Types of “Errors”

- Human errors vs.
- Medical errors vs.
- Medical events

To err is human, to forgive is divine...

Approaches of other industries:

- Nuclear Power
- Aviation
- Cruise Ship Industry
### Commercial Aviation Safety

- High profile accidents
- Long period of experience and study
- Evolutionary changes in culture
- Enviable safety record

### Concepts applicable to Health Care and Medical Physics

- Review and analysis of incidents
- Emphasis on team coordination
- Procedural tools
- Identification of Error Chains

### Review and Analysis of Incidents

- Learning from experience
- Regulatory reporting requirements
- Centralized repository
- Incentivized no-fault reporting
- Analysis
- Dissemination
### Required Reporting of Major Incidents

<table>
<thead>
<tr>
<th>Aviation</th>
<th>Radiology/Radiation Therapy</th>
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<tbody>
<tr>
<td>Federal Aviation Administration</td>
<td>Medical Events: State/NRC</td>
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<tr>
<td>National Transportation Safety Board</td>
<td>Sentinel Events: Joint Commission</td>
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### Centralized Reporting of Incidents

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### Voluntary No-Fault Reporting

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<th>Aviation</th>
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<tbody>
<tr>
<td>NASA – Aviation Safety Reporting System</td>
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Incentivized No-Fault Reporting

- ASRS – Aviation Safety Reporting System
- Voluntary reporting
- Maintains confidentiality
- Analyzes data
- Disseminates to Community

Elements of Safety Reporting System

- Voluntary Submission
- Submitters identity is confidential
- Incentive – Immunity from enforcement actions
- Encompasses all stakeholders
- Basis for human factors research
  - (source of 2/3 incidents)

- Not limited to regulatory violations
- Includes incidents / near misses
- Observations of unsafe practice
Parallels in Medical Physics?

- Need recognized and discussed at various meetings
- AAPM recognizes the need
- Working with ASTRO and others towards addressing the need

AAPM Response to NY Times Article (March 2011)

- In summary, AAPM believes that patient safety in the use of medical radiation will be increased through: a consistent and accessible national event reporting/recording system; and ...

In Development?

- Patient Dose Index Registry
- NASA has a version of ASRS available to health care professionals - PSRS
Centralized Reporting System provides

- Honest indicators of industry performance
- Evaluation of trends and management
- Opportunity to learn from “our” mistakes – without making them
Emphasis on Team Coordination

- Maximize team & system
- Reduces individual importance
- Safety is not a solely individual responsibility

Team Effort

- Human Factors
- Reduces the consequences of “rogue” personalities

CRM – Crew Resource Management

- Utilized to minimize human error
- Optimizes use of available resources, equipment, procedures & people
- Emphasis
  - Not on technical knowledge and skill
  - Cognitive and interpersonal skills
  - Interpersonal communication
  - Leadership
  - Decision making
CRM Strategies & Tools
- Flatten hierarchical order
- Enhanced feedback by junior team members to senior members
- First names used during normal procedures
- Alternating roles
- Common Knowledge
- Responsibility: shifts from individual to corporate organization

CRM for Healthcare
- Recognized benefits are being adapted to healthcare
- Books and Pamphlets
- Commercial Training Courses

Procedural Tools & Discipline
- Training
- Checklists
- Sterile Console (Cockpit)
Training

- Organizational responsibility
- CRM and oversight of individual
- Recurrent training
  - Licensure
  - MOC
  - "Applications" or service engineers
- Restricted duties enforced by organization for those lacking
- Other members of health care team?

Checklists

- Ensure proper order and execution of complex procedures
- Types
  - Memory aid
  - Read and Do
  - Challenge and Response
  - AAPM Working Group on Checklists
To be useful:

- Readily available
- Thoughtfully reviewed
- Requires more than a rote check or click of a mouse

Sterile Cockpit Rule

- Refrain from non-essential talk during critical operations
- Designed to eliminate unnecessary distractions
- Many control consoles are burdened with distractions (i.e. phones)

Lessons Learned from Review

- Accidents/Errors rarely are the result of a single unrecoverable event.
- Evolve through a series of events – Error Chain
- Typically there is ample opportunity to
  - Recognize a developing error chain
  - Break a link of the error chain
Accidents/Events only infrequently are the result of a single cause. Most have multiple root causes, or are the result of a combination of events.

Error Chain
• Series of independent events that contribute to a dangerous condition.
• Clearly there are many combinations best characterized after the fact.

Recognition of these patterns or events.

Eastern Flight 401, 1972
• New York to Miami flight, uneventfully approaching Miami
• Landing gear extended on approach
• Landing checklist: Captain notices nose gear down light not illuminated
• Gear lever position verified
• Instructed to go-around, raised gear, circled and climb to 2000 ft
• Flight Engineer troubleshooting light
• Autopilot engaged at 2000 ft so Captain can investigate
• First officer further disassembled bulb fixture
• Flight Engineer verifies gear down
• Autopilot disengaged (inadvertent override)
• Descended at 200 fpm to 900 ft., Called by ATC
• Radio altimeter alarms
• Aircraft impacts Everglades with total break-up

CRM Failure?
• 3 man crew fixation on minor problem
• Plane was flyable – yet no one was flying it!

Opportunities to break the Error Chain?
• Designate one individual to work on problem, someone to fly the plane
• Ignore once gear verified down
• ATC notification of altitude loss
• Less cockpit activity would not have disengaged autopilot
• Maintain situational awareness
ASRS Report

- GA Aircraft gear did not retract on take-off
- Pilots cycled gear handle
- Checked circuit breakers, electrical busses, etc.
- Initially one pilot was flying, one working on problem
- Soon both were working on the problem
- Senior pilot recalled parallel to Flt 401 and recognized no one was actually flying.
- Error Chain broken and an uneventful landing was made

Medical Events

- Fl 2008-2011

Wrong Patient Case

- Patient identified (correctly) and escorted to vault by Therapist 1
- Patient initiated discussion of next patient with Therapist 1
- Therapist 1 inadvertently selects patient record of next patient at workstation
- Therapist 1 takes a phone call
- Therapist 2 continues
- 3 of 4 fiducials closely aligned
- Therapist 2 treats without checking patient data in room, or on console.
CRM Failure?

- Distractions
- Changes in normal procedure
- Lack of situational awareness

Opportunities to break the Error Chain?

- Designate one individual to deliver the treatment
- Minimize distractions (sterile console)
- Therapist 2 had a prime opportunity to verify patient ID
  - Re-initiate and complete the checklist
  - Maintain situational awareness
  - Alert! – normal procedure disturbed!

Another Wrong Patient Case

- Therapist sets up for scheduled Pt
- Scheduled Pt goes to restroom
- Pt 2 shows up 1.5 hr early
- Therapist calls for Pt 1, Pt 2 responds
  - Patient photos look similar
  - English not native language of either
  - Both have prostate treatment markings
- Pt 2 Treated
Opportunities to break the Error Chain?
- Two forms of positive patient ID
- Use open ended questioning
- Similar patients – Flag for caution

Yet another Wrong Patient Case
- Power outage locked-out MLC
- Physicist rebooted and tested with a “random” patient file
- Physicist did not close file
- Therapists continued treatment after timeout without verifying patient name on record

Error Chain
- Initiated by unusual event
- Physicist – close file
- Timeout – should restart procedure along with checks
Common Themes resulting in Events

- Most often result when an unexpected procedural change occurs.
- Assumptions regarding the situation are made but not verified (fly the plane)

Facilities have good procedures but may not follow them
- Staff attempting to maintain schedule
- Considered to be redundant
- Checklists – required completion
- Organizational culture emphasizing procedure

Some Error Chain Initiators

- Any Unusual Event
- Change of normal procedure
- Distraction
- Interrupted procedures
- Time pressures
Breaking the Error Chain

- Disciplined approach
- Awareness & objectivity
- Heightened awareness can break the chain
- Prioritize courses of action & consequences

Summary
Learning from Past Misteaks

- Need a centralized reporting mechanism for events and "close-calls"
- Analysis of those events
- Dissemination
- Cultural Awareness

Acknowledgements

- Don Steiner and Tom Tomczak, Bureau of Radiation Control, Florida Department of Health
- Robert Boissenault Oncology Institute

Resource

- NASA – Patient safety Reporting System: www.psrs.arc.nasa.gov
One last aviation safety concept:
• 8 hours: Bottle to Throttle

Happy St. Patrick's Day!