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Brief Opinion

A Paradigm Shift in Radiation Oncology Training

Subha Perni, MD,[a,b,c,*] Anurag Saraf, MD,[a,b,c] Michael Milligan, MD, MBA,[a,b,c] Oluwadamilola T. Oladeru, MD, MA,[a,b,c] Idalid Franco, MD, MPH,[a,b,c] and Shekinah N.C. Elmore, MD, MPH[a,b,c]

[a]Harvard Radiation Oncology Program, Boston, Massachusetts; [b]Department of Radiation Oncology, Massachusetts General Hospital, Boston, Massachusetts; and [c]Department of Radiation Oncology, Dana-Farber Cancer Institute/ Brigham & Women's Hospital, Boston, Massachusetts

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Abstract

The coronavirus disease 2019 pandemic has been intertwined with the movement for racial justice in the United States and has highlighted and risks aggravating educational and workforce disparities within radiation oncology. We discuss wide-ranging changes within radiation oncology training that are essential to developing and maintaining diversity, including utilization of competency-based educational models that allow for streamlining of training and examinations; responsiveness to the needs of residents and medical students of different gender, racial/ethnic, and socioeconomic groups; and technological integration to increase educational efficiency and decrease barriers.

Introduction

Thomas Kuhn, the famed philosopher who wrote *The Structure of Scientific Revolutions,* was a physics student during the atrocities of World War II and the Holocaust. His term "paradigm shift" has slipped into our vernacular. Informed by the unprecedented societal and technological changes that rollicked his training, Kuhn argued that the accumulation of scientific understanding is not achieved in an orderly, additive process. Rather, there are revolutionary phases — extraordinary times of uncertainty and turmoil — that are marked not only by upheaval but also by the rapid development of new models, new *ways* of thinking that may expose practices that are no longer useful.[1]

As in Kuhn's generation, trainees in radiation oncology (RO) are facing unrelenting societal and technological change. Thus far, the coronavirus disease 2019 (COVID-19) pandemic has caused an unimaginable death toll within the United States, one that has been inextricable from racial injustice in this country. It has caused the disproportionate deaths of black, Latinx, and indigenous people and coincides with a nationwide reckoning on police brutality and racism as a public health emergency.[2] The recession it has created will create economic hardships for millions of Americans, the effects of which will be disproportionately felt in black, Latinx, and indigenous communities.[2]

Are we in a revolutionary phase? Before the pandemic, modern medicine would have been unrecognizable to practitioners a generation ago. Millennials have gone through education with infinite information at their fingertips; it now takes less than a minute to access nearly every paper or guideline from a smartphone. Artificial

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* Corresponding author: Subha Perni, MD; E-mail: sperni@partners.org

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intelligence technologies are being integrated into research and practice. Social media has amplified the ability to build communities and organize activism. Medical schools and graduate medical education are undergoing unprecedented innovation, with increased emphasis on social determinants of health and competency-based educational models (CBEMs) that allow individualization of training.[3]

Current Inequalities and Inefficiencies

Women outnumber men in medical schools, but in RO, only 33% of trainees and 26% of practicing physicians are women.[4] In a study of women RO residents, 52% felt gender-specific bias existed in their programs.[5] We recognize that gender is not binary, and the dynamics of gender discrimination are even more complex. Meanwhile, people from racial and ethnic groups underrepresented in medicine (UIM) compose 16% of medical school graduates but only 7% of RO trainees and 7% of practicing radiation oncologists.[4] UIM trainees face considerable obstacles throughout medical education and bear the emotional burden of being cultural mediators at their institutions.[6]

Layered upon these unequal experiences during training is the COVID-19 pandemic. Although many states have reopened, the future of public health safety remains unclear. In addition to the nationwide attention it has brought to racial injustices and socioeconomic disparities, the pandemic has caused an abrupt shift toward telemedicine. Telemedicine poses unique challenges for the apprenticeship model, making informal mentorship and off-the-cuff teaching more difficult. Male and white medical trainees have been shown to have more assertiveness and less reticence than women and black, East Asian, and indigenous trainees.[7] The distancing effects of telemedicine may thus compound educational gaps, as some trainees are more assertive in repeatedly requesting formal teaching. This effect may be particularly seen in RO, where many women and/or UIM residents find themselves in gender, race, and/or ethnicity-discordant attending-resident dyads. The diminishing yield of education, possibly disproportionately experienced by UIM and/or women, is thus a cause for alarm that prompts not only consideration of how to supplement education, but also an awareness that perhaps efficiency and quality should be emphasized over length.

At the same time, residents and fellows have faced stress from reassignment to frontline care of patients with severe acute respiratory syndrome coronavirus-2 at the expense of clinical, research, and study time. UIM trainees faced the additional emotional toll of seeing their racial/ethnic identities disproportionately reflected in the population hospitalized and dying during this pandemic. Concerns about examinations and RO careers compounded the stress as the American Board of Radiology rescheduled the 3 written RO certifying examinations to December 2020. The oral examination was initially rescheduled to October 2020, and then moved to September 2021.

Potential Solutions

This time of turmoil, however, may mean we are in the midst of a *Kuhnian* paradigm shift that will transform RO training. The need for a suitable response has been thrown into sharp relief by the appalling disparities in the pandemic's effects as well as educational concerns about transitions to telemedicine and scheduling of certifying examinations. The answer will be to restructure RO training to develop and maintain diversity at every level via the following mechanisms:

1. CBEM: Decreasing training length lessens its economic burdens, making the path easier for those without access to generational wealth. In medical education more generally, there is a movement toward CBEM rather than strict time or case requirements.[3] Emanuel and Fuchs[8] have argued that reducing internal medicine residencies by 30% would not sacrifice physician competency. In light of the pandemic, RO program directors have already started to emphasize competency rather than sheer case numbers. Implementation and standardization of high-quality and concrete competency assessment across programs will allow for both decreased bias in evaluation and increased personalization and effectiveness of training, allowing for its streamlining.
2. Examination streamlining: Streamlining of examinations may also help decrease burdens on trainees. RO has more certifying examinations than any other medical field. Having multiple examinations has economic costs and creates more obstacles for trainees to plan family and career decisions around. These examinations have been shown to have a significant negative effect on research, mental health, clinical development, and family life.[9] During the COVID-19 pandemic, there have been additional adverse effects on trainees as they have been rescheduled. In light of these issues, the Society of Chairs of Academic RO Programs has called for consolidation into 1 written examination.

There was also significant stress precipitated by rescheduling of the oral examinations, which has financial and personal implications and may pose safety risks in the post-COVID-19 era to examiners

and examinees. Fortunately, virtual examinations have now been instituted with extended lengths of examination completion times. This policy change will reduce the burden on trainees and demonstrates responsiveness to the needs of women, and all caregivers, within RO. The subjectivity of the oral clinical examinations, allowing for susceptibility to unconscious bias, is also of concern, however. They also bear little resemblance to real-world clinical decision-making processes, providing additional impetus to re-evaluate their utility.

3. Didactics and rotations: How will training efficiency improve? The RO Education Collaborative Study Group has already developed and continues to develop interventions, such as use of simulation. Formal dedicated teaching time must be set aside for all trainees, not merely those who ask the most persistently. It is also essential that all trainees have independent access to the virtual platforms used by attending physicians for patient visits and RO workflow. Trainees should be encouraged to take the lead in seeing patients with attending observation and feedback. Screen-sharing through a number of platforms can allow for real-time contour and plan review with immediate feedback, and contouring edits can also be recorded through many platforms, such as Zoom. Increased utilization of virtual conferencing platforms provides the benefit of sharing lectures, conferences, and chart rounds across sites and institutions, while research collaborations have never been more accessible. Residents can also come together to advocate for resources that support black, Latinx, indigenous, and other racial/ethnic group patients, broader insurance acceptance, and improved curriculums in health systems/policy that integrate data on local/state disparities in access to cancer care. Virtual teaching, mentorship, and social media interactions across institutions build a sense of community, which may be lacking for UIM and/or women in RO and is particularly necessary in this time of isolation.

Let us take this moment to also consider medical students. We have quietly accepted the economic burdens on students of away rotations, research years, and in-person interviews. Although there are difficulties with the virtual determination of program "fit" for applicants, this is also an opportunity to evaluate the default process. To increase diversity in racial/ethnic, socioeconomic, and gender composition in RO, Nead et al[10] describe the need to not only concretely define and apply evaluation criteria for medical students, but also to directly reach out to promising candidates from underrepresented backgrounds and de-emphasize costly away rotations. The transition to the "virtual" has thrown such an opportunity into the lap of RO. It has been heartening to see the resultant, rapid creation of virtual medical student rotations. For example, the Harvard Radiation Oncology Intensive Shadowing Experience provided UIM students from outside institutions, many without associated RO residencies, the opportunity to participate in a remote immersive RO experience and connect with resident and attending mentors. Curriculums aimed at outreach to UIM trainees that transcend institutional walls should continue to be in place following the pandemic. Residents can serve as mentors to students who have limited or no access to a RO residency program within their home institution, fostering greater collaboration and mentorship. Virtual residency interviews are also a legacy of COVID-19 that will decrease the economic burden and promote applicant safety.

The direction that RO takes now, in the midst of the COVID-19 pandemic and reckoning on racial injustice, will determine the field's future. Kuhn's generation has been called the "greatest generation" by historians. This generation came out of a time of incredible turmoil with the ability to adapt, but also with a collective purpose of working toward social good. The current generation of trainees, who have adapted remarkably to being on the frontlines of caring for patients with severe acute respiratory syndrome corona virus-2, share a collective purpose as well — improving care for our patients with cancer by tearing down structures that perpetuate inequality and exclusion in our profession. COVID-19 will thus have the legacy of leading to a paradigm shift in medical training. This restructuring should intentionally foster diversity, inclusion, and equity. In RO, let us lead the way.

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