Increasing Exposure to Radiation (Education): Leveraging Medical Physics Expertise for Early Medical Student Education in Radiation Physics and Fluoroscopy Safety

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As experts in the safe use of radiation in medicine, medical physicists are in a unique position to provide education to medical students which will benefit them during clinical rotations and can also have far reaching impacts on the future safety mindset of physicians.

Introduction

While physicians are educated on radiation safety through fluoroscopy credentialing programs and during residency for select medical specialties, exposure to radiation and the need for foundational safety knowledge, begins early on in medical school. Medical students participate in rotations throughout their education in clinical areas that frequently utilize radiation like surgery, emergency medicine, radiology, radiation oncology, and interventional radiology. Furthermore, studies have shown that early career physicians lack a knowledge of radiation-based principles.[1,2] One analysis demonstrated that the majority of imaging education is delivered during the fourth year of medical training, predominantly through elective coursework.[3] There have been initiatives to increase awareness of the field of radiology and clinical time spent in these areas, but deficiencies remain in undergraduate medical education.[4] Specifically, curriculum lacks adequate inclusion of foundational radiation science principles to prepare trainees for clinical experiences during medical school.

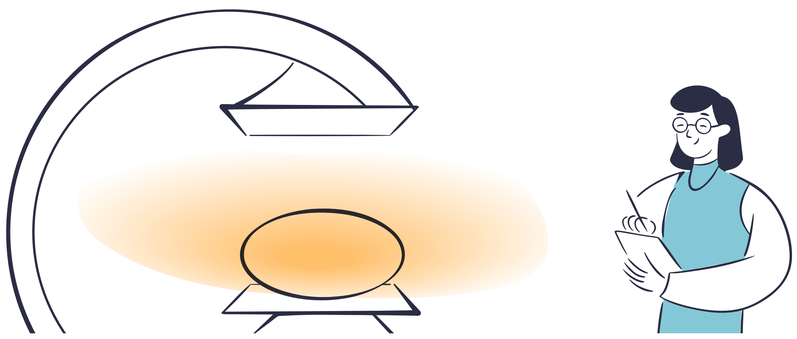
Medical physicists are uniquely positioned to address these education needs with their expertise on the safe use of radiation in a clinical setting. The purpose of this study was to show how medical physicists can address a critical education gap in radiation protection principles and fluoroscopy safety practices in early medical student instruction.

Methods & Materials

A didactic lecture was developed to educate medical students on principles of radiation physics and tenets of fluoroscopy safety with a focus on content needed for student experiences in medical school.

Core Topics of the Curriculum:

- Types of radiation
- Biological effects
- Diagnostic imaging modalities
- Radiation safety principles
- Methods to reduce exposure in a clinical fluoroscopy setting



A questionnaire following the Assessment for Learning (AfL) educational framework for knowledge assessment was given prior to and immediately after the didactic lecture.[5] Additionally, students were asked to reflect on changes in knowledge perception after receiving education and completing reassessment. Ten students participated in this educational experience. Statistical analysis of pre- and post-lecture assessment scores was performed using a Mann–Whitney U test.

Results

The pre- and post-lecture assessment consisted of 6 questions, with 2 of those questions having multiple correct answers yielding a maximum of 9 correct responses. Students scored 1 point for each correct answer they chose, and no penalty was given for incorrect selections on a multiple-response question.

Assessment performance improved with the median score increasing from 4.5/9 to 9/9. Post-lesson scores were significantly higher than pre-lesson scores ($U = 2$, $p < 0.001$, $r=0.96$), with substantially reduced variance ($\sigma^2_{pre}=7.8$, $\sigma^2_{post}=0.24$). Notably, no incorrect responses were selected on either multiple-response question at post-assessment. Based on these results, in congruence with student feedback, educators have been invited to incorporate this didactic lecture into future medical student curriculum at our institution.

In addition to answering questions on didactic material, information about previous experience and confidence was collected with each of the surveys. Medical students responded that just 10% of them had previous formal didactic radiation safety instruction. 100% of students agreed with the following statements in their post-lecture assessment:

- I understand more about radiation.
- I know what PPE I need when in a space with potential radiation exposure.
- I feel like I can advocate for my own safety better now.

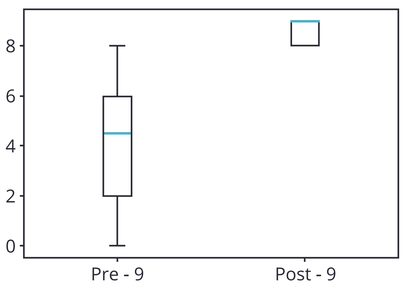


Figure 1. Distribution of quiz scores before and after instruction. Pre-lesson scores were widely variable; post-lesson scores clustered near the maximum, reflecting gains in both performance and consistency following instruction.

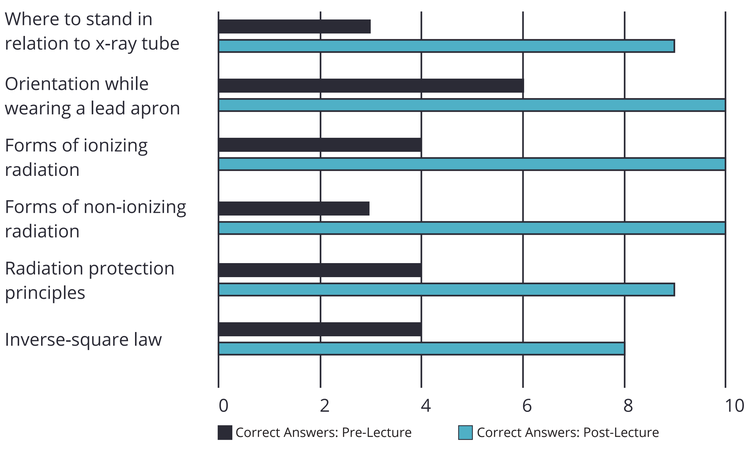


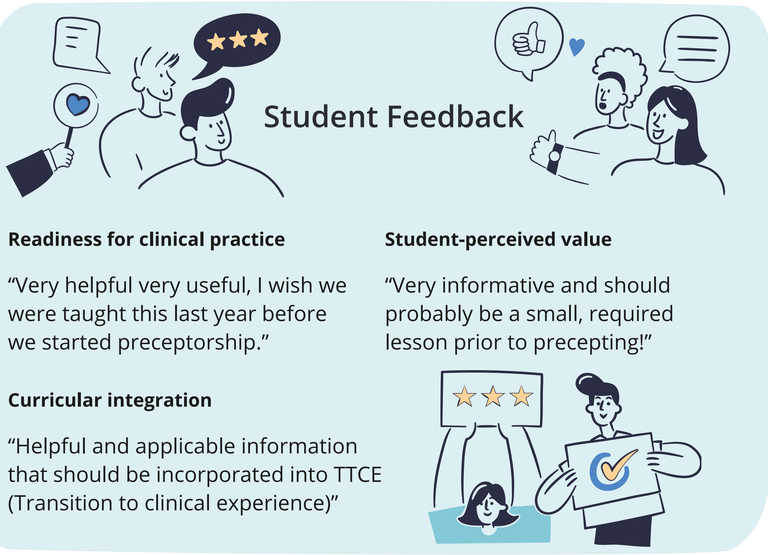
Figure 2. Correct responses per assessment category before (blue) and after (orange) the radiation safety lecture (n=10). All six categories showed improvement following instruction, with three categories reaching 10/10 correct responses post-lecture.

Discussion

Medical physicist led didactic lectures resulted in substantial improvement in radiation and fluoroscopy safety knowledge among medical students. This highlights an especially critical role for medical physicists, as available support for radiology-focused education from physicians is limited in times of ever-increasing clinical workloads.[3] Early exposure to these topics in medical school helps students better understand the principles that underpin the safe and effective use of radiation in clinical practice. Increasing awareness of medical physics also highlights the diverse roles physicists play in patient care and fosters a stronger understanding of the scientific and technological aspects of modern medicine from the outset of medical training.

Medical Student Feedback & Analysis

Student feedback was collected following the session. Beyond the improvement in knowledge of radiation protection principles and fluoroscopy safety, 100% of students answered that their perceived knowledge base improved. The figure below shows some of the responses collected and qualitative themes that emerged.



Conclusions

This work demonstrates the value of early education on principles of radiation and fluoroscopy safety for medical students and the vital role that medical physicists play as experts in these domains. Incorporating these topics into medical student curriculum, with support from medical physicists, develops radiation safety practices during medical school and builds a strong foundation for future clinicians to lead and sustain a culture of safety.

References

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