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# Impact of Coronavirus Disease 2019 (COVID-19) on the Practice of Clinical Radiology

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## Abstract

The speed at which coronavirus disease 2019 (COVID-19) spread quickly fractured the radiology practice model in ways that were never considered. In March 2020, most practices saw an unprecedented drop in their volume of greater than 50%. The profound changes that have interrupted the arc of the radiology narrative may substantially dictate how health care and radiology services are delivered in the future. We examine the impact of COVID-19 on the future of radiology practice across the following domains: employment, compensation, and practice structure; location and hours of work; workplace environment and safety; activities beyond the “usual scope” of radiology practice; and CME, national meetings, and professional organizations. Our purpose is to share ideas that can help inform adaptive planning.

**Key Words:** Clinical practice, COVID-19, radiologist

J Am Coll Radiol 2020;17:1096-1100. Copyright © 2020 Published by Elsevier Inc. on behalf of American College of Radiology

## INTRODUCTION

During the past 50 years, radiology has enjoyed an unprecedented boom, fueled by a combination of technological advances in imaging, computers, communications, and

favorable political and economic factors. With the exception of uncertainties related to potential impacts of health reform in the 1990s and the Great Recession of the late 2000s, the growth in radiology has been essentially unstoppable. Associated with this growth has been a steady increase in radiologists' salaries, stiff competition for residency training positions, and a chronic shortage of radiologists to meet the demands of growth.

Starting in the early 1980s, the shift away from barium studies, diagnostic catheter angiography, and intravenous pyelograms to CT and MRI moved a substantial percentage of radiologists away from direct patient contact. The technological advances of PACS, computing power, and the Internet further distanced diagnostic radiologists, allowing practice from any location in the world, and also placed radiologists at the forefront of telemedicine and physical distancing.

In 2007, Gunderman and Brown [1] postulated about the potential consequences of an avian influenza pandemic on the delivery of health care. However, the speed at which coronavirus disease 2019 (COVID-19) spread quickly fractured the radiology practice model in ways that were never considered. In March 2020, most practices saw an unprecedented drop in their volume of greater than 50% [2]. Some specialties such as mammography and elective outpatient ultrasound saw

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Dr Rosen is on the scientific advisory boards of LungLife AI, Parexel, and Canon Medical Systems, outside the submitted work. He has received payments from Parexel and Canon Medical Systems, and stock options from LungLife AI. Dr Norbash is a scientific advisor for GE, Siemens, Pneumbra, Stryker, IBM, and cofounder and stockholder of Boston Imaging Core Laboratories, outside the submitted work. Dr Kruskal is an author for Up-To-Date, Inc. Dr Meltzer is a board member of RSNA. Dr Yee reports grants from Echopixel, Philips, and GE Healthcare US, outside the submitted work. Dr Thrall states that he has no conflict of interest related to the material discussed in this article. Dr Rosen, Dr Norbash, Dr Kruskal, Dr Meltzer, Dr Yee, and Dr Thrall are nonpartner, non-partnership track employees.

volumes decline by more than 80%. For the first time in memory, there was not enough work for everyone. Long PACS work lists dwindled to one to two cases, with radiologists competing to read a case as soon as it was seen on the list. Many radiologists who had little or no patient contact after completing their training were asked to assume clinical responsibilities facilitating the work of “clinical” colleagues.

The profound changes that have interrupted the arc of the radiology narrative may substantially dictate how health care and radiology services are delivered in the future. If this is the case, then radiologists and their associated institutions and organizations must develop new tactics and strategies to define the pathway forward.

We examine the impact of COVID-19 on the future of radiology practice across the following domains: employment, compensation, and practice structure; location and hours of work; workplace environment and safety; activities beyond the usual scope of radiology practice; and CME, national meetings, and professional organizations. Our purpose is to share ideas that can help inform adaptive planning.

## EMPLOYMENT, COMPENSATION, AND PRACTICE STRUCTURE

The adverse impact of COVID-19 has been greatest on outpatient imaging. A large New York metropolitan health system reported an 87% reduction in outpatient imaging and specifically a 93% reduction in mammography because of COVID-19 [3]. Another constraint on imaging volume (and radiologist’s compensation) might come from third-party payers and ultimately CMS if the decrease in imaging volume experienced during COVID-19 does not have a significant impact on health outcomes. COVID-19 may adversely impact medical students’ choice of radiology and radiology residents’ choice of subspecialty and practice location (avoiding large, densely populated urban centers [4]).

The most recent (2019) ACR Commission on Human Resources Workforce Survey [5] found that the radiology workforce “continued to show a relatively stable employment environment and outlook for those seeking jobs as practicing radiologists in 2019.” The survey reported an essentially stable mix of practice types, subspecialty distribution, and predictable hiring patterns. As noted, this stability has been disrupted by COVID-19 placing enormous financial strain on both academic and private practices. Women radiologists, who often have less practice seniority, may be especially disadvantaged because of COVID-19.

Private practices typically disperse all of their profits each year to avoid double taxation. They have no corporate

reserves or easy methods to develop them. There is no larger organization to back them up apart from what their affiliated institutions might do if they themselves are financially able. Partnership and employee agreements may have to be rewritten with force majeure clauses to allow for increased flexibility in case of another pandemic.

Academic groups are usually required to maintain a certain reserve balance, either at the departmental or organizational level. The amount of financial reserves may need to be revisited (and increased) after the COVID-19 pandemic, and academic practices may be forced to include new significant at-risk components in their compensation structure. This could adversely impact the ability to pay monthly bills and maintain current lifestyles.

A recent survey [6] found that 45% of radiologists not affiliated with a teleradiology company interpreted imaging studies remotely. Radiology practices may choose to cover a fixed percentage of their projected volume internally and rely on teleradiology firms or spot-market and business-to-business radiologist hires to handle any incremental volume, thus reducing their fixed labor costs.

With falling revenues and contribution margins, merger and acquisition activity may increase with an even greater acceleration of consolidation of the field into employed radiologist models [7]. In 2019, the ACR [8] estimated that at least 6% of radiologists were practicing within a for-profit corporate structure. The number of investor transactions in radiology had increased steadily from approximately 10 per year in 2000 to 30 per year in 2018. COVID-19 disruption of radiology practice cash flows and lower estimates for future growth may make radiology less attractive to corporate investors. On June 5, 2020, Aunt Minnie [9] reported that Mednax announced that it is restructuring in a plan that includes selling off its radiology business, after a \$500 million purchase of teleradiology provider vRad in 2015. In its first-quarter financial results, Mednax procedure volume fell 50% to 60%, forcing the company to implement measures to conserve cash, including salary reductions and furloughs for nonclinical employees. It should be noted that a variety of prior financial challenges have resulted in some academic medical centers, with and without associated physicians, seeking shelter in the for-profit sector. This may happen again in the COVID-19 era but is unlikely to be a major trend.

## LOCATION AND HOURS OF WORK

Before COVID-19, many radiology practices already utilized home PACS workstations. A survey published in *JACR* found that, before COVID-19, teleradiology was often only used for call and overnight shifts. In response to the pandemic, an increase in the proportion of practices

installing home workstations and switching normal daytime shifts to internal teleradiology was reported [10]. Overall, respondents were pleased with their internal teleradiology experience, with a majority reporting decreased stress levels, improved or no change in turnaround time, no change in rapport with other physicians, and decreased interruptions. Telecommuting decanted crowded reading rooms and provided a secondary benefit to radiologists with young or school age children because the children were no longer in school or able to access planned day care. As this responsibility often disproportionately falls on women, telecommuting may help more women remain active in the radiology workforce [11]. Telecommuting also allows more flexible evening and weekend shift coverage, in turn decreasing moonlighting costs.

Since the enhanced deployment of home PACS workstations, it will likely be difficult to return to the paradigm of everyone in the department from 8 AM to 5 PM. Some radiologists may now expect to be able to work from home at least 1 or 2 days per week. As long as hospital reading rooms are sufficiently staffed for clinical and educational purposes, having some radiologists routinely work from home may have several benefits, beyond social distancing. Eliminating commuting time should create additional work hours, without adding to the length of the workday. Having some faculty read in an uninterrupted fashion may also help to increase overall productivity. Avoiding long commutes can also help to improve individual well-being and allow added personal time. Staggering home interpretation shifts may further help to ensure longer periods of consistent and subspecialized radiology services.

Working from home may increase job satisfaction and reduce stress, especially for radiologists with young children who now will also have a backup option when caregivers are suddenly unavailable, or schools or day cares are closed during snowstorms or other unplanned events. Home PACS workstations may help radiologists extend the clinical day, which in the short term may be necessitated by COVID-19 equipment cleaning protocols increasing the time between patients having CT, ultrasound, and MRI.

Alternatively, working from home may place increased stress and distance between radiologists, trainees, technologists, support staff, as well as other clinicians. Workers in higher socioeconomic groups have been better able to stay home during the COVID-19 pandemic than workers in lower socioeconomic groups [12]. The ready availability of this option may lead to discord or tension within the radiology department, antagonizing technologists and other nonradiologists in the department. The onsite presence of radiologists is necessary, not only for those who consult us, but may be even more important for technologists, nurses, and residents who see radiologists as

their teammates. Radiologists cannot be seen as, or act as, self-protecting elites.

## WORKPLACE ENVIRONMENT AND SAFETY

The current Centers for Disease Control and Prevention guidance advises that the virus is typically spread from person to person between people in close contact [13]. This places increased pressure on the concept of the central reading room. In some large hospitals, 25 or more radiologists previously worked in close proximity for prolonged periods. The tradition of teaching “at the view box” may be replaced with distanced or even remote readouts. Distanced readouts can be facilitated by screen sharing, although the faculty-resident interaction in the reading rooms is one of the last vestiges of the pre-PACS training and teaching era. With radiologists working from home on a regular basis, the need for reading room and office space in congested hospitals may be reduced, facilitating social distancing without the need for a larger footprint within our departments.

Past environmental concerns for radiologists often centered on ergonomic challenges of sitting in front of PACS systems for prolonged periods of time [14], or interventional radiologists’ exposure to radiation [15] and blood-borne pathogens [16]. A recent guideline published by the RSNA [17] describes recommendations and best practices for the radiologist’s role in patient screening for COVID-19, room cleaning, use of personal protective equipment, and droplet or airborne pathogen precautions. These represent occupational hazards that diagnostic radiologists have likely given little attention to until the COVID-19 pandemic.

With significant reductions in imaging volume, some radiologists have been asked to redeploy, utilizing their clinical skills for direct patient care and potentially exposing radiologists to infectious risks absent in the reading room. The combination of individual financial concerns, social distancing, and fear of COVID-19 exposure may further increase radiologists’ feelings of burnout and lack of emotional wellness [18].

## ACTIVITIES BEYOND THE USUAL SCOPE OF RADIOLOGY PRACTICE

COVID-19 has required radiologists to develop active triage guidelines, for both patients who are positive for COVID-19 and patients who are negative for COVID-19. In addition, radiologists are at the forefront of identifying COVID-19 in patients [19,20]. In up to 37% of patients presenting to the emergency department with gastrointestinal or neurologic symptoms, COVID-19 was confirmed after being suspected by imaging alone [21]. These cases place the

burden on the radiologist for the rapid identification of suspected COVID-19 and the notification of technologists and other hospital personnel, as well as closing the CT or MRI for appropriate cleaning.

Radiologists are uniquely situated to mine the enormous amount of real-time data being generated by artificial intelligence (AI) algorithms constantly “reading” imaging studies. The ability for almost real-time data aggregation across 856 hospitals using an AI platform recently allowed radiologists to document the decrease in the number of patients undergoing neuroimaging for stroke as a result of COVID-19 [22]. AI data may also allow radiologists to identify subtle complications of COVID-19 infection that would have previously gone undetected using single institution data, such as an increased incidence of pulmonary embolism [23].

### CME, National Meetings, and Radiology Professional Organizations

Many radiologists attend multiple national meetings a year, often supported by academic institutions and private practice to ensure that their radiologists are trained in the latest techniques and to satisfy CME requirements. With travel bans and concerns about the safety of air travel, along with crowded lecture halls and networking or social events, it may take a long time for radiologists to regain the confidence to return to onsite meetings. Fortunately, many radiology organizations have already developed online educational opportunities and virtual meetings that will most likely now experience accelerated growth.

Professional and educational meetings provide a venue for networking and strengthening relationships with colleagues. New remote approaches to achieve this type of networking are wanting. Nevertheless, some radiologists will prefer the virtual meeting format. It does not require the time or cost for travel. Virtual formats also allow for a wider audience, help faculty presentations be more easily and broadly disseminated, and may provide an opportunity for radiologists with young children (particularly women) to participate more fully in organized radiology through a virtual format.

Radiology professional organizations rely on the work of member volunteers to carry out their missions, and most rely on dues to fund their activities. At least during the time of restricted travel, it will be more difficult, and perhaps less attractive, for volunteers to participate, potentially weakening the ability of these vital organizations to continue functioning at the highest levels. Likewise, reduced financial circumstances are likely to cause some radiologists to cut back on the number of organizations they support with their dues. Optimistically, when

there is a return to more normal conditions, both of these issues will resolve.

### IMPLICATIONS AND QUESTIONS FOR THE FUTURE

The COVID-19 pandemic is likely to alter the way that radiology is practiced, financed, resourced, and taught for a very long time and may even affect the way we see ourselves. What new financial and organizational strategies will be deployed to support, resource, and financially buffer our practices now that we know financial disasters are real possibilities? What new employment models and incentive programs will emerge to protect radiologists, practices, and our specialty?

As one example, perhaps we are becoming increasingly disembodied omniscient voices, ever more distant from our referring physicians than in our halcyon pre-PACS days of in-person daily film rounds. Defining our new radiology normal will be the result of a set of experiments and adaptations, which we will all intentionally and unintentionally design and participate in, as we attempt to insulate ourselves from the uncertainties of future pandemics.

Radiology has traditionally benefited from strong trainees entering our field, contributing to our dynamic innovation engine and adding to our ubiquitous and robust clinical influence. Much radiology training traditionally has taken the form of an apprenticeship. It relied on teaching our students in close proximity and with prolonged presence at the workstation. In a postpandemic state, in which our personal presence may be reduced or relegated to a remote connection, will our influence as mentors and role models and in the daily life of our hospitals be diminished? Will we still be able to recruit the most competitive medical students to radiology? How do the dynamics within the reading room change when we are no longer all colleagues in one place?

The focus, prioritization, and funding of our research is likely to shift, just as we have seen accelerated support for COVID-19 research virtually instantaneously. A nimble focus on funding may enable more rapid and more collaborative targeted projects in support of health services and safety.

Change is inevitable, and we now face the need for change precipitated by the COVID-19 pandemic. Our challenge is to ask the right questions to understand the issues and to then respond with the insight and creativity necessary to achieve positive outcomes for all stakeholders: radiologists and the radiology team, referring physicians, patients, institutions, and society in general.

## TAKE-HOME POINTS

- The COVID-19 pandemic is likely to alter the way that radiology is practiced, financed, resourced, and taught for a very long time.
- Defining our new “radiology normal” will be the result of a set of experiments and adaptations, which we will all intentionally and unintentionally craft, as we attempt to insulate ourselves from the uncertainties of future pandemics and find ways to sustain and grow the field of radiology.
- To fully understand the impact of COVID-19 on our referring physicians, our patients, and our institutions, we must ask the tough questions and acknowledge the consequences of our actions.

## ACKNOWLEDGMENTS

The authors acknowledge the additional Society of Chairs of Academic Radiology Departments (SCARD) COVID writing task force members for their guidance in the planning and development of this manuscript: Dr Jennifer Harvey, MD and Dr Manuel Brown, MD.

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