Introduction to Simulated Error Training

University of Colorado Anschutz Medical Campus

Leah Schubert, Ph.D.

Conflict of Interest Disclosure

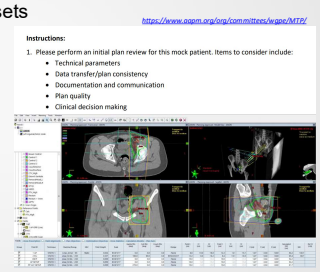
I have no conflicts of interest related to this presentation

Objectives

- Define the concept and rationale of simulated error training
- Describe the educational techniques on which simulated error training is based
- Understand how simulated error training can be used as a tool to develop, assess, and improve your method for performing physics plan reviews

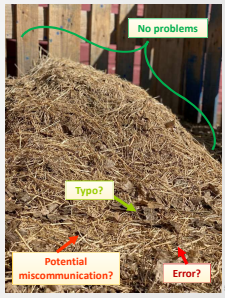
What is Simulated Error Training?

- AAPM WGPE creating mock data sets
  - Simulate real treatment plans
  - Embed known errors into the plans
- How to use the mock data sets
  - Perform physics plan reviews
  - Assess performance



Why Simulated Error Training?

- Physics plan reviews, needles in a haystack
- Complexities in the planning process
- Errors, potential to cause mistreatment, documentation compliance
- How do we know we can catch these errors?



Motivation for Simulated Error Training

- WGPE developing as practical tool for the physics community
- Follow up project to TG-275
- New recommendations for physics plan reviews (TG-275, MPPG #11)
- TG-275 identified high priority failure modes for the plan review process
- Simulated error training uses errors from TG-275 tables

Interest in Simulated Error Training

- Survey of Program Directors of CAMPEP-accredited therapy physics residency programs
- Determine the current state of residency training in physics plan reviews
- Most common training methods in use
  - Observe staff physicists performing plan reviews (96%)
  - Perform supervised plan reviews (93%) (either for training or clinical practice)
  - Use a checklist (80%)

Schubert, et. al. "The current state of physics plan review training in medical physics residency programs in North America," PRO 2019

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Interest in Simulated Error Training

- Simulation plans with embedded errors to train residents
  - Currently using: 19%
  - *Would* use: 71%
- Largest difference out of all of the training methods presented
- High interest for residency programs

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Challenges to Implementation

- Resource intensive
  - Anonymize patients
  - Re-create plans
  - Embed errors
  - Re-export and write up the chart documents
  - Updates and maintanence
- Pool resources as a group

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What is the Basis of Simulated Error Training?

- Based on educational techniques
- Simulation-based education
  - Aviation, military fields
  - Medical education
- Deliberate practice
  - Method of improving performance
  - Applies to any field, in and out of the workplace

Flight simulator exhibit at the McConnell Science Museum, Grand Junction CO

University of Colorado Center for Advancing Professional Excellence (CAPE)

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Simulation-Based Education in Medicine

- Simulates real-life scenarios in a low risk environment
- Allows one to acquire and practice clinical skills without using real patients
- Formative and summative assessment
- Examples in medicine
  - Simulation centers in medical schools
  - Physical exams, code response, IV placements
  - IV placements, cardiac arrest response

Simulated intensive care room with high fidelity mannequin
University of Colorado Center for Advancing Professional Excellence (CAPE)

McGaghie, et. al "Revisiting 'A critical review of simulation-based medical education research: 2003–2009'" Medical Education 2016
Sestanet. al, "Exploring the extent to which simulation-based education addresses contemporary patient safety priorities: A scoping review" Collegian 2019

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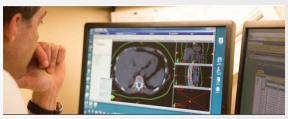
Simulation-Based Education in Radiation Oncology

- Use in the radiation oncology field
  - Training for emergency on-call treatments
  - Communication and interpersonal skills
  - Radiation oncologist plan reviews
- Embedded errors can potentially happen in real life
- Ability to assess and improve performance without risk to the patient



Mazur, et. al "Improving Radiation Oncology Providers' Workload and Performance: Can Simulation-based Training Help?" PRO 2017
Brown, et. al "Multidisciplinary Medical Simulation: A Novel Educational Approach to Preparing Radiation Oncology Residents for Oncologic Emergent On-Call Treatments" URODP 2014
Ia, et. al "Assessing Interpersonal and Communication Skills in Radiation Oncology Residents: A Pilot Standardized Patient Program" URODP 2014

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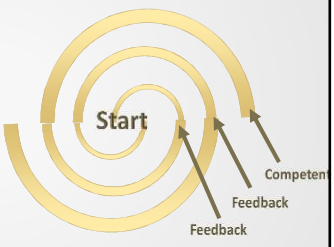
Deliberate Practice

- Technique to improve performance – reach expertise
- Different than just practicing
- Structured with feedback
- Identify weaknesses and course-correct
- Simulated error training – multiple mock data sets with answer keys



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Early Experience Using Simulated Error Plans

- Used in medical physics for various applications
- Gopan et al study measured the error detection rate of physicists performing plan reviews
- 8 physicists performed reviews on 6 plans (total 17 errors embedded)
- Embedded errors were detected in 67% of reviews [58-75% CI]
- First to quantify the error detection rate of physics plan reviews

Gopan, et. al "Utilizing simulated errors in radiotherapy plans to quantify the effectiveness of the physics plan review" Med Phys 2018

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Early Experience Using Simulated Error Plans

- Mayo Arizona simulated error plan suite
  - to facilitate education of new staff and residents
  - to measure the efficacy of an in-house electronic checklist
- 20 simulated error plans were created (21 errors embedded)
- 9 physicists reviewed over a 5 week period
- Useful to inform guidelines for physics plan reviews and further develop checklist

Error Category	Group Detection Rate
Bolus Correct	88.89%
Contours Correct	44.44%
Planning Approach	100.00%
Rx Dose/Fxs	88.89%
Rx Location	77.78%
Bolus Selected	88.89%
SPC Consult Present (4DCT)	100.00%
SPC Contains All Info	100.00%
Plan Approval Document Correct	66.67%
Field Names	100.00%
Bolus Documentation	88.89%
Gate Info	77.78%
Isocenter Shift	100.00%
DRR Quality	66.67%
Proper Tolerance Table Selected	88.89%
Table Coordinates the Same for All Fields	88.89%
Ref Point Equals Rx Dose	88.89%
Secondary Dose Matches Rx	100.00%
Total Dose Correct	100.00%
Correct Number of Sessions	100.00%
Imaging Matches Orders	100.00%
Average	88.36%

Geyer, et. al "Initial physics chart check: A tool to improve error detection", presentation at the 2017 Arizona AAPM Chapter Meeting

Courtesy Courtney Buckey and Ed Clouser

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Early Experience Using Simulated Error Plans

- University of Colorado – primary tool for resident training curriculum
- 5 simulated error plans (23 embedded errors)
- Goal to provide residents with the skills and knowledge to develop a method to perform effective plan reviews, wherever they end up working
- Curriculum overview
  - Determine what to check
  - Create a checklist
  - Deliberate practice

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Early Experience Using Simulated Error Plans

- Deliberate practice with simulated error plans
  - Mechanics of how to perform a check
  - Discussion what they caught or didn't catch
  - Ways of viewing plans to detect errors
  - Formulate personal best practices maximizing detection ability (environmental and internal factors)
- Decision making skills about what to do *after* errors are detected

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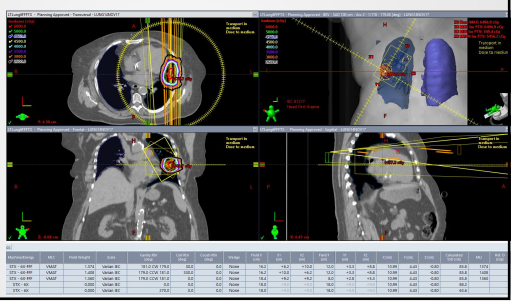
Early Experience Using Simulated Error Plans

- Put new skills to the test
- Motivating for residents
- TG-275 failure modes applied to clinical scenarios
- Engaging



How Can Simulated Error Training Be Used in My Clinic?

- Various uses from early experiences
  - Robustness of current plan review practices
  - Efficacy of new tools
  - Foundation of training curriculum
- Initial and ongoing training
  - Residents
  - New and existing staff physicists

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How Can Simulated Error Training Be Used in My Clinic?

- Initial training
  - Residents: develop and fine-tune their method
  - New staff physicists: differences in software and equipment
- Ongoing training
  - New programs added, changing equipment/software vendors, significant software updates
  - Accreditation needs
- Competency assessment – initial and ongoing
  - Method to objectively assess

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Conclusions

- Being developed by AAPM WGPE as a follow up project to TG-275
- Training tool based on established educational techniques
- Early experiences
- Potential applications
  - Initial training of new physicists
  - Ongoing training
  - Competency assessments
- Can be used by residents and practicing physicists

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