

Development and Assessment of a Novel Educational Package to Teach Fundamental Concepts of Radiation Oncology

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I. Specific Educational Aims

1. Design an online interactive case-based educational package including 360-degree, or immersive, video technology to teach core concepts of radiation oncology: radiation biology and its effect on cancer cells; physics and technical aspects of the delivery of radiation; the role and function of a radiation oncologist; role of radiation therapy in the multidisciplinary management of malignant disease; the side effects of radiation therapy; emergency indications for radiation therapy.
2. Administer a pilot of the case-based modules and assess their efficacy at Stanford Medical School.
3. Disseminate this sustainable and innovative educational package to other departments at Stanford as well as other United States academic centers through collaboration with the Association for Directors of Radiation Oncology Programs (ADROP).

This project promotes interdisciplinary **collaboration** by increasing awareness and knowledge of the discipline of radiation oncology among trainees destined to be the future physicians to care for cancer patients. Its **impact** will be **sustainable** beyond the initial funding period as this project is highly translatable and deliverable to future students, resident physicians, and other medical professionals, at Stanford and across the United States. Additionally, we will continuously improve our product, scale it beyond Stanford, and apply for future funding (e.g. the Radiologic Society of North America's Education Scholar Grant). This project promotes **diversity** and **inclusion** as our online modules will be made available to all on the open-source platform YouTube.

II. Project Rationale

Cancer is a frequent cause of morbidity and mortality in the United States; the majority of all cancer patients will receive radiotherapy during their disease course¹. Therefore, current and future physicians who provide longitudinal care for these patients will benefit from increased awareness and knowledge of radiation therapy. Adverse clinical outcomes such as misdiagnosis or improper management of incorrectly attributed symptoms to previous radiotherapy may occur when doctors lack fundamental knowledge of radiation oncology². Large knowledge gaps about principles of radiation exist among medical students and primary care physicians³. Outside of a formal rotation, medical students have little exposure to or education about radiation oncology within the MD curriculum. Delivery of a formalized curriculum in radiation oncology will increase knowledge base, facilitate consideration of the field as a potential career option^{4,5}, and improve patient care. Our project seeks to address this important area of need in medical education by studying the efficacy of a novel instructional delivery approach.

At Stanford, the current radiation therapy clerkship is an elective offered to Stanford and non-Stanford medical students. Enrolled students receive didactic lectures on core principles of radiation oncology and feedback has been uniformly positive. However, these lectures are currently only accessible to enrolled medical students and the quality, content, and timing of lectures is nonuniform at Stanford and medical schools across the country. Through collaboration with Stanford Medicine, we intend to deliver our educational package to enrolled students and eventually to the broader medical community by way of an open-source platform, in order to reach the majority of students, trainees, educators, and other medical professionals who lack the opportunity to participate in a formal rotation in radiation oncology.

III. Approach

An online interactive case-based educational package will be developed to teach the fundamentals of radiation oncology as detailed in *Specific Educational Aims (I)*. The modules will integrate 360-degree videos demonstrating radiation equipment and delivery of radiation, which we have created, and contouring exercises to immerse students in the practice of radiation oncology. We have consulted with Erfan Mojaddam and Kim Walker in Stanford Medicine's Education Technology department who will contribute their expertise in education technology, instructional design, and video production. The modules will be administered to medical students enrolled in the Radiation Oncology clerkship and will replace existing didactic lectures. Students will be asked to complete pre-post curriculum tests of knowledge for each module and a post-curriculum survey to assess satisfaction with the educational package. We will collect the data from pre-post curriculum tests and post-curriculum surveys, modify the educational package for delivery to medical students in 2019-2020, and disseminate it to other departments and medical schools.

Our team is uniquely qualified to collaborate on this project. Julie Koenig is a medical student at Stanford and helped introduce video modules into the MD program's Immunology course as a teaching assistant. Nicolas Prionas, MD PhD, is a PGY-5 resident in the Department of Radiation Oncology and has worked extensively within the Stanford School of Medicine on curriculum development for near-peer mentorship via the Stanford Mentorship Academy for Resident Training Program and on technology innovation for improved mentorship networking across the Stanford Medicine community. Dr. Erqi Pollom is an Assistant Professor and the Medical Student Clerkship Director in the Department of Radiation Oncology. Finally, we will be consulting with Dr. Sarah Donaldson, the Director of Mentoring, recipient of the Women Who Conquer Cancer Mentorship Award, and former Radiation Oncology Program Director.

IV. Timeline and plan for implementation

- **October – December 2018:** (1) Obtain IRB approval. (2) Create case-based modules, pre-post curriculum tests of student knowledge (adapted from Zaorksy IJROBP 2016 Tables 1-3)³, and post-curriculum survey.
- **January – July 2019:** (1) Deliver educational package to medical students enrolled in the Radiation Oncology elective at Stanford. (2) Collect data from pre-post curriculum tests and post-curriculum survey, analyze findings, and continuously modify and improve educational package.
- **June – July 2019:** (1) Disseminate educational package to other departments and medical schools. (2) Prepare manuscript for submission.

V. Anticipated Work Product

- An online interactive case-based educational package that teaches core concepts of radiation oncology as detailed in *Specific Educational Aims*.
- Pre-post curriculum tests of student knowledge and post-curriculum surveys.
- Peer-reviewed manuscript, describing the efficacy of the innovative education package.

VI. Evaluation Plan

Efficacy of the educational package will be assessed by pre-post curriculum tests of knowledge using a validated questionnaire³. Student satisfaction with curriculum components will be assessed with a post-curriculum survey using Likert scales⁶.

VII. Dissemination of Results

Results of this work will be submitted for presentation at the annual meeting of the American Society for Radiation Oncology and for publication in a medical education or radiation oncology journal (e.g. *Academic Medicine* or the *International Journal of Radiation Oncology Biology Physics*).

IX. Appendix (References)

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