



# Can lessons from the COVID-19 pandemic help define a strategy for global pediatric radiology education?

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The novel coronavirus disease 2019 (COVID-19) pandemic and the aftershocks of profound economic turmoil and widespread social unrest resulted in seismic shifts in how radiologists work and teach [1, 2]. The upheaval that defined the first half of 2020 has created a new landscape, however, one in which long-standing barriers and silos have crumbled. With this new vista comes an historic opportunity to restructure pediatric radiology educational efforts to be more efficient, effective, cooperative and inclusive, both domestically and globally.

In the past, global educational efforts have been driven by a relatively small group of pediatric radiologists concentrated within a few epicenters. Over time, these efforts have expanded to include international resident rotations and some funding support from radiology professional societies. For example, the Society for Pediatric Radiology (SPR) Heidi Patriquin Fellowship Award for International Education has been sponsoring the attendance of colleagues from outside the United States to the annual SPR meeting since 2003 [3], and the World Federation of Pediatric Imaging (WFPI) successfully launched a program of regional pediatric radiology fellowships in 2018 with fellows gaining sub-specialized experience from colleagues in South Africa, Argentina, the Philippines and India [4]. Despite these advances, however, the global reach of pediatric radiology educational efforts has been constrained by physical and human resource limitations and pronounced

technological challenges, all of which have been exacerbated by travel restrictions and supply chain disruptions during the pandemic. The process changes that were catalyzed by the events of early 2020 have revealed opportunities for us to apply the technological acumen and wisdom we gained by working, teaching and learning remotely to global radiology education.

## Readout

At the core of most teaching interactions in radiology is the one-on-one readout at the picture archiving and communication system (PACS) workstation, which is incongruous with the current recommendations by the Centers for Disease Control and Prevention of maintaining a distance of 6 ft between any two individuals [5]. Many radiologists have transitioned to readouts that occur synchronously over the phone, using a videoconferencing platform that allows the participants to share their screens with each other, or platforms that allow the attending radiologist to take control remotely of a trainee's workstation [6]. This type of interaction allows for real-time assessment of the trainee's knowledge with an opportunity for feedback and just-in-time learning, closely approximating the in-person experience at the workstation. As radiology attending physicians and trainees become more adept in virtual readouts, it would seem we could expand on our experiences and serve as virtual attendings for radiology residents in parts of the world where attending coverage is limited. The amount of bandwidth and data needed to conduct a synchronous readout remotely is even more than the amount of data needed for synchronous conferencing because bandwidth and data are consumed by the PACS systems and web-conferencing platforms simultaneously. In cases where a program has a web-based PACS system that can be accessed by attending physicians remotely, asynchronous readouts would be a more feasible solution. We could also curate an anonymized series of cases that could be previewed by residents off-line and reviewed during a scheduled conference,

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which would be a more efficient use of data and is similar to the strategy employed by some U.S.-based residency programs during the slowdown related to the pandemic [7].

## Teaching conferences

Another cornerstone of radiology education is the teaching conference. Conferences for radiology trainees are generally didactic, case-based, or some hybrid of the two approaches. During the initial period of the pandemic in the United States, when the Centers for Disease Control recommended against gathering in groups of more than 10 people, most programs swiftly transitioned to remote conferences using videoconferencing platforms. Reaching a large group of trainees synchronously requires a robust videoconferencing infrastructure that often requires a paid subscription to accommodate the number of participants in the conference, usually \$13 to \$20 per month per host [8]. Technological proficiency on the part of the facilitator and participants, fast and reliable internet connection at the source of the conference and at each of the locations where the conference is being streamed, and computer hardware and software that can accommodate the technical and logistical requirements of this platform are also paramount to the success of these conferences.

Synchronous videoconferences allow for real-time participation, but these interactions have been challenging, particularly during case conferences. A trainee might not have a device on which images can be viewed optimally or that has audio and video capability. For the facilitator, utilizing more than one monitor during synchronous conferences allows the presenter to see the participants' faces and to gauge understanding. This also allows for viewing chat comments on one monitor while viewing the presentation on another monitor. Similar strategies for synchronous videoconferences have been employed for interdisciplinary conferences. During the initial period of rapid transition to remote teaching, many of us realized limitations in our technological infrastructures that we had not appreciated before the pandemic. Once we adjusted for these limitations, it was clear that distance participation was possible and happening and this paradigm could be adopted by global collaborators. Faculty from the Hospital for Sick Children in Toronto, for example, optimized the increase in non-clinical time and technological infrastructure during the pandemic to conduct bimonthly conferences with residents at the Hospital Central de Maputo in Mozambique.

## Webinars and videoconferencing

Webinars and videoconferencing have emerged as viable tools for sharing pediatric radiology education, domestically and globally. With almost all training programs switching to

virtual conferences, multi-institutional collaborations have gained impressive momentum. A few examples worth mentioning include the International Pediatric Neuroradiology Teaching Network of the American Society of Pediatric Neuroradiology, under the leadership of Kish Mankad, MD, and David Mirsky, MD, which hosts free weekly webcasts that now have more than 1,000 participants each week. The tagline on the website for the weekly conference reads, "Come together to share your knowledge and bring the world closer," an eloquent and profound response to these challenging times [9]. These efforts have had international reach with a significant number of participants from around the globe. International live webinars have also been organized or co-sponsored by the European Society of Paediatric Radiology (ESPR), Sociedad Latino Americana de Radiología Pediátrica (SLARP) and the WFPI. The common denominator for all these initiatives is the sponsoring groups who took advantage of their preexisting dissemination channels — email lists, membership lists and social media presence — to invite participants to their synchronous sessions. One exception is the multi-institutional curriculum designed by the educational team at the Children's Hospital of Philadelphia and with initial collaboration with pediatric radiologists from Cincinnati Children's Hospital Medical Center, Nemours/Alfred I. duPont Hospital for Children, Arkansas Children's Hospital, and Texas Children's Hospital. Multi-institutional curriculum was created during the COVID-19 pandemic as a grass-roots effort to provide a national pediatric radiology curriculum. These weekly online 45-min sessions now include participants from as far as Ghana, Mexico, Indonesia and Ethiopia.

Despite their popularity, access to synchronous conferences can be limited by multiple factors. These limitations, which many of us experienced for the first time during the period of working and teaching remotely, had been a part of life for many of our colleagues globally long before the pandemic and can inadvertently amplify disparities in resources among learners. Asynchronous learning resources alleviate some of the barriers associated with synchronous learning — including time differences, intermittent or less reliable internet access — and might allow for shared cost of mobile internet data access. Another alternative is to save a series of lectures on a hard-drive or plug-and-play local network [10].

## Repositories

The pandemic prompted nearly universal curfews, stay-at-home, shelter-in-place or lockdown orders — increasing the demand for asynchronous learning resources. Pre-recorded lectures that are made available to a closed community or on an open platform such as the "Best of ATS" lecture series of the American Thoracic Society [11] and musculoskeletal imaging core courses presented by the International Skeletal

Society and Society of Skeletal Radiology [12] have been invaluable during this period, particularly when case volumes decreased and case-based learning needed to be supplanted with other activities. These pre-recorded lectures are valuable tools that can be used as part of residents' independent learning plans, as part of a flipped classroom paradigm where a short lecture is previewed before a conference, and as part of a structured curriculum for the program. These resources are particularly useful in global radiology education where pre-recorded lectures can function as surrogate subspecialty attending lectures.

In pediatric radiology, independent learning platforms such as the modules originally developed by Janet Reid, MD, Marilyn Goske, MD, and others, which are now maintained by the Center for Online Medical Education and Training (COMET) through the Cleveland Clinic [13], have played an important role during these periods of sequestration. Another resource for independent learning was developed in response to the pandemic by the Society for Pediatric Radiology Education Committee, under the leadership of Dr. Reid and Sarah Milla, MD. It is a topic-specific list of educational resources curated by pediatric radiologists/educators from around the United States that were made available to trainees free of charge, primarily as lists of suggested readings, videos and other educational resources from their preferred sources.

For quite some time, education committees of various societies have been planning projects that would increase access to pediatric radiology educational materials domestically and globally. In-person meeting attendance is inherently limited by financial, travel and time constraints; however, online education efforts have encountered other barriers, such as individual and institutional concerns about intellectual property, questions about where such content could be hosted and supported, questions about who would fund such an experiment, and differing opinions about who should be able to access the content. Moreover, curating already available material is a time-intensive endeavor that is difficult for individuals or institutions to tackle on their own. The circumstances of the global pandemic that forced us to work and teach remotely with virtually no warning served as a powerful catalyst to advance these initiatives more rapidly than ever before.

## Moving forward

The enthusiastic engagement of trainees and colleagues from around the world during the pandemic with these synchronous, asynchronous and personalized educational resources suggests that most, if not all, are here to stay. However, the success of most initiatives is dependent on strong personal connections between colleagues and teachers and trainees that predated the pandemic. It remains to be seen how new

connections are supposed to happen and how durable the existing connections are in the absence of in-person meetings.

Other ripple effects of the pandemic — restrictions on travel and gathering — have resulted in the cancellation or postponement of traditional in-person educational events in radiology [14]. Important lessons can be learned from the virtual versions of radiology societal meetings that have already happened — including those of the American College of Radiology, American Society of Neuroradiology, Society for Imaging Informatics in Medicine — and those that will follow, such as the American Society of Emergency Radiology and International Society for Magnetic Resonance in Medicine and most prominently the Radiological Society of North America annual meeting this fall. These meetings will help us understand the balance between reaching a wider audience at a lower cost, with a much lower carbon footprint, and the needed personal interaction that feeds collegiality and nurtures collaboration.

The impact of the global COVID-19 pandemic has transformed the way students are learning from pre-kindergarten through clinical clerkships. The trainees that enter our programs in the future will be accustomed to streamlined delivery of content that optimizes the use of technology. As we move forward in pediatric radiology education, the ground beneath our feet will feel more like shifting sands than the terra firma we were used to. It is essential that we establish a robust yet nimble pediatric radiology educational resource repository that can be used by educators and trainees to meet the dynamic needs of the future of the pediatric radiology education community, following the lead of our pediatric neuroradiology colleagues in bringing the world closer by sharing our knowledge.

## Compliance with ethical standards

**Conflicts of interest** None

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