

The Science of QA

- This session has been designated among the President's choices for exemplary science consistent with the theme of Reinvigorating Scientific Excellence in the Medical Physics Enterprise.
- As described in the meeting program, that theme is meant to recognize the importance of scientific research to the AAPM mission and to the future of medical physics.

UC San Diego
SCHOOL of MEDICINE

1

Topic and Speaker Line Up

- Topics in quality and safety research and level of evidence
 - Todd Pawlicki, University of California San Diego
- Indicators and technique analysis
 - Marco Carlone, Univ of Toronto
- Mental workload and performance
 - Lukasz Mazur, Univ of North Carolina
- Summing it up: The future of quality and safety research
 - Eric Ford, Univ of Washington

UC San Diego
SCHOOL of MEDICINE

2

Topics in quality and safety research and level of evidence

Todd Pawlicki, Ph.D.
Department of Radiation Medicine & Applied Sciences

UC San Diego
SCHOOL of MEDICINE

3

What's the problem?

- Everything a medical physicist does can be viewed towards improving quality and safety
 - Making a better 'widget' is quality improvement
- Quality and safety is easy to understand
 - Issues of quality and safety are solved problems
- Don't need research, we already know what to do
 - But, what's 'obvious' isn't necessarily what's correct or optimal

UC San Diego
SCHOOL of MEDICINE

4

Quality and Safety Research?

- Quality in Radiation Oncology (Vision 20/20)
 - Encourage research on quality
 - Close collaboration with vendors
 - Utilize resources outside radiation oncology
 - Adopt a patient view of quality
- The (implied) definition of quality and safety research is too broad to be useful
 - No formal definition exists for medical physics

Quality in radiation oncology.
Pawlicki T, Mundt AJ. Med Phys. 2007

UC San Diego
SCHOOL of MEDICINE

5

Definition of Research

- The systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions
- How to adapt it for our use?
 - What is needed to improve quality and safety?

UC San Diego
SCHOOL of MEDICINE

6 Definitions from a Google search

A Definition for Consideration

- Quality and Safety research is...
- The development of wholly new quality and safety tools and techniques that are not specific to radiation therapy
- The investigation or application of tools and techniques from quality and safety engineering, Design, etc.
- Demonstrate and quantify effectiveness of an intervention
 - Can't just make the widget; prove that it improves quality and safety

A Paradigm for Q & S Research

- Phase I – Proof of concept
 - Propose a quality and safety intervention
- Phase II – Local longitudinal study
 - Is the intervention effective over time?
- Phase III – Multi-institution longitudinal study
 - Do benefits of the intervention translate to other centers?
- Phase IV – Very long-term effectiveness

Examples

- Statistical process control for radiotherapy quality assurance
 - Pawlicki *et al.* Med Phys, 2005.
- Radiation oncology Lean Six Sigma project selection based on patient and staff input into a modified quality function deployment
 - Bonilla *et al.* Int J Six Sigma and Competitive Advantage, 2008.
- Biological consequences of MLC calibration errors in IMRT delivery and QA
 - Moiseenko *et al.* Med Phys, 2012.
- Passive tracking of linac clinical flow using radiofrequency identification technology
 - Harry *et al.* Pract Radiat Oncol, 2014.

Many More Research Opportunities

- Hazard models, risk and accident analysis
 - Prospective and retrospective
- Human-Centered Design and Cognitive Science
 - Hazard and risk mitigation, preventing errors
- Systems theory and process control
- Change management and sustaining change
- Education and training for quality and safety

10

UC San Diego
SCHOOL of MEDICINE

Where do we go from here?

- A call to action!
 - Quality and safety can still be greatly improved
 - Good introduction to some basic tools
- Medical Physicists have a lot to offer quality and safety both within, and beyond, radiation therapy
 - Research & Development
 - Implementation and effective clinical use
 - Healthcare Leadership

11

UC San Diego
SCHOOL of MEDICINE

Topic and Speaker Line Up

- Topics in quality and safety research and level of evidence
 - Todd Pawlicki, University of California San Diego
- Indicators and technique analysis
 - Marco Carlone, Univ of Toronto
- Mental workload and performance
 - Lukasz Mazur, Univ of North Carolina
- Summing it up: The future of quality and safety research
 - Eric Ford, Univ of Washington

12

UC San Diego
SCHOOL of MEDICINE
