Medical Errors:
The Systems Approach
What is Quality Healthcare?
Six Dimensions of Quality

**Safe** – avoiding injuries to patients

**Effective** – providing services based on scientific knowledge

**Patient-centered** – providing care that is respectful of and responsive to individual patient preferences, needs, and values

**Timely** – reducing waits/delays

**Efficient** – avoiding waste

**Equitable** – providing care that does not vary in quality because of personal characteristics
The 5 Million Lives Campaign defines "medical harm" as:

- Unintended physical injury resulting from or contributed to by medical care (including the absence of indicated medical treatment), that requires additional monitoring, treatment or hospitalization, or that results in death.

- Such injury is considered harm whether or not it is considered preventable, resulted from a medical error, or occurred within a hospital.
Medical Error

• “Failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim… including problems in practice, products, procedures and systems”

  QuIC Task Force, 2000

• Patient Safety: Freedom from accidental injury due to medical care, or medical errors

  AHRQ/IOM
Medical Approach To Error Prevention

The Myth of Perfect Performance

– Method: Training & Punishment

– Error = Negligence/Carelessness
Culture of Safety - Reporting Incidents and ‘Near Misses’

• A ‘fair and just’ Culture of Safety makes it safe to report incidents, mistakes and near misses.

• Learning together from mistakes and preventing their recurrence is the priority.

• You may report incidents, mistakes or near misses through your supervisor. You may also do so, anonymously if you wish, by contacting the Patient Safety Officers, JoAnn Spear, at x2-1530 (UH) or Barbara Lopez, at x2-2950 (NJMS).
BLAMELESS REPORTING
‘Blameless’ Reporting

- University Hospital & NJMS holds staff who report errors or near misses ‘blameless’ EXCEPT IN THE FOLLOWING CASES:
  - Error is due to staff illegal behavior
  - Error is due to staff willfully disregarding policy
  - Error reporting is delayed and results in worsening harm to the patient
The Modern Approach to Patient Safety
July 9, 2008, 9:07 pm
Heparin Overdoses Hit Babies in Texas Hospital
This time, it’s more infant overdoses: 17 babies at a Texas hospital got too much of the blood thinner…. 

Parents sue over babies' heparin overdoses Infants were given too much heparin at Methodist Hospital

Heparin Overdose at Cedars-Sinai Hospital Endangers Three Babies, Including Twins of Actor Dennis Quaid
This report says medical errors such as indecipherable prescriptions cause the deaths of 98 patients a year, or is that 98,000? It's hard to read this. In any case, we're supposed to report them, or is that repeat them?
Magnitude Of The Problem

• **98,000** preventable deaths each year due to medical errors in America’s hospitals
  “To Err Is Human” IOM report 2000

• **191,000** deaths/yr - Estimated cost:$6.3 billion/yr
  “2004, Health Grades”

• IHI estimates that nearly 15 million instances of medical harm occur in the US each year – a rate of over 40,000 per day.

http://www.ihi.org/IHI/Programs/Campaign/Campaign.htm?Tabld=1
Medical Errors

Medical errors would be ranked as the sixth leading cause of death in the US if recognized by the CDC in its annual National Vital Statistic Report.

The United States loses more Americans lives to Patient Safety incidents every 6 months than it did in the entire Vietnam War.
Out of 40 million hospitalizations, 1.16 million “safety incidents” occurred.

247,662 deaths were directly attributed to the incidents.

The safety incidents accounted for $8.6 billion in additional Medicare costs.

The Patient Safety Indicators with the highest incidence rates were decubitus ulcer, failure to rescue and post operative respiratory failure/sepsis.

Source: Third Annual HealthGrades Patient Safety in American Hospitals Study

Map showing top performers, as expected performance, and bottom performers across the United States.
Comparison to other countries

U.S. ranks last or near last on basic performance measures of quality, access, efficiency, equity, and healthy lives.

*Business Week June 2007*
Types of Medical Errors

- Medication
- Surgical
- Diagnostic
- Nosocomial
- Teamwork & Communication
- Human Factors Engineering
- Transition & Handoff
What is Human Factors Engineering?

• Designing systems devices, software and tools to fit human capabilities and limitations

• Using methods to uncover hidden needs and unexpected interactions

• Taking advantage of knowledge bases about human-system interaction
Case study

• An unconscious patient was brought into the ICU.

• Initial physical examination and chest radiography revealed possible worsening CHF. Blood gases were consistent with COPD. He had several instances of ventricular arrhythmias in the previous 12 hours and it was determined that he needed more invasive and closer monitoring.

• The transport monitor showed a blood pressure of 120/80 mm Hg and a heart rate of 72 bpm.

• One of the 4th year medical students had recently completed a month on the cardiology service. His attending had constructively "counseled" him several times to treat the patient, not the "numbers". This student noticed and commented to the group that the patient had a respiratory rate of 24 beats/min. Given the stable BP and heart rate on the transport monitor, this tachypnea seemed out of place. At nearly the same time the ICU nurse hooked the leads up to the wall mounted cardiac monitor. Many in the room gasped in surprise to see the "real" heart rate of 140 bpm and BP of 80/60.

• The transport monitor had been left in demonstration (demo) mode. Demo mode is a software program within the device that generates data to continuously display waveforms and numbers that demonstrate the capabilities of the monitor device. It is often used during training. The former EMT pointed out the small "D" on the monitor screen to the team who were now assessing and preparing emergency treatment for this unstable patient.

• Over the next few hours the ICU team was successful in stabilizing the patient. Throughout these activities many of them wondered aloud: "How could the transport team have been so careless . . .?"
How Big a Role is HFE?

99% of all adverse events

HFE

- The more “human-centered” the design, the more it can support or can enhance a person’s performance.

- If a device has a high level of usability it can reduce the likelihood of causing harm to a patient.

- The more complex and counterintuitive the sequence of actions required to run medical devices or use clinical software, the more likely an error during use can cause a patient to suffer inadvertent harm.
PCA: Programming Sequence
Redesign

Legend
- Decision
- Message-guided
- Action

Existing Design

New Design
The Stroop Test

The Stroop Test provides insight into cognitive effects that are experienced as a result of attentional fatigue.


Radar Scope to Detect “enemy” ships
Can You Read This?

Aocdrcnig to a rscheearch at Cmabrigde Uinervtisy, it deosn’t mttaer in what oredr the ltteers in a word are, the olny iprmoetnt tihng is that the frist and lsat ltteer be at the rghtit pclae. The rset can be a toatl mses and you can stitll raed it wouthit porbelm. This is bcusea the huamn mnid deos not raed ervey lteter by istlef, but the word as a wlohe.
Can You See The Problem?

Look-Alike/Sound- Alike Drugs

hydralazine
hydroxyzine

cerebyx
celebrex

vinblastine
vincristine

chlorpropamide
chlorpromazine

glipizide
glyburide
A better approach…
TALL MAN LETTERING

hydrALAZINE
ceREBYX
vinBLASTine
chlorproPAMIDE
glipiZIDE

hydrOXYzine
ceLEBrex
vinCRIStine
chlorproMAZINE
glyBURIDE
Front and back photos of similar labeling/packaging between Isuprel® and Lopressor®.
A healthcare professional recognized that the labeling of their heparin Carpjects® (for thromboembolic disorders) and digoxin Carpjects® (for congestive heart failure) were so similar that if the labels were faced away from the reader, the Carpjects® could easily be mistaken for one another.
Photo of similar size vials and colored caps between tobramycin and naloxone.
Healthcare “Systems”
Range from the Simple to Complex

- Syringe, catheter bag and its tubing
- O₂ cylinder, ECG machine, IV pump
- Code cart, anesthesia work station
- Hospital computer system
- MRI control room and suite
- ICU, ED, OR
Scope of Human Factors Engineering (for example)

• Anesthesiology
  – Design of alarms, monitors, and safety systems

• Emergency Medicine
  – Design of decision-making tools and monitoring

• Surgery
  – Design of hand tools and visualization devices (laparoscopy)
“Quotes” from Adverse Events

- “Get the green and gray tank and put it in the endoscopy cabinet & attach it to the insufflator valve"

Green tank and Gray tank?
Green and Gray tank….?
Can you really ignore the color?

- “Ignore the color in some cases, focus on the label…”
  » Summary from an ECRI Alert

- “Color is not fool-proof, only read and trust the label”
  » Guideline from the Compressed Gas Association
Baseline Drawer ("Laundry hamper")
Range = 2:43-3:58 min, Avg=3:07 min

Note the multiple orientations
Code Cart Drawer Fifth Version
Range = :55-1:25 min,  Avg=1:08
Conclusion

HFE provides a "tried and true" framework for building and strengthening that elusive safety culture.

The process of HFE can also be applied to many patient safety activities in healthcare organizations, including procurement of medical equipment, RCAs, and patient safety training activities.
PATIENT SAFETY GOALS & ROOT CAUSE ANALYSIS (RCA)
2008 – 2009 Patient Safety Goals

Goal 1: Improve the accuracy of patient identification.

Goal 1A. Use at least two patient identifiers when providing care, treatment or services.

Goal 1C. Eliminating transfusion errors related to patient identification.

UH Policy #831-200-301, Patient Identification. Name and MR # in hospital, name and DOB in Outpatient areas.
2008 – 2009 Patient Safety Goals
Goal 2: Improve the effectiveness of communication among caregivers.

2A For verbal or telephone orders or for telephonic reporting of critical test results, verify the complete order or test result by having the person receiving the information record and "read-back" the complete order or test result.

2B Standardize a list of abbreviations, acronyms, symbols, and dose designations that are not to be used throughout the organization.

2C Measure and assess, and if appropriate, take action to improve the timeliness of reporting, and the timeliness of receipt by the responsible licensed caregiver, of critical test results and values.

2E Implement a standardized approach to “hand off” communications, including an opportunity to ask and respond to questions.

UH Policy #831-200-271
Verbal orders NOT to be accepted for routine orders.

UH Policy #831-200-304
Reporting of Critical Findings/Results Diligence is essential.

UH Policy #601-100-760
Handoff Communication Using SBAR Model
2008 – 2009 Patient Safety Goals

Goal 3  Improve the safety of using medications.

Goal 3C  Identify and review look-alike/sound-alike drugs, and take action to prevent errors involving them.

- Celebrex, Celexa and Cerebyx
- HydrOXYzine and HydrALAzine
- Pitocin and Pitressin
- Retrovir and Ritonavir

Goal 3D  Label all medications, medication containers (for example, syringes, medicine cups, basins), or other solutions on and off the sterile field.

Goal 3E.  Reduce the likelihood of patient harm associated with the use of anticoagulation therapy.

Warfarin is a narrow therapeutic range drug and caution should be taken when administered to certain patients such as the elderly or debilitated or when administered in any situation or physical condition where added risk of hemorrhage is present.
Goal 7: Reduce the risk of health care associated infections

7A Comply with current World Health Organization (WHO) or Centers for Disease Control and Prevention (CDC) hand hygiene guidelines.

7B Manage as sentinel events all identified cases of unanticipated death or major permanent loss of function associated with a health care-associated infection.

7C Prevent Multi-Drug Resistant Organism Infections.

7D Prevent Central-Line Associated Blood Stream Infections.

7E Preventing Surgical Site Infections.

Use of proven guidelines!
2008 – 2009 Patient Safety Goals

Goal 8: Accurately and completely reconcile medications across the continuum of care.

8A There is a process for comparing the patient’s current medications with those ordered for the patient while under the care of the organization.

8B A complete list of the patient’s medications is communicated to the next provider of service when a patient is referred or transferred to another setting, service, practitioner or level of care within or outside the organization.

8C The complete list of medications is also provided to the patient on discharge from the facility.

8D Reconciliation of short-term medications

UH Policy #831-200-320 - Medication Reconciliation Policy
Applies to all UH Patients at admission, entry, transfer, and discharge
Goal 9: Reduce the risk of patient harm resulting from falls

UH Policy 831-200-303
All patients will be assessed for fall risk using the Morse Scale. Patients at risk will wear a yellow wrist band.
Goal 13: Encourage patients’ active involvement in their own care as a patient safety strategy.

13A Define and communicate the means for patients and their families to report concerns about safety and encourage them to do so.

- Speak up if you have questions or concerns, and if you don’t understand, ask again.
- Pay attention to your care. Make sure you’re getting the right treatments. Don’t assume anything.
- Educate yourself about your care and treatment plan.
- Ask a trusted family member or friend to be your advocate.
- Know what medications you take and why you take them.
- Use a hospital that has undergone an on-site evaluation such as that provided by The Joint Commission.
- Participate in all decisions about your treatment. You are the center of the health care team.
2008 – 2009 Patient Safety Goals

Goal 15: The organization identifies safety risks inherent in its patient population.

15A The organization identifies patients at risk for suicide.

UH Policy#601-100-0713 - Patient Observation
The caregiver must remain within arm’s reach of the patient at all times.
2008 – 2009 Patient Safety Goals

Goal 16: Improve recognition and response to changes in a patient’s condition.

Goal 16A: The organization selects a suitable method that enables health care staff members to directly request additional assistance from a specially trained individual(s) when the patient’s condition appears to be worsening.

UH Policy # 831-200-324

Early Response Team

Dial 111 and ask the operator to call the early response team if the patient is suddenly showing changes in Airway, Breathing, Circulation, or Mental Status, or if something is just not right.
Universal Protocol for Preventing Wrong Site/Side, Wrong Person, Wrong Procedure/Surgeries

UH Policy # 831-200-280, Universal Protocol for Preventing Wrong Site / Side, Wrong Procedure, Wrong Person Surgery

UH Policy #831-200-315  Invasive Procedures
Applies to procedures performed by the medical staff Of UH; for use in all licensed locations that are part of University Hospital.

Pre Procedure Verification
Correct Person,
Correct Procedure,
and Correct Site

Site Marking

Time out
Immediately Before Starting
the Procedure
Sue Sheridan
Video
Practice RCA
Reference List
Web Sites

• Human Factors Society (HFES)
  – Website: http://www.hfes.org/
  – Graduate programs in Human Factors
  – Local Chapters of the Human Factors Society

• The Usability Professionals Association (UPA)
  – Website: http://www.upassoc.org/index.html
  – Local Chapters of the Usability Prof Association

• ACM-Special Interest Group on Computer-Human Interaction (SIGCHI)
  – Website: http://sigchi.org/
  – Local Chapters of SIGCHI
Other Learning Links

• FAA Human Factors ONLINE Training

• FDA Web Site and Publications
  (free and good!)
  – http://www.fda.gov/cdrh/humanfactors/
  – Human Factors Engineering and Medical Devices ("Do It By Design" & "Device Use Safety")
Acadia

- University of Wisconsin
  - Series of courses for certificate in patient safety
  - Students from nursing, medicine, engineering
  - HFE and BME key to DCERPS
  - http://www.engr.wisc.edu/ie/

- University of Maryland
  - Video analysis in OR and ED
  - Alarms redesign
  - HFE and BME key to DCERPS
  - http://www.safetycenter.umm.edu/
Academia

• University of Virginia
  – Laparoscopic Cholecystectomy – training, etc.
  – http://www.sys.virginia.edu/hci/

• University of Toronto
  – PCA pumps
  – Procurement
    • Savings from one device investigation paid for expense of HF Expert for one year
  – http://www.mie.utoronto.ca/labs/cel/research/pca.html
  – http://www.mie.utoronto.ca/labs/cel/
HFE and Patient Safety Specific

