Medical Errors and Medical Physics

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Outline

• Introduction – Are Errors A Problem?
  – Are Medical Physicists Part of it?
• Quantitative Assessment of Causation and Prevention
• Specific Examples and Instances
• Role of JCAHO
• Impact on Medical Physics Training/Practice

Patient Safety: The extent of the problem

Data used in the IOM Report, To Err is Human 1999

And some other

From the Harvard Medical Practice Study*

1984 study of the charts of 50,000 random discharges in 51 NY state hospitals

• Adverse events cause increase in hospital time in 3.7% of the cases
• 58% were due to “preventable errors”
• 27.6% due to negligence

Harvard Study Continued

- Almost all cases included disability lasting more than 6 months
- 13.6% led to death
- 2.6% to permanent disabilities
- About 1/4 of negligent failures led to death.

Harvard Study Continued

- 19% Drug complications
- 14% Wound infections
- 13% “technical complications”

Colorado and Utah Study*

1992 Study of 15,000 discharges from 28 hospitals
- Adverse events in 2.9%
- 53% “preventable errors”
- 29.2% due to negligence
- 8.8% led to death (same % for negligence and not)


Differences between the studies

Possibly due to:
- Average health of the populations
- Differences in the health care systems
Extrapolation to the Whole Country

Projections of deaths/year due to errors using the:

- NY study => 98,000
- Colorado/Utah study => 44,000

Some papers suggest that these are overestimates, and others that these are underestimates. Either way, there is a problem.

How Bad?

- Using the lower number, medical errors would be the 8th leading cause of death!

It May Be Worse

  - 36% of patient in hospital had hospital-acquired (iatrogenic) problems,
  - 9% life threatening
  - 2% died.

- Andrews et al (Lancet 1997) 1,047 ICU pts
  - 45.8% adverse events
  - 17.7% event causes disability or death

And

- A study of the ER found an average of 2 errors per minute
- A study of hospital deaths found 14 to 27% from errors*
- A study** of surgical patients, 2.7% had surgical deaths due to errors; of other deaths of these pts in hospital, 7.5% from errors.

Medication Errors

- Error rates have been measured between 0.3% and 6.5%
- For 7 Gigascripts/y nationally, that would be 21M errors/y at the least!
- Other studies have found 15 - 30% hospital medication administrations have some error.

Events related to equipment affecting many patients

- Radiation measurement systems:
  - Calibration of reference system *
  - Intercomparison with secondary system *
  - Routine use *

* - Physicist involved?

IAEA Report - Lessons Learned from Accidental Exposures in Radiotherapy, 2000

Medical Physics

- Calibration
- Data Corruption
- Data Communication
- …

Equipment Continued

- Treatment machine
  - Commissioning (acceptance) *
  - Calibration (annual) *
  - Constancy check (daily, weekly) *
  - Malfunction of machine
  - Incorrect use
Equipment Cont’d

• Treatment planning system
  – Commissioning and input of basic data
  – Routine use

Patient Specific Errors

• Miscommunication of prescription
• Error in use of images
• Incorrect Documentation
• Calculation of treatment time or monitor units
• Incorrect use of treatment planning system
• Patient identification
• Documentation of patient setup
• Incorrect operation of treatment machine
• Final review at completion of treatment

Some Reasons

• Inadequate Resources
  – Personnel, Equipment
• Inadequate Training
  – Human-Machine interfaces
• Poor Communication/Documentation

Patients exposed to high radiation levels

A machine’s programming error caused the problem for 10 months.

An improperly installed machine exposed 77 patients with brain tumors and malformations to higher-than-prescribed radiation levels for nearly a year before the mistake was caught.

Federal inspectors detected the error on March 7, after 10 months during which the machine had been used. They determined that the machine, installed in May, gave patients radiation doses 1.5 times more powerful than prescribed amounts.

Published April 1, 2005
Gamma Knife Miscalibrated
Service Engineer inadvertently changed source calibration date.
- 2003

During a software upgrade the date of source calibration was changed (to something like 3 years prior)
No routine QA in place to catch this error. For months patients were treated with incorrect (and very high) doses.

Our Responsibility!

• Safety and QA program
• From Draft SCOPE OF PRACTICE

• The essential responsibility of the Qualified Medical Physicist’s clinical practice is to assure the safe and effective delivery of radiation to achieve a diagnostic or therapeutic result as prescribed by a licensed practitioner in patient care.

To Peter Dunscombe

Implications on Training

• Proper Training is Essential
• Too Many Medical Physicists Placed in Practice sans Proper Training
• Safe and Effective Practice is our responsibility.
• QA documentation . . .
Training Essentials

- Graduate Degree – Physics, Medical Physics – Accredited
- Didactic Training in Medical Physics
- Clinical Training in Medical Physics
- Board Certification
- (Expand these) – Provides a foundation of individuals who will be competent and accountable for carrying out safe procedures in patient care.

Implications on Practice

- QA and Safety is Paramount
- Complex, High technology, Pressure to produce
- Safeguards MUST be in place
- Team must work together…..

Summary/Discussion