

Patient Safety & Human Factors Science



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Outline

Define human factors and describe key concepts

Examine the relationship between human factors and patient safety principles

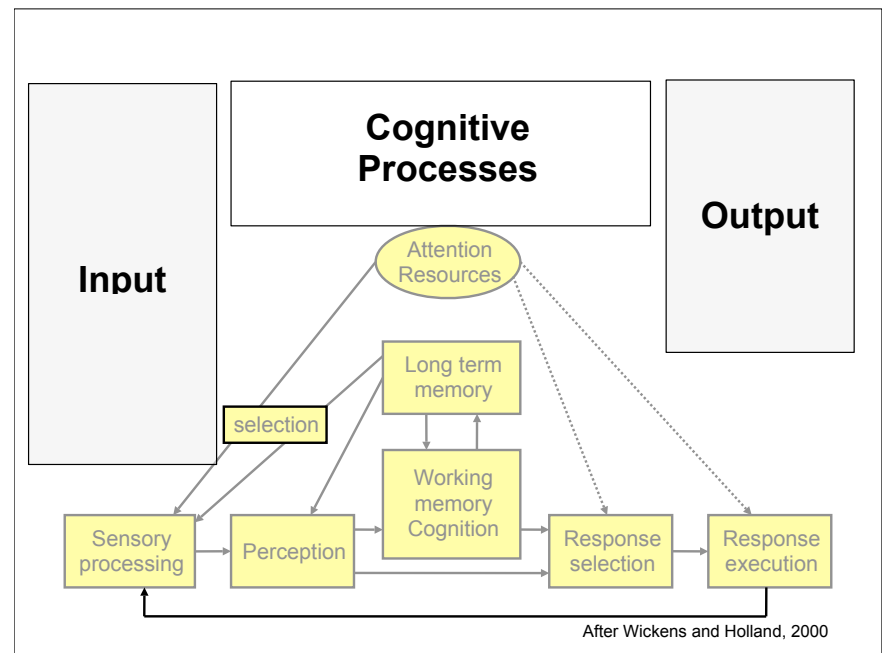
Consider application of human factors to perianesthesia nursing

Human Factors

The study of how humans interact with systems...

Designing systems to **meet** needs, limits and capabilities of the people who **work in them**.

Fundamental goal: "to reduce error, increase productivity, and enhance safety and comfort."



Medication Error PACU

Cause: performance deficit
Cause: procedure not followed

Contributing:
Distraction
Workload
Inexperience

Cause of Error	No.	Percent	Contributing Factor	No.	Percent
Performance deficit	278	45.6	Distractions	76	47.2
Procedure/protocol not followed	145	23.8	Workload increase	25	15.5
Communication	105	17.2	Staff, inexperienced	24	14.9
Documentation	80	13.1	No access to patient information	14	8.7
Knowledge deficit	69	11.3	Shift change	14	8.7
Contraindicated, drug allergy	40	6.6	Cross coverage	13	8.1
Dispensing device involved	40	6.6	Emergency situation	7	4.3
Written order	38	6.2	Staffing, insufficient	7	4.3
Pump, improper use	32	5.2	Staff, floating	5	3.1
Transcription inaccurate/omitted	32	5.2	No 24-hour pharmacy	4	2.5
Monitoring inadequate/lacking	31	5.1	Staff, agency/temporary	3	1.9
Calculation error	24	3.9	Poor lighting	1	0.6
System safeguard(s)	22	3.6			
Preprinted medication order form	19	3.1			
Verbal order	19	3.1			
Dosage form confusion	18	3.0			
Drug distribution system	18	3.0			
Computer entry	13	2.1			
Equipment design	12	2.0			
Packaging/container design	12	2.0			

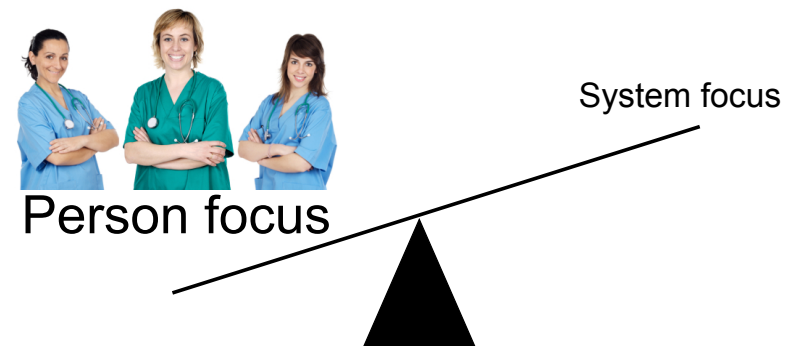
Medication errors involved drugs used for analgesia, sedation, antimicrobial therapy, or anticoagulation. Because these are frequently used agents in postanesthesia settings, this finding is consistent with expected results.

Human Factors and Patient Safety: The Connection



The Systems Approach

- Preventable adverse events are caused by interaction between:
 - flaws in the working environment (system)
 - unavoidably imperfect humans
- Adverse events can be reduced by building a system that:
 - reduces error
 - prevents error from causing harm





Person focus

System focus

What happens when human factors are not considered?



See cases at:

<http://www.webmm.ahrq.gov/index.aspx>

Right patient, right _____.

Web M&M

<http://www.webmm.ahrq.gov/case.aspx?caseID=62>

Near Miss

Active Patient Identification

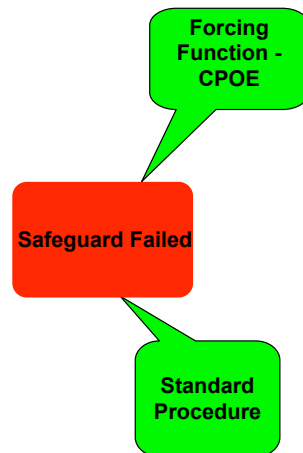
Patient Misidentification

"Time Out"

Epidural Hematoma

Web M&M

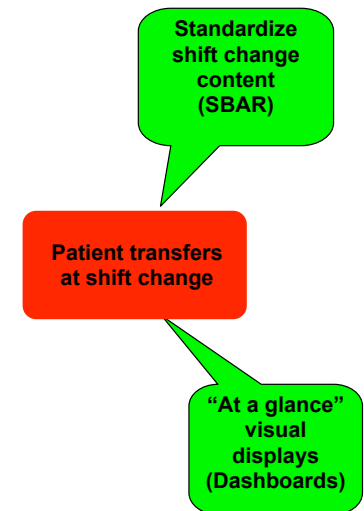
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Handover Communication

Web M&M

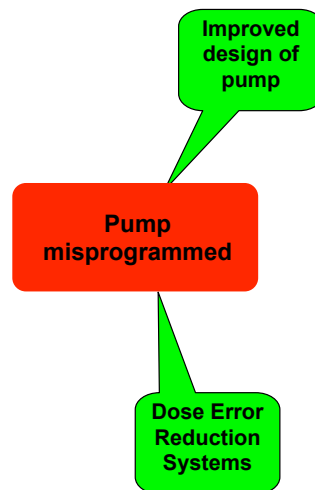
<http://www.webmm.ahrq.gov/case.aspx?caseID=103>



PCA Overdose

Web M&M

<http://www.webmm.ahrq.gov/case.aspx?caseID=103>



The bottom line:

We must understand and integrate the principles of human factors in order to build/support a **culture of safety**

The Story of Patient Joe

Background

- 42 year old male
- Active and healthy
- History of repeated right knee injuries leading to osteoarthritis of the knee
- Tries multiple modalities to alleviate pain
- Family Physician refers him to a orthopedic surgeon

Joe's First Visit to the Hospital

- Meets Surgeon
- Surgeon recommends a right knee replacement
- Joe agrees
- Surgeon's assistant makes an OR booking request
 - Books appointments for the OR and Preadmission Clinic Appointment (PAC)

POTENTIAL HAZARD: Pre-printed orders from surgeon do not reach the Pre-Admission clinic

Failure to get the information needed.

acquisition, record...

Paper and Online Forms

Form Purpose

- Communication Device
 - Conveys information as instructions or orders
 - Aid to safe handoffs
- Process Guide
 - Affords proper execution of steps in a process (process checklist)

* Many forms serve both purposes*

Communication Device

- Text (answer) spaces
 - Adequate in size
 - Appropriate location
- Instructions to guide accurate completion
 - < 100 words
 - Use active sentences
 - Use affirmative sentences
- Tick boxes
 - Offer clear choices
 - Adequate space for accurate placement of marking

Process Guide

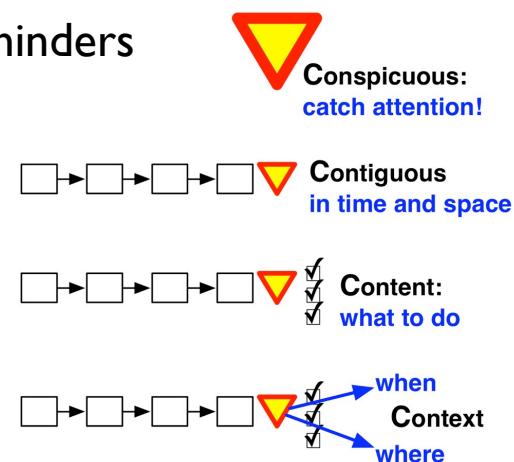
- Form sequence matches process sequence
- Build-in checklists for safety
- Constraints to restrict inappropriate or unsafe choices/entries
- “Mapping and congruence”

Joe's Second Visit to the Hospital

- Joe arrives at pre-admission clinic
- A chart for Joe has been assembled
- Joe has
 - Bloodwork ECG
 - ARO screening
 - completes the anesthesia questionnaire
 - reviews his medication list with the nurse
 - participates in pre-op teaching
- Joe goes home

POTENTIAL HAZARD: Critical lab results from pre-admission not communicated to patient prior to surgery

Criteria for effective reminders



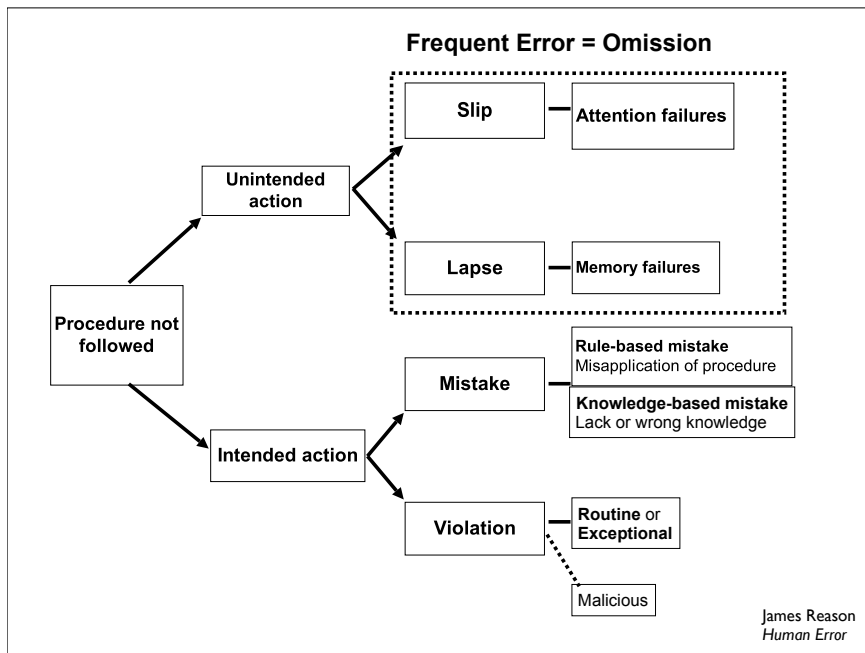
J Reason

Joe's Third Visit to the Hospital

- Joe arrives on his day of surgery
- Checks into the Same Day Surgery Unit
- Nurse admits Joe
 - IV started
- Consent, allergies etc. confirmed
- Joe is taken to the OR
- Joe has his right knee replacement

POTENTIAL HAZARD: The wrong knee is replaced

Misidentification of
patient, procedure, side...



Omission Affordance

- **Affordance** -Situational factors or characteristics which promote the likelihood of a particular action.
- **Omission affordance in procedures**
 - Situational factors or characteristics of a procedural step which promote the likelihood of omitting that step or part of the action involved in that step.
- 8 omission affordances

Omission Affordances

- Information Load
- Functional Isolation
- Repeated Step
- Necessary Step After Main Goal
- Item Acted On Hidden or not Obvious
- Departure from Standard
- Weak or Ambiguous Signal
- Interruption Likely

Post Surgery

- Joe is transferred to the PACU
- No face to face verbal report from OR to PACU prior to patient arriving

POTENTIAL HAZARD: PACU staff are not aware that the patient requires isolation for MRSA and appropriate isolation precautions not taken

Functional Isolation

No prior step cues the action involved in this step or the step does not follow as part of an easily recognized succession. No subsequent step requires this step's completion.



Post Surgery

- Anesthesiologist provides report to PACU RN
- RN admitting patient
 - Reviewing record
 - Setting up monitor
 - Setting up PCA
 - Listening to Anesthesiologist
 - Multiple alarms in background
 - Noisy room with high people traffic

POTENTIAL HAZARD: Critical patient information is missed i.e. STAT Hgb order due to large interoperative blood loss

Weak or Ambiguous Signal

The step must be triggered by a signal that is easily missed (not heard, not seen, or not recognized)

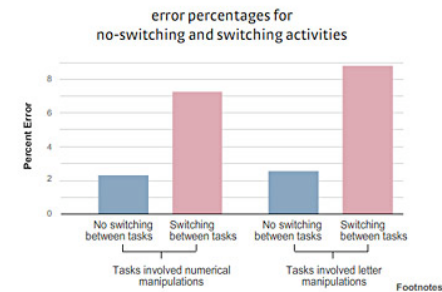
Unexpected Interruption Likely

The procedure is likely to be interrupted at, or just before, this step.

The Age of Multitasking

the brain
does not multi task,
it switches attention
between tasks...

...and switching causes error



See *Brain Rules* by John Medina

Post Surgery

- Joe wakes up
 - RN teaches him how to use the PCA machine for pain management
- **POTENTIAL HAZARDS:** Pump is programmed incorrectly by RN due to multiple interruptions (and poor pump design)

Usability: A Good Solution

Human Factors & Usability

- A major component of human factors is looking at and understanding how humans interact with technology
- Usability
 - Focuses on the user
 - Goal is to ensure user can easily complete tasks

Usability in Healthcare

- Focus on the healthcare clinician as the user
 - Healthcare clinicians use technology to be productive and efficient
 - Healthcare clinicians must complete tasks safely in chaotic environments
 - Healthcare clinicians provide the best feedback on ease of use
 - Dumas, J., Redish, J. A Practical Guide to Usability Testing Revised Edition 1999

Outcomes of Applying Usability Principles

- Eliminate or reduce errors
- Enable quicker performance
- Less frustration for user

Usability Engineering Tools

- **Usability Testing:** empirical evaluation of people using a device in lab or realistic situation
- **Heuristic Evaluation:** application of Human Factors guidelines or principles to identify potential problems
 - Device Usability Checklist

Device Usability - Checklist

- General Human Factors Impressions
 - **Feedback and Visibility of System Status**
 - Consistency with Other Devices and Experience
 - Functionality of Controls
 - Displayed Messages
 - **Recognition and Recovery from Errors**
 - Ease of Use
 - Readable and Understandable Labels and Warnings
- » Gosbee, J., Gosbee, L.L. (2003)

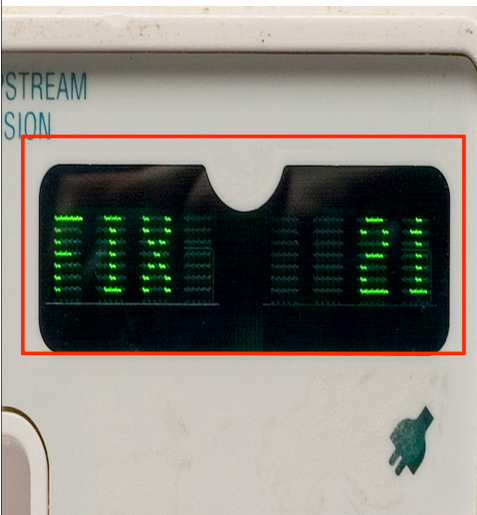
Feedback and Visibility of System Status

Do something - get feedback?

Know what device is doing? What to do next?

Distracted - know where you are?

Recognition and Recovery from Errors



Error messages clear?

Can you tell if you make an error?

Know how to fix errors? Cues to help?

Application

Device Usability Checklist

- **DEVICES IN-USE:** Determine potential hazards and take preventive action
- **NEW DEVICES:** As a guide to assist product trial evaluation and procurement
- Support other analysis (e.g. FMEA, RCA)

The ideal time to
apply human
factors science is
at design or
acquisition.

Include:
Hazards
Safety
Human Factors

Joe Leaves the PACU

- Joe admitted to the Orthopedic in-patient unit
- Transferred by Porter

POTENTIAL HAZARD: Without RN to RN handover critical information about the patient is missed i.e. repeat bloodwork to monitor low Hgb from interoperative blood loss

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A Handover Tool

 **Internal Patient Hand-over Tool**
P&G DRAFT OCTOBER 23rd

LAST NAME (First)
DATE OF BIRTH HFNR
YY MM DD
ADDRESS
Imprint or enter details by hand

This checklist provides a standardized guideline for communicating patient information when transferring a patient from one unit of the hospital to another. The purpose of this checklist is to ensure that the receiving healthcare provider has enough information to **safely** care for the patient & family. *Is this our purpose? Yes we thought this was the purpose of the TOA*

Guidelines

- Please ensure that report is given in the presence of the family if possible
- All items on checklist must be reviewed and acknowledged
- Follow the order of the checklist as outlined
- All shaded areas must be read back
- If you are interrupted or distracted at any point start over

Information to Communicate
<input type="checkbox"/> Family member present – Yes <input type="checkbox"/> No <input type="checkbox"/>
<input type="checkbox"/> Name
<input type="checkbox"/> Gender / Gestational Age
<input type="checkbox"/> HFN ID bracelets checked
<input type="checkbox"/> Date/Time of Birth – needs to be shaded
<input type="checkbox"/>
<input type="checkbox"/> Admitting Diagnosis
<input type="checkbox"/> Pertinent history of current illness
<input type="checkbox"/> Physical Assessment (findings)
<input type="checkbox"/> Vitamin K/Erythromycin eye ointment given & signed
<input type="checkbox"/> Planned feeding method
<input type="checkbox"/> Pain Scale and Management
<input type="checkbox"/> Medications/ MAR reviewed/last dose/next dose
<input type="checkbox"/> IV site/ Saline Lock
<input type="checkbox"/> Labs/diagnostics completed or pending (e.g. preparation completed, abnormal results, tests not completed, results pending)
<input type="checkbox"/> Treatments, procedures, therapies completed and/or pending (last accucheck)
<input type="checkbox"/> Orders (admission or transfer orders) Reviewed
<input type="checkbox"/> Isolation required? Type – based on symptoms (confirmed infection/current policies)
<input type="checkbox"/> VRE/MRSA screening
<input type="checkbox"/> Standards of Nursing Care activated
<input type="checkbox"/> Monitoring/level of observation
<input type="checkbox"/> Consults completed and/or to be completed
<input type="checkbox"/> Patient/Family concerns addressed or reviewed on report
Other:
Additional Notes
RN Transferring Patient: _____ (print name) _____ Unit _____
RN Receiving Patient: _____ (print name) _____ Unit _____
Date Report Provided _____

Key Messages

- Human Factors is a science
- Design of systems should include human factors criteria to be effective
- Elaborate re-design is not always necessary
- Many improvements are practical and achievable by everyone

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