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How has COVID-19 changed the educational paradigm in Radiology?

The novel coronavirus disease 2019 (COVID-19) pandemic has shifted the way radiologists teach and work. [1, 2] The human and physical resource limitations present during the first half of 2020 necessitated innovation in the delivery of radiology teaching, presenting the unique opportunity to restructure our educational paradigm to be more effective, efficient, and accessible.

Radiology Teaching– Changes and Future Directions Post-COVID

Pre-COVID radiology teaching is usually delivered through case-based discussions, reporting/'hot-seat' sessions and didactic lectures.[3] At the advent of lockdown impositions and social distancing during COVID, online radiology teaching has gained worldwide popularity due to ease and accessibility. Regular and free online webinars, such as those run by the Royal College of Radiologists (RCR), or the British Society of Interventional Radiology (BSIR) have improved accessibility and engagement in radiology teaching by offering the chance to attend webinars from any location and ask questions in real-time ('synchronous' webinars). International examples include the American College of Radiology's and Cardiovascular and Interventional Radiological Society of Europe's COVID webinars.

Videoconferencing is another synchronous form of teaching that saw increased uptake across hospital departments nationwide. Tools such as Zoom and WebEx were used to conduct regional and intradepartmental teaching, widening accessibility to department staff by allowing those at home post-shift or across hospital sites to attend.

The reach of these methods undoubtedly improved engagement, particularly from those in remote locations. Moving forward, to establish more interactive content, audience response systems or other instructional methods have and should be implemented to encourage active learning and facilitate communication between teacher and learner.[4] Online learning resources

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produced in response to the pandemic can promote useful, free, and open-access radiology education.

There are several potential limitations of synchronous online webinars: unstable internet connection, an environment amenable to participation or focus, security, and the ability to attend at a suitable time that will not otherwise disrupt the learner's daily workflow. Building an e-Learning repository of recorded webinars is a practical resource to help mitigate these potential limitations. For example, previous RCR and BSIR webinars are easily accessible online to be used 'asynchronously' - allowing learners to access them whenever it is most convenient. Whilst e-Learning repositories cannot substitute formal teaching, repositories can be used as easily accessible surrogate teaching materials that empower learners to have agency over their education.

These suggestions are not novel. Prior to COVID-19, there were countless free, online radiology content available on YouTube and on websites such as Radiology Cafe, Radiopaedia and Aunt Minnie to be used when required. What is new is the addition of frequent online webinars to this pedagogic architecture by larger institutions like the RCR and BSIR, where there is the added opportunity for learners to engage in discussions with the UK's leading experts during synchronous webinars and where the recordings are available to view later. To consistently provide high quality content in the post-COVID era, the RCR should provide teachers, such as senior registrars or consultants, with protected time to engage in this type of teaching - engaging in recorded or pre-recorded lectures to add to an open-access repository.

Similarly, protected time for teaching medical students may especially benefit junior radiology trainees looking to enhance their portfolio. There is extensive literature on the merits of implementing radiology teaching in medical school curricula,[5] yet delivery of undergraduate radiology education has remained static and under-supported.[6] There is also a trend of having clinicians and anatomists conduct radiology teaching to undergraduates.[7] Radiologists' breadth of training in anatomy, physiology, pathology, and imaging physics mean they are best suited to provide a well-rounded and clinically relevant educational experience for medical students.

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Amidst juggling audits, FRCR examinations, research and personal lives, early trainees will especially benefit from protected teaching time. This time should be mandated by the RCR and lobbied for by local departments, allowing registrars to contribute to the undergraduate radiology experience meaningfully and consistently post-COVID.

The challenge in implementing a greater role for radiology trainees within medical education is a lack of resources. Radiology departments are stretched for manpower, and there are concerns over meeting competencies and an ever-increasing case volume load. Regularly preparing course material will be challenging even with protected time. 'Flipped classroom' approaches have been shown to significantly improve student learning compared to traditional teaching methods[7] and may have less demands on the radiologist's time, affording them the opportunity to build other areas of their portfolio. An approach to implementing the 'flipped classroom' paradigm could be to first build a repository of undergraduate radiology lectures for medical students to review before attending a radiologist-led small groups teaching, allowing the learner to actively apply the knowledge gained from the pre-recording. Applying knowledge in real-time under the guidance of the radiologist allows for rapid correction of mistakes, opportunities to ask questions and to plug any gaps in knowledge. The affiliated medical schools should support junior registrars by ensuring adequate feedback and certificates for teaching are provided to demonstrate their commitment at annual appraisals and show how teaching has been improved.

From the trainee perspective, the decrease in case volumes during the pandemic period led to lower trainee confidence in several key skills, such as hands-on ultrasound and interventional radiology training.[9] Simulation-based curricula may offer a solution to supplement practical skills training. There exists a role of endovascular simulation training for new learners and experienced operators,[10] but it cannot entirely replace 'live' procedural training.[11] A survey distributed to ophthalmology trainees showed that their most desired forms of teaching included online and live case presentations for clinical training and discussions surrounding edited surgical videos for procedural training.[11] These findings support the use of online didactic teaching and multidisciplinary meetings in the delivery of 'hands-on' aspects of radiology

teaching. The disruption caused by COVID-19 therefore presents a unique opportunity for us to review the way we teach the practical and multidisciplinary aspects of radiology.

Limitations and Other Considerations

Connecting online is not a substitute for meeting in-person. For example, social distancing saw many first-year radiology trainees missing out on connecting with senior staff who would usually be responsible for providing career mentorship and immersing them in the culture of radiology.

The pandemic also worsened trainee well-being. Concerns surrounding childcare, school closures, delayed FRCRs and Completion of Certificate of Training have created additional anxiety in many radiology trainees' learning and examinations.[9] This should shed light on the importance of viewing our educational paradigm more holistically and support trainees by providing frequent communication, social support and mental health/wellness resources.[12]

Conclusion

The COVID-19 pandemic has accelerated the uptake of digital resources in radiology teaching, sharpened learners' self-directed learning skills and highlighted the importance of developing a robust curriculum but remaining agile in our responses to the needs of trainees. Future efforts should be directed updating our curricula to incorporate novel modalities of teaching, such as simulation and online teaching, to be more mindful about trainee welfare and create adequate channels of support.

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Supporting Statement

To Whom It May Concern:

I support this essay and confirm that it is Rosemary Ho's original work.

Dr. Raghuram Lakshminarayan