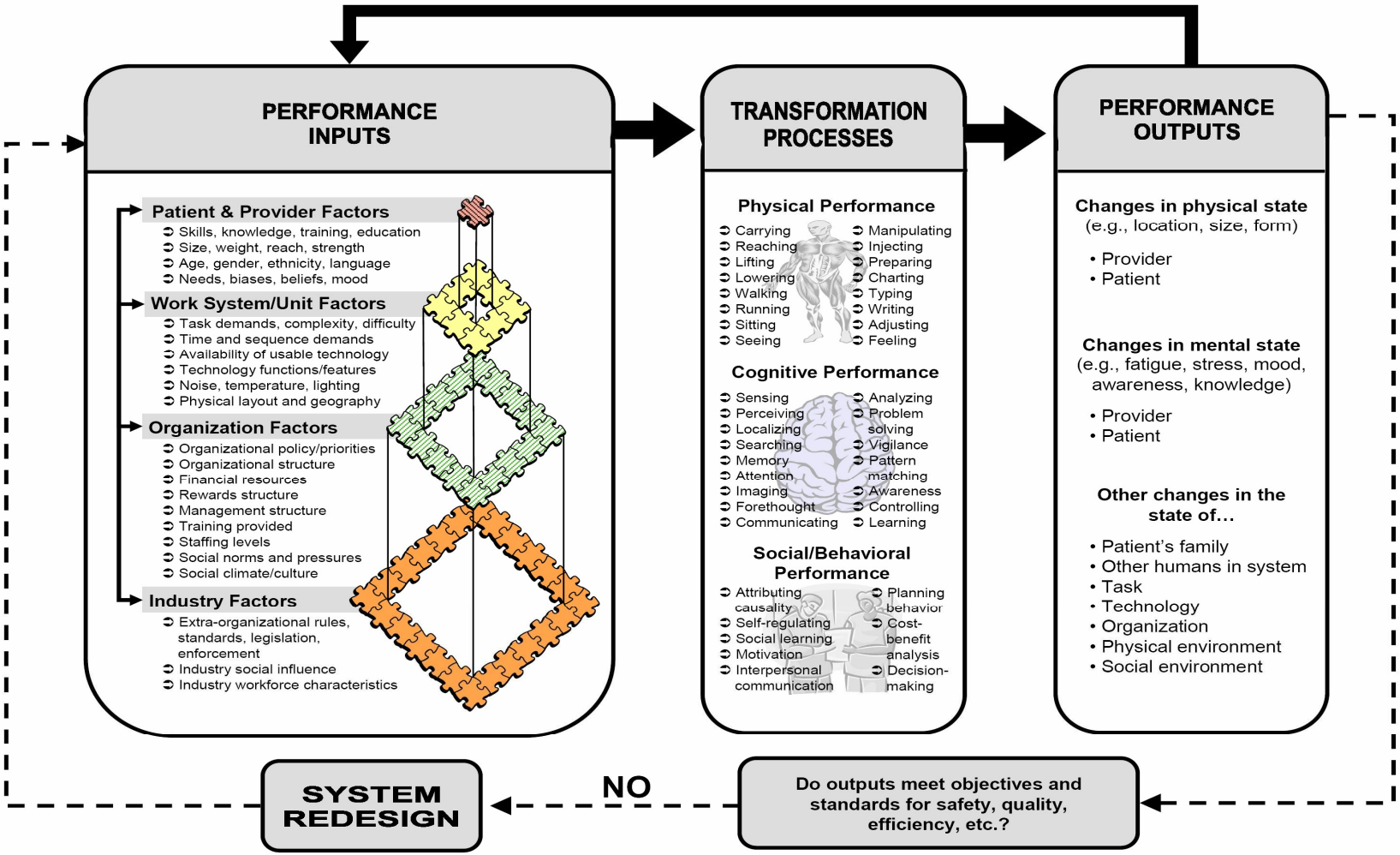


Carayon, P., Hundt, A. S., Karsh, B., Gurses, A. P. Alvarado, C. J., Smith, M., and Brennan, P. F. (2006). Work system design for patient safety: the SEIPS model. Quality and Safety in Healthcare, 15(Suppl I), i50-i58.

THE UNIVERSITY of WISCONSIN MADISON

Presented by Ben-Tzion Karsh, PhD

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov



Karsh, B., Holden, R. J., Alper, S. J., and Or, K. L. (2006). A human factors engineering paradigm for patient safety – designing to support the performance of the health care professional. Quality and Safety in Healthcare, 15(Suppl I), i59-i65.

The Good News…

There is a science related to technology implementation

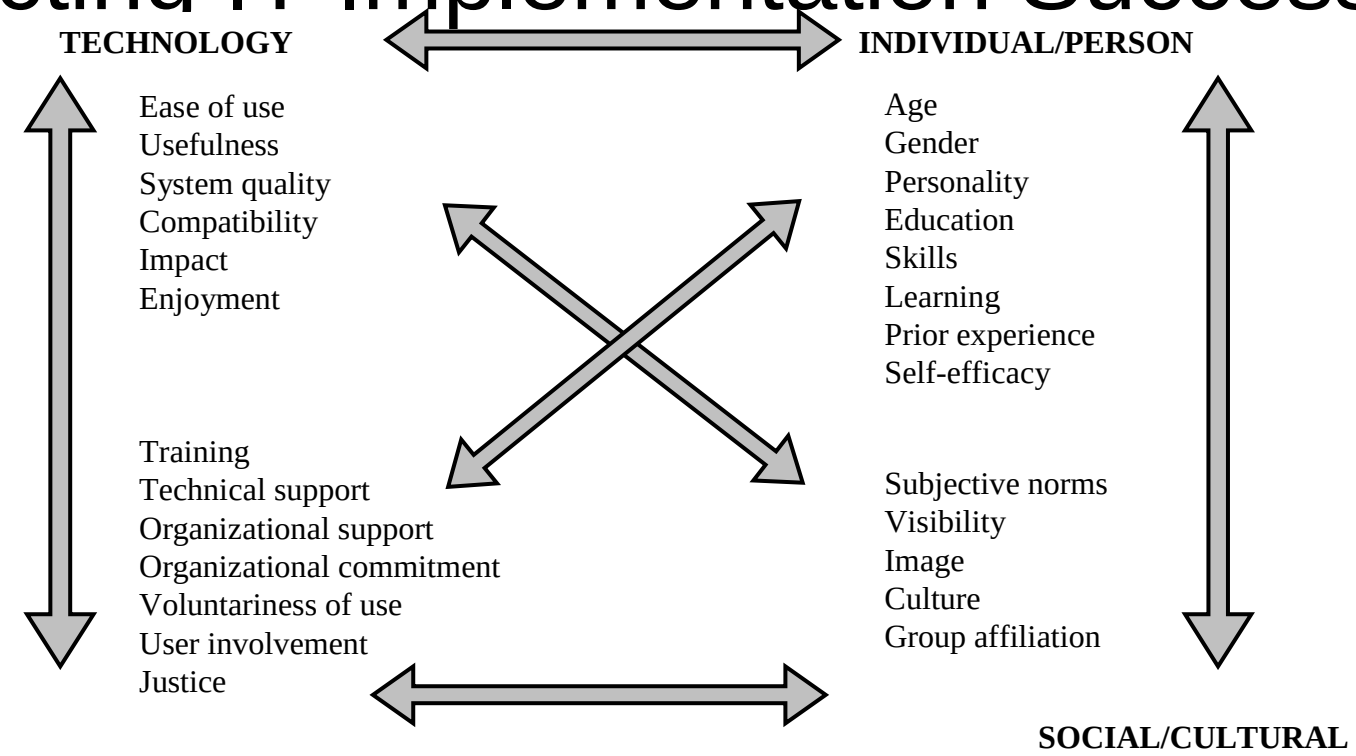
Foundations of the Science

- Open system theory
- Sociotechnical system theory
- Behavioral theories from psychology
- Communication theories
- Organizational behavior theories

Specific literature examples

- Diffusion of innovations
- Technology acceptance model (TAM)
- Management of Information Systems (MIS)
- Organizational justice
- Self-efficacy
- Macroergonomics
- Participative decision making (PDM)

Summary Systems Model of Variables Affecting IT Implementation Success



Karsh, B. (2004). Beyond usability for patient safety: designing effective technology implementation systems. British Medical Journal: Quality and Safety in Healthcare, 13(5), 388-394.
Karsh, B. Holden, R. (2006). New technology implementation in health care. In P. Carayon (Ed.). Handbook of Human Factors and Ergonomics in Patient Safety (pp. 393-410). Mahwah, NJ: Lawrence Erlbaum Associates.

Translating research into practice

- Top management commitment
- Simulation before, during and after implementation
- Develop clear communication structures
- Design to accommodate the range of user needs
- Create readiness for technology change
- End-user participation
- Training
- Pilot test
- Benchmark
- Study the horizon
- Utilize feedback systems
- Structured program
- Implement at a pace that facilitates learning

Each must be designed appropriately to promote success

Thank you

Ben-Tzion Karsh, Ph.D.
Associate Professor
Department of Industrial Engineering
UW-Madison

Contact Information
Industrial Engineering
University of Wisconsin-Madison
1513 University Avenue, Room 4155D
Madison, WI 53706
Tel: 608-262-3002
Fax: 608-262-8454
E-mail: bkarsh@engr.wisc.edu
URL: http://www.engr.wisc.edu/ie/faculty/karsh_ben-tzion.htm

Sociotechnical Lessons for HIT Implementation:
Examples and Insights

Ross Koppel, Ph.D.
Center for Clinical Epidemiology and Biostatistics, School of Medicine, University of Pennsylvania & Sociology Department, University of Pennsylvania

UNIVERSITY OF PENNSYLVANIA HEALTH SYSTEM
Center for Clinical Epidemiology and Biostatistics

Presented by Ross Koppel, PhD

AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

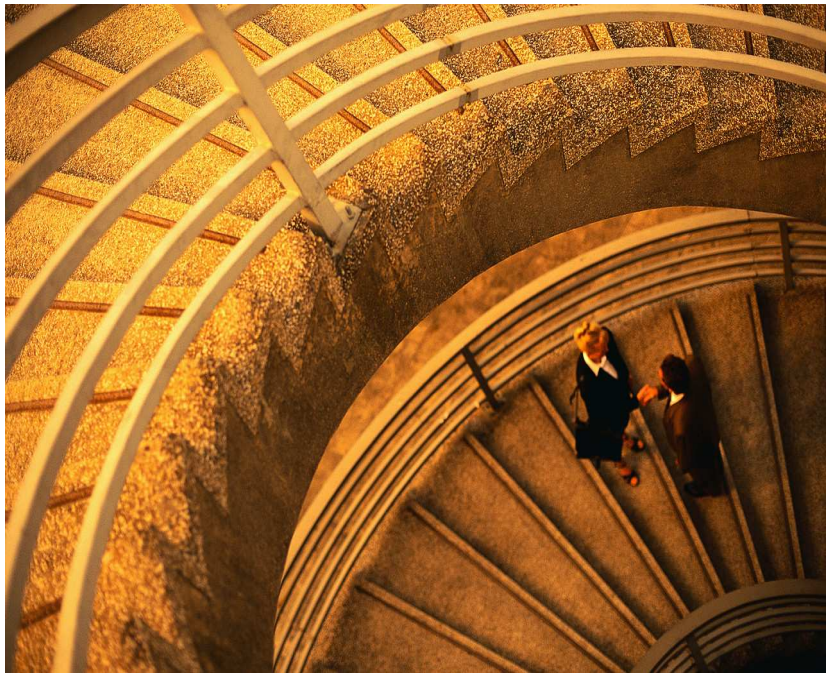
HIT Takes A Village

Say you introduced a topnotch HIT last week.

In preparation, you spent years examining:

- workflow
- interaction among departments
- interactions with other systems
- workplace culture
    - and….

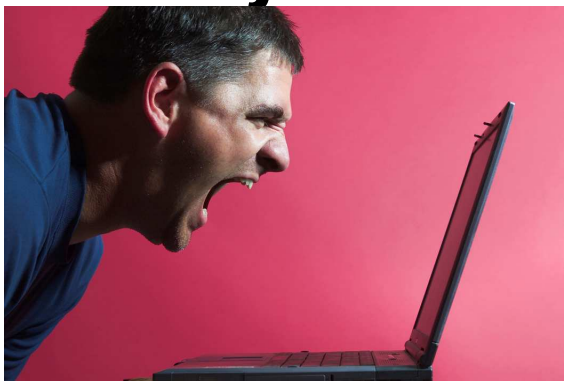
HIT Takes A Village (2)



- You even looked at everyone's histories of HIT implementation (which, of course, is absurd)

If you did all that...you would:

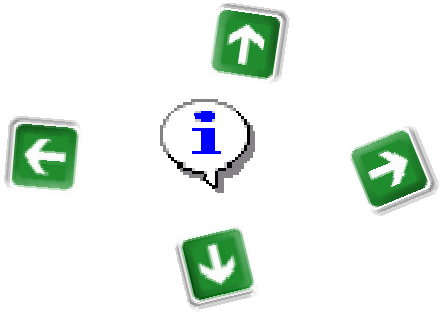
- Make far fewer mistakes
- Irritate far fewer people
- Get much greater buy-in
- …..***But you would still have to make thousands of adjustments***.



Why?

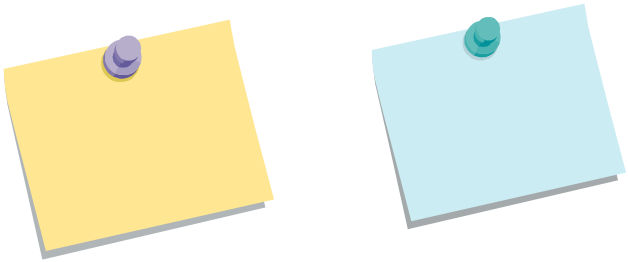
- Because HIT interacts with everything…

(often in ways that we don't see even when we are looking for them)



Simple Example:

- A hospital, planning for CPOE, diagramed and studied every process, workflow, handoff, etc.
- But on “go live” day, children’s and adult’s orders were totally confused. Why? Because nurses had always used differently colored forms for kid vs. adult patients… (and no one noticed).

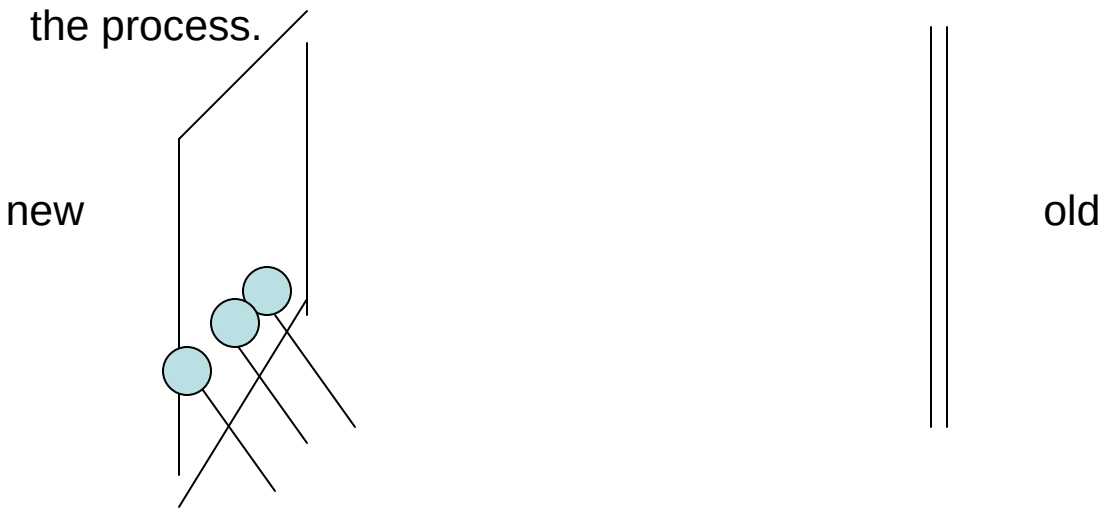


Example 2: ED e-Whiteboard

- Robert Wears' example of a new electronic whiteboard in the ED: It displayed everything you'd want (each patient, the primary team, stage of movement through the ED, pending data, etc.)
- But, the computer console for the new electronic whiteboard was inconveniently located. The staff could not all look at the e-whiteboard and make immediate changes or notes.
- With the old one, people could physically interact with the board. (They could move names, add notes, and all could see and participate).

ED e-Whiteboard (2)

- Wears' photo: The ED staff are all leaning against the new e-whiteboard looking at the old whiteboard. The e-whiteboard, although technically fine, failed to allow the staff interaction best suited to allocating resources or exchanging and displaying information and priorities. The control console was not integrated into the process.



ED e-Whiteboard (3)

- Also, the e-whiteboard couldn't put up a little magnetic teddy bear to denote infant patients

Templates as Gods

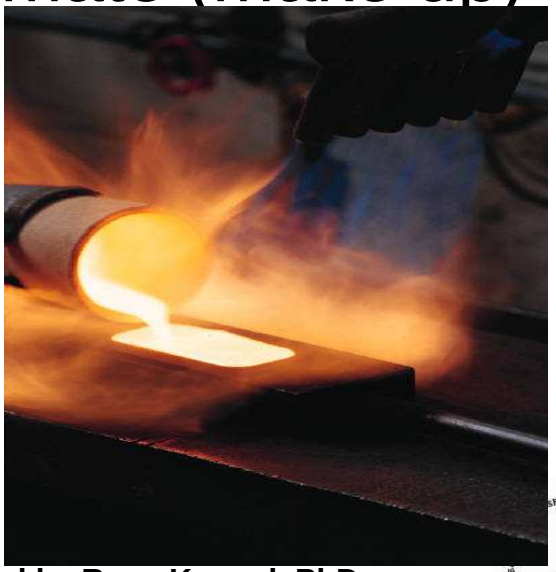
- Consider these questions:

- Are you in a relationship now or are you looking for a new relationship?
- Are you happy with your job or do you want a new job?

Templates as Gods: Forced Fields

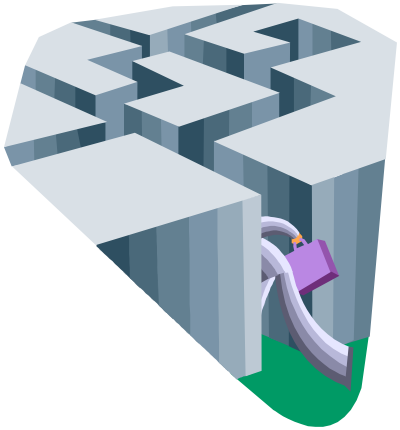
Some on-line forms demand information or answers that don't fit reality or circumstances

One CPOE requires docs to enter a **patient's weight** before ordering meds. For some medications, physicians often estimate (make up) weights…just to get past a "forced field" (required data item).



Templates as Gods: Forced Fields

- Alas, if the *next* physician is calculating a *weight-sensitive* medication, he/she may use that "estimated" weight. That benign guess becomes the critical factor in an error.



Templates as Gods: Solutions?

- A correct (dated) patient weight could be on all ordering screens
- Or the forced field may allow an *"I don't know and it's not relevant"* option for some meds….

Last Example: Stealth Dosing

From a forthcoming article coauthored by Koppel.

1. Housestaff are often eager to try new, expensive antimicrobials.
2. But ID fellows must approve their use. ID fellows use CPOEs and EMRs to examine antimicrobial med orders.

So, 3, Housestaff developed ***stealth dosing.*** They wait until the ID fellows go off-duty at 10 PM to order restricted antimicrobials.

Stealth Dosing (2)

- In the morning, ID fellows review the night's orders. Sometimes they demand changes. (But changing antibiotic regimes can be problematic, so the ID fellows let most orders stand.)
- Because ID fellows often take no remedial actions, and housestaff can game the system, stealth dosing weakens antimicrobial oversight.
- **Lesson: Interaction of (A) the social system with (B) the HIT → affects (C) HIT-in-use, which then further alters (A) the social system**
- **A ⇄ B → C** (A = eager housestaff, B = CPOE/EHR, C = how HIT is really used)

This Slide Assumed

Remember Harrison, Carayon, and Karsh on sociotechnical theory and practice

– So we jump to action

Implementing HIT: History is Alive

Implementation of HIT, even when accomplished with *kindness & forethought*, is the insertion of powerful software that reflects many compromises made in the HIT's:

- design
- history with previous systems & clients
- integration with current systems…&
- the willing or not-so-willing consent

of participants in the receiving institution.

The best HIT reflects learning from mistakes

All commercial HIT represents embedded choices of others who have made thousands of mistakes

Safe HIT benefited from those mistakes via ***continuing and proactive assessments, analyses and, then, ongoing corrective action.***

How to get it right….Less wrong

Implementation of HIT requires meticulous attention to its actual use *in situ*.

<u>Evaluation should</u>:

1-Encompass organizational and unit workflows, environment, policies and rewards

2-Involve a multidisciplinary group

3-Use mixed methods, e.g., statistical analyses, observations, workflow analysis, interviews, and focus groups (from Koppel, Wetterneck, Telles, Karsh)

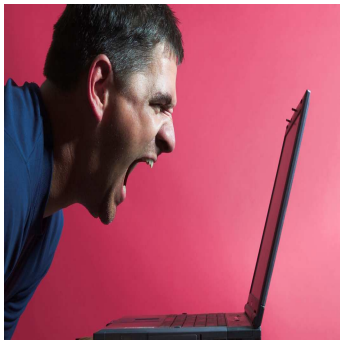
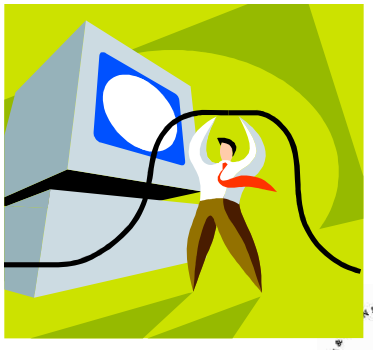
How to get it less wrong (2)

4. Evaluators and implementation teams should work with vendors, but not cede control to them
5. Qualitative and quantitative examinations must be *on-going*

You are never done because the interaction of HIT and your system is dynamic.

Thank you.

Ross Koppel, Ph.D.

Center for Clinical Epidemiology and Biostatistics, School of Medicine, University of Pennsylvania & Sociology Department, University of Pennsylvania

rkoppel@sas.upenn.edu