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# The Early Influence and Effects of the Coronavirus Disease 2019 (COVID-19) Pandemic on Resident Education and Adaptations

SA-CME

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## Abstract

The novel coronavirus disease 2019 (COVID-19) has had a major impact on the education of trainees in the radiology environment. The precipitous drop in patient volumes and sequestering of faculty and trainees to maintain social distancing affects experiential learning. The shift of nearly all teaching settings to a virtual environment has been challenging but may also allow more interaction during teaching sessions than traditional readout sessions or didactic lectures. Faculty development is key in ensuring competence and confidence in this new environment. Recruitment of trainees using a virtual platform will require communication of opportunities as well as the culture of the department and institution as well as the community. Delay of the board examinations has caused angst as well as disruption of the timing of clinical rotations but may ultimately result in a shift of how the examinations are administered. The exceptional disruption of the COVID-19 pandemic allows us to reconsider how the educational aspects of imaging can emerge as improved in the years to come.

**Key Words:** COVID-19, faculty development, resident education, resident recruitment, virtual teaching

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## INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) pandemic resulted in deferred imaging examinations and the shifting of radiologists to more isolated reading locations either within the medical facility or at home [1]. This caused a

precipitous drop in the volume of imaging studies at most academic medical systems in mid-March. In locations where the COVID-19 infection rate was high, some residents were reassigned to clinical inpatient services, often with little notice. The peak incidence for much of the

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Dr Chertoff reports other from Varex Imaging, outside the submitted work. Dr Zarzour is a consultant for Bracco, outside the scope of this work. Dr Canon is a member of the Board of Governors of the ABR. Dr Harvey reports that she is a shareholder from Volpara Solutions, LLC, outside the submitted work, and she is the editor-in-chief of the *Journal of Breast Imaging*. The other authors state that they have no conflict of interest related to the material discussed in this article. Dr Chertoff, Dr Zarzour, Dr Morgan, Dr Lewis, Dr Canon, and Dr Harvey are nonpartner, non-partnership track employees.

country seems to have been in mid-April, with recovery beginning in late May and early June, although the incidence is still rising in the Southern United States. The rapid shift from on-site working shoulder to shoulder with trainees to working remotely, often in shifts, has resulted in a significant disruption to teaching efforts.

Likewise, teaching-related travel is restricted because of both concern for spread of infection and cost containment. Attendance at courses and national meetings, where presentation of papers and educational exhibits has traditionally been encouraged for trainees, will be difficult for the near future. The board certification process has also been disrupted.

All of these new restrictions have influenced how we teach, and it is unlikely that we will return to our same methods when the pandemic resolves. New approaches have become mandatory. This pause allows us to reflect on how we can alter our teaching and methods for the better.

## IMPACT OF COVID-19

At this writing, most teaching institutions are recovering their volumes and adjusting to the “new normal.” Although most places provided web conferences and distant readout by telephone or computer, many faculty did not teach during the acute period of the pandemic and must now catch up with a new and fluid paradigm. Faculty reading in a relatively isolated reading room, or at a reading station at home, may find it challenging to communicate electronically with their learners. Faculty have to adjust their well-developed “view-box” teaching methods to an environment that is less spontaneous, particularly if the IT environment and support are not robust. In contrast, residents are likely to be more facile with the digital environment. This potential mismatch will be particularly challenging as we welcome new residents into our departments. Faculty will have to engage with the new residents, getting to know them, evaluating their abilities, teaching them the culture of radiology, as well as teaching them radiology content, and social distancing. Developing connection with residents may become easier as we return on site, although with fewer people gathering in less constricted spaces. For example, teaching conferences could be attended in person by a small proportion of each class as the space allowed. Planz et al have described other ways to engage and ensure inclusion during the pandemic, including frequent virtual communications, social support, and wellness resources [2].

Although learners, including residents and fellows, used to see themselves as filling essential functions in the department, in many cases they now feel redundant. In the new socially distance image interpretation model, do we still

need residents? Institutions currently facing the daunting task of recovery may decide that residency expenses outweigh the benefits. If that happens, departments may have to decide how many residents they can afford, as well as how many they can effectively teach with distancing and decreased volumes, and anticipating additional surges.

Many of our residents saw fewer studies and performed fewer procedures, because of reduced clinical volumes, compounded by changes in their environment and activities. Portions of key rotations, critical to call, if missed could reduce knowledge base, experience, and subsequent confidence. Residents about to start taking call may feel, and actually be, less prepared and may depend on in-house or at-home faculty, slowing their progress to independence. Hands-on ultrasound skills will likely be less developed.

With schools closing and loss of childcare arrangements, many faculty and learners had to take on the additional responsibility of teaching and caring for their children, in addition to their work. For many residents, this produced a disruption to their learning and anxiety regarding work, boards, and their job searches.

Our residents may find it more difficult to create a supportive resident group without the usual social activities, casual and organized, with and without other parts of the department. The different experiences of COVID-19 during internship and residencies could be divisive, rather than inclusive. The support of the resident group is more important than ever in this context. There may be an increase in depression and posttraumatic stress disorder among residents in COVID-19 hot spots, because of personal experiences of illness or loss among friends and family. Academic departments need to create an environment that encourages faculty and learners to ask for help as well as providing access to appropriate care and support.

## EFFECT ON THE TEACHING ENVIRONMENT

Radiology reading rooms have traditionally been a hub of activity, with faculty and residents reading at PACS workstations throughout the day and discussing interesting cases, teaching medical students, referring clinicians joining for consultations, and helping technologists who were looking for direction. Because of distancing, this workflow has been disrupted and is less efficient with disbursement of these activities, and thus the opportunity to provide the “soft” knowledge of interactions between radiologists with patients and providers is lost. Additionally, opportunities for team building and camaraderie are hindered in the virtual format. This will perhaps be felt the most by the new postgraduate year 2 residents, who began their radiology training in July 2020. Programs have worked with their departments and infection prevention to identify new work sites, move

workstations, and assign residents to specific workstations [3]. A critical component of radiology training has been through active on-the-job learning in which the resident independently interprets an examination to generate a differential diagnosis and then receives case-specific feedback when reviewing each examination with the supervising radiologist [4]. Residents may now be reading remotely from their supervising radiologist and readouts have moved from in-person to virtual sessions using remote desktop software such as Zoom (Zoom, San Jose, California) or TeamViewer (TeamViewer AG, Goppingen, Germany) allowing HIPAA-compliant screen sharing. IT support is critical to resolve connectivity and other issues related to the virtual platform. Virtual readouts should include two-way communication while viewing images simultaneously and should provide for both parties to scroll, annotate, and point on images [4]. Furthermore, didactic, case, and interdisciplinary conferences that consisted of gathering groups of people have ceased and shifted to virtual format. Similarly, journal clubs, quality conferences, and grand rounds have become remote in allowing for continued participation. Maintaining meaningful interaction during virtual conferences requires webcams on so that faces can be shown when speaking via remote software. This also allows the presenters to “call on” residents during virtual conferences. Innovative teaching methods such as gamification have shown potential positive educational benefits [5].

The impact to residency programs has varied across the country, with some radiology residents and fellows being reassigned to medicine wards including intensive care units and others experiencing reduced clinical work because of the initial postponement of nonurgent and elective procedures [1]. Some programs manage the active resident workforce with a team-on team-off approach, with one group assigned to clinical work and the other to distance learning. These groups would alternate over time and could fill in the clinical service in case of illness [3,6]. In response to those assigned to home with distance learning, numerous national radiology societies quickly compiled and disseminated free learning material to residents. Some institutions created PACS teaching files for remote viewing and interpretation with remote readouts with teaching faculty [7]. Self-directed learning by radiology residents is now of utmost importance to provide for their continued growth. This is a skill that residents will need beyond residency and will be beneficial to their development.

With the reduction in elective and nonurgent procedures, residents experienced decreased procedural volume [8]. Additionally, to conserve personal protective equipment, some hospitals have limited those in the room to the

radiologists performing the procedure. For those residents in the early specialization in interventional radiology (IR) pathway, the ACGME recognizes that procedural volumes will likely be lower because of the COVID-19 pandemic and is allowing residents to enter independent IR residencies with fewer than the 500 case requirement. However, the ACGME still requires a total of 1,000 cases before the end of their 2 years of IR training. Early specialization in IR block schedules may be adjusted to allow for flexibility in timing of the required intensive care unit rotation [9].

Courses, including those by the American Institute of Radiologic Pathology, and national meetings that have been forced to move to a virtual platform have benefits as well as negative consequences. The virtual platform may need synchronous content provided during hours convenient for those living in all US time zones, in addition to asynchronous content that can be accessed at any time. The lack of required travel makes these activities more accessible and less costly. One disadvantage is reduced networking opportunities as well as diminished group experiential learning, although trainees in this generation may place less value on in-person experiences.

## FACULTY DEVELOPMENT DURING THE PANDEMIC

At most centers, efforts in the initial phase included transforming practice to effectively care for patients with suspected or confirmed COVID-19 followed by training for remote imaging interpretation and education issues surrounding personal protective equipment [10]. The commitment to education of trainees became a second-tier concern [11]. As the pandemic moved into new phases, the intermediate and long-range challenges facing faculty required a multifaceted approach to professional development using departmental, institutional, and national resources.

The most important initial faculty training requirement caused by the pandemic involved use of new communication tools. Immediate needs arose for virtual gathering in the setting of physical distancing. Thus, faculty development and instruction on the setup and use of virtual meeting software were necessary to bring groups together for decision making and dissemination of new and rapidly changing policies. These same tools became new modes for education of trainees and faculty.

Open source and peer-reviewed publications addressing ways to pivot teaching methods in the time of physical distancing are beginning to accumulate [12,13]. This remodeling of teaching within the clinical environment in a proactive manner is where faculty development is most needed [14], recognizing that the familiar instruction

methods of the past will likely not return to the prepandemic status quo [15].

Virtual teaching sessions can be effective, interactive, and entertaining and may allow even more audience participation options than might have been utilized before the pandemic. For example, on some platforms learners have the ability to draw simultaneously or label radiographic anatomy on virtually presented PowerPoint presentations (Microsoft, Bellvue, Washington). Remote view-box teaching likewise can be positively affected using virtual platforms. Explanations of the rules of engagement for virtual presentations or readout session should be distributed department-wide to enable sustained best practices.

Trainee feedback (formal and informal) may be missing or reduced with virtual platforms compared with prepandemic experiences. Infrastructure must be provided to assess trainee performance and provide feedback for nonclinical assignments or to receive information from other departments for nonradiological care rendered by radiology trainees. Nonclinical learning assignments include resident creation of presentations used for medical student education or resident orientation, learning modules with pre-post testing, participation in multidisciplinary conferences, and creation or use of simulation exercises for procedures, contrast reactions, or patient-centered care topics. Finally, group feedback sessions with program directors and departmental leaders facilitated on software such as Zoom can be scaled to meet the needs of various learning groups and can be a tool for faculty development. For faculty development, formal group review of junior faculty presentation skills in real time may be undertaken with less interference than perceived during typical conference dynamics. Use of video features during feedback meetings can effectively recreate traditional in-person meetings.

Fostering interdisciplinary collaboration through multidisciplinary conferences is an important aspect of faculty development. To ensure that faculty members are able to efficiently and expertly host these conferences in the new virtual environment, a standard operating procedure for setup and invitation of faculty and trainees is required. A robust system and rules around screen sharing are necessary. In our experience, the creation of virtual multidisciplinary conferences has allowed many more people to attend, learn, and interact, no matter their location, service assignment, or level of training.

A significant challenge of faculty development in the new paradigm of abundant online resources and electronic dissemination of pandemic information is information overload. Offerings on standard faculty development items such as leadership compete with crisis management, or COVID diagnosis, roundtables on teaching, and trainee issues stream from departments, universities, national

radiology organizations, and vendors. Leaders must help faculty discover the most meaningful resources to meet both their individual professional development needs as well as those required for the group. One solution is to identify departmental personnel to screen and make recommendations for programs that meet site-specific needs. Periodic departmental communications can help address this challenge.

## RECRUITING TRAINEES

Recruitment for the 2020 to 2021 match season will almost definitely be virtual. This has been supported by local institutions, the Coalition for Physician Accountability [16], the Association of Program Directors in Radiology, and the Association of Program Directors in Interventional Radiology [17]. Despite the unreliability of interviews in predicting performance, they significantly affect ranking and student program preferences and therefore are unlikely to be abandoned [18,19]. Virtual residency interviews have been proposed from several specialties for some time [20], and given that the IT infrastructure is available, perhaps their time to be universally employed has come.

There are many potential benefits to virtual recruitment. The cost of interviewing and the travel time will be markedly reduced. A 2015 study showed that 13.5% of students applying to radiology spent more than \$7,000 on interviewing [21]. This and reduced scheduling conflicts may allow students to interview at a wider variety of programs, improving the diversity of applicants. More time can be spent on educational pursuits that may include additional elective rotations, research, or subinternships. In a virtual platform, there are also opportunities to conceal one's gender or race, which may make this approach more supportive of diversity.

Cost and time savings also extend to programs. The same number and length of faculty interviews may be reduced, and therefore less time off the clinical schedules may be needed. Programs may be able to offer students access to a wider range of faculty such as by postinterview follow-up virtual meetings. For example, a candidate may be very interested in pursuing a career in breast imaging, and interviews with those faculty could be made available even if they were not part of the typical interview process.

There are significant potential challenges involved with implementing virtual recruitment. Because applicants will not be on site to experience the culture firsthand, programs must advertise their institutional, departmental, research, educational, faculty, and residency strengths and culture on their websites to attract applicants, which will be especially important for smaller and lesser known programs. Multiple

short-focused videos including resident and faculty interviews and institutional, department, and local tours should be developed by programs or institutions. In particular, the *culture* of the program, institution, and locality needs to be conveyed. Social media may be a helpful resource to leverage, as well as streaming resident conferences.

With less cost and anxiety over the virtual format, students may apply to more programs, which could improve diversity of the institutional applicant pool, although higher numbers could overwhelm the process. Faculty recommendations may be limited because electives have not taken place. The US Medical Licensing Examination Step 2 has been delayed, and these factors may affect the program's ability to evaluate students, particularly international medical graduates who rely heavily on these.

Interview days will be organizationally and technologically complex. Web conferencing will need to be thoroughly tested with IT support, minimizing stressful technological glitches, and faculty and administrators will be trained to present the institution in its best light. Interviews may need to be shorter and spaced to reduce video-conferencing fatigue. The pre-interview dinner could be replaced by an informal postinterview virtual social hour between small groups of students and residents.

Students, particularly disadvantaged students and international medical graduates, may have concerns that limited technological resources, or the local setting, may affect a program's perception of them. Faculty mentors should guide students in how to optimize their presentations [22]. Medical schools may provide quiet, interruption-free, technologically equipped spaces for students. Interviewing faculty must be constantly aware of any unconscious biases that might influence their evaluation of the students because of these factors [23].

If both programs and candidates put significant effort into planning this virtual match season, approaching it as an opportunity for creativity and improvement and iteratively adapting techniques based on successes and failures, there is every possibility that we will never want to go back to the old system.

## BOARD CERTIFICATION

The mission of the ABR is to certify that its diplomates demonstrate the requisite knowledge, skill, and understanding of their disciplines to the benefit of patients. Board certification must be sufficiently rigorous to ensure public trust of the process. Initially, the ABR canceled one and rescheduled several of its examinations during the COVID-19 crisis because current testing environments preclude adequate social distancing and incur the risk of travel. The

ABR subsequently made the difficult decision of postponing all 2020 examinations. Many voiced frustration and a strong desire to pivot to an alternative testing model to avoid the delay. The ABR subsequently committed to administering all currently unscheduled and future oral and computer-based examinations to remote platforms beginning in the first half of 2021 [24]. Residents originally scheduled to take the Core Examination in June 2020 will now take the examination in February 2021. Rising third-year residents will still take the Core Examination in June 2021 but with a virtual platform. Certifying examinations will be provided twice in 2021.

Although dedicated time off from clinical responsibilities is not (and should not be) condoned by program directors, training programs commonly assign candidates to rotations that allow additional study time preceding the examination. With the delay of examinations, this practice may shift or even fall by the wayside. If the diagnostic Core Examination is delayed so that two classes are taking it simultaneously, the clinical workforce will have reduced access to its best-trained residents. The impact to IR programs is more complicated, with trainees moving to more time-intensive interventional rotations during the pre-examination period and distancing the examination from foundational core training. Ironically, this may force the concept that the best preparation is engaged patient care with active learning during clinical rotations and not the binge-and-purge learning process.

The current crisis has forced the decision to move to a virtual platform, the method of which has not yet been determined. Multiple examination centers could allow for increased social distancing. The ABR currently uses Pearson VUE testing centers for a limited number of its examinations. To date, it has been impossible to hold image-rich diagnostic radiology and IR examinations in testing centers because of lack of appropriate equipment, such as servers to handle the large data sets and high-resolution monitors and lack of environmental control, including ambient lighting [25].

Some have queried distribution of examinations in radiology departments with accredited training programs. The equipment becomes less of an issue and more closely replicates a real imaging environment. Examination validity and security in these microtesting environments are assured by local proctors. A personalized distributed model could mimic the ABR online assessment for maintenance of certification. The online assessment process allows for efficient and convenient periodic assessment of diplomates to achieve their maintenance of certification requirements. Although it does replace the previous every-10-year examination, it is both a summative and formative tool, providing assessment with

immediate feedback and focused learning and is focused on “walking-around knowledge” rather than a deeper foundational knowledge that is expected as part of residency training and assessed in the Core Examination.

A fast pivot of various standardized and certifying examinations across the United States to alternative processes has occurred. These virtual examinations use biometrics, such as facial recognition, to confirm candidates’ identity. Sessions are recorded. Proctoring programs can lock down browsers to prevent searching of content. Some include artificial intelligence to observe behaviors of testing candidates, and others incorporate fitness monitors to detect changes in pulse rate. This may raise suspicion for those concerned about privacy.

Although trust in the certification process is critical and changes would require time to ensure appropriate examination delivery, the uncertainty about the new normal will force the consideration of alternatives to the current testing process.

## CONCLUSION

The COVID-19 pandemic has been exceptionally disruptive. Although many locations are in recovery, some have yet to hit a peak, and secondary peaks could certainly occur. As the number of patients with COVID-19 could vary over time and location, we should be prepared to remain flexible in our approach and anticipate additional future needs, potentially even including a shift of trainees to inpatient service. The pandemic has forced virtual platforms for daily teaching as well as participation in departmental, institutional, and national meetings. Faculty development will be essential to effectively leverage the advantages of this new approach to education. The recruitment of trainees in the virtual environment will require focus not only on departmental and institutional educational opportunities but also culture. The administration of board examinations will likely undergo a paradigm shift. We will hopefully take advantage of the many opportunities presented in this new era.

## TAKE-HOME POINTS

- Lower volumes and restricted access to patients may reduce experiential learning for radiology trainees.
- The shift to a virtual environment for daily readout sessions as well as most meetings requires a shift in the approach to be more interactive, and support in faculty development is needed to gain expertise in using the virtual environment.
- The requirement for virtual recruitment of trainees will necessitate communication of not only

educational and research offerings but also the culture of a department, institution, and community.

- Administration of initial board certification examinations requires significant logistics including a secure environment with optimal viewing conditions that is not easily replicated in the virtual environment. Delay in examination administration will prompt re-evaluation of how these examinations are given.

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