Around-the-Clock Radiology Coverage: Challenges and Opportunities

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Healthcare use in the United States (US) has increased as the number of uninsured Americans has fallen, thanks largely to the Affordable Care Act. As the population ages, the pressure on healthcare resources is anticipated to increase. Between 2000 and 2020, the portion of the population aged 65 and older grew by 60%, and the trend is expected to continue well into the future.[1]

National trends in emergency department (ED) utilization have demonstrated steady increases since the 1990s, reaching new heights in 2015.[2] Although ED utilization largely stabilized in the second decade of the 2000s, the growth continues to impact EDs across the country, especially those in rural communities where the ED serves as a catchment for under-resourced communities and hospitals designated as Safety Net Hospitals.[3] This means that a large portion of the population relies on the emergency department their care.

As a result, radiology is experiencing increased demand for its services. Several studies in recent years have assessed radiology utilization trends. For example, Hong, et al, in 2019 found steady growth in imaging use until 2009, when it began to drop, largely because of code bundling.[4] Smith-Bindman, et al, looked at trends across the US and Ontario, Canada, and found that computed tomography (CT) and magnetic resonance imaging (MRI) rates steadily increased between 2000 and 2016, but at a slower pace in the latter half of that period.[5]

Studies like these provide the data to demonstrate the day-to-day reality of radiologists, but they do not show the increased pressures that radiology departments feel as they increasingly focus on metrics like turnaround time (TAT) and work relative value units (RVU) targets.

These concerns have led to an increase in 24-hour radiologic attending staff coverage across the US. This trend is more acute in academic radiology where, historically, off-hours coverage centered on trainee models, while nonacademic practices have had to leverage models that do not rely on trainee coverage. These include off-hours call and overnight staffing, either centrally or through a contracted service.[6, 7] Additionally, consolidation of radiology practices and healthcare systems has forced radiology groups to adjust staffing models to ensure adequate coverage of services. Ultimately, practice leaders are having to rethink staffing while accounting for impacts on imaging volume, hiring capabilities, workplace efficiency, patient care, and physician well-being.

Radiology is not alone in grappling with these issues. Across healthcare specialties, coverage models have evolved to meet patient care demands. Many studies in the nursing and ED literature have analyzed the effects of shift coverage on patient care, productivity, and well-being.[8-10] Although radiology's needs may differ, this literature holds valuable lessons for the field. This review examines how 24-hour staffing has evolved and how it may be leveraged within the specialty. It also offers recommendations on potential future models of imaging coverage.

A Look Outside of Radiology

Emergency medicine (EM) is likely the closest corollary to understanding the potential impacts of 24-hour staffing on radiology. Arising in the 1960s to meet the growing need for unscheduled and after-hours medical care, EM is dedicated to functioning around the clock in a way that no other specialty has had to do.[10] Therefore, the EM model can provide a basis for looking at radiology's changing coverage models and what imaging practice may look like going forward.

Key to EM practice is the concept of shift work, with patient care scheduled within the confines of a time frame, and non-shift work, which typically

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is not spent on patient care. Although not a hard and fast rule across the board, this model has been leveraged to provide EM physicians with flexible schedules. The trade-off for this flexibility is that many of these physicians work evening, night, and weekend shifts — as opposed to largely more desirable weekday shifts.[11]

Applying Shift Scheduling to Radiology

The first two considerations in designing optimal shifts in radiology is shift length and shift cadence. In EM, shifts tend to range from 8 to 12 hours, with multiple physicians scheduled based on historical demand. Shift cadence depends on group preferences, but typically includes a range of 3 to 7 consecutive shifts followed by comparable downtime. Similar practices occur in nursing, so it is prudent to look at the literature for both specialties to understand the impact of around-the-clock care needs.

It is important for radiologists to be able to make diagnostic decisions while maintaining high cognitive capabilities relating to focus and performance throughout their shift. There is conflicting literature on this topic. For example, some studies in the EM literature have shown reduced post-shift cognitive ability compared to pre-shift performance.,[12] Other research such as the work of Zeng, et al,[13] has shown no change in decision-making ability. However, there are many standard practices in the ED that aid in decision making (eg, decision trees),[14-16] which may mitigate the effects of decreased cognition. In the radiology literature, Hanna, et al, found that longer shifts and higher exam volumes correlated with increased interpretive diagnostic discrepancies.[17]

Importantly, several studies demonstrate poor health effects on persons who engage in shift work. These range from increased risks for cardiovascular disease and dyslipidemia, to increased use of medication.[8, 9, 18-23] Adequate sleep is necessary under such conditions. Studies have shown that compared to night sleep, day and evening sleep result in fewer total hours of sleep, with more sleep interruptions, and increased sleep disturbances as the number of shifts increases.[24, 25] Understanding how to mitigate these negative health impacts is paramount to maintaining a stable and healthy workforce. Strategies to explore include reducing the number of consecutive shifts and hours, allowing for adequate downtime, and providing support for potentially interruptive tasks within the typical workflow.[23]

Changing Models within Radiology

While there are significant differences between the work of radiologists and that of nurses and emergency physicians, lessons from these specialties can help in developing optimal staffing schedules in radiology.

Historically, radiology departments have staffed physicians in a model optimized for daytime work; eg, 7 am or 8 am to 5 pm. When longer shifts are needed, coverage typically ranges from 5 pm to 8 pm or 10 pm for evening coverage, and 8 pm or 10 pm to 7 am for overnight coverage. Minimal staffing in the evening and overnight has been the norm based on expectations of minimal demand for imaging services during these periods. While this may be the case for outpatient imaging, this model does not hold for emergent and after-hours patient care.

Evening medical imaging coverage has largely been based on a shift or on-call model. Overnight staffing, meanwhile, has been more of a challenge, owing to its less desirable time periods.[6] Many practices leverage contracted radiologist services to cover these periods and enable practice members to maintain better work-life integration.

However, with increasing demand to cover these hours with in-house radiologists to help reduce the financial impacts of contracted services, more practices are exploring full coverage by core group members. These issues are further complicated by the needs and expectations of subspecialty coverage,[26] making a one-to-one comparison of 24-hour radiology and EM services somewhat different. Larger practices fare better in navigating these issues internally, while smaller practices must continue to leverage external resources when needed. For academic practices, there is added concern for how to accomplish nonclinical responsibilities while working clinically around the clock.[27] Additionally, the importance of non-RVU-generating activities, including consultations and multidisciplinary conferences, must be considered.

Many practices have created an ED radiology division to provide evening and overnight coverage. Often the radiologists within this division are subspecialty trained but also have broader, generalist capabilities. This makes them valuable not only within the ED, but also as potential stopgaps within other subspecialties. While the ability to generalize is more common in nonacademic and smaller practices, it is growing in academic and larger practices.[28]

COVID-19 Impacts

The COVID-19 pandemic spurred many healthcare providers to deliver services in a novel way and to offer more opportunities for remote work.[29, 30] As technology-centered specialists, radiologists increasingly worked from home. This shift to remote work led to increased schedule flexibility and productivity for many practices, along with improvements in work-life integration for some. Indeed, there is a trend toward permanent remote work capabilities for a variety of reasons, including the risks of COVID-19 exposure in the workplace, child-care issues,

improved lifestyle, and general preferences among radiologists to work remotely.[29] The downsides of remote work include potential collegial disconnects, such as feelings of isolation from the broader group practice. With the nationwide shortage of radiologists, practice leaders will need to understand how to integrate traditional practice types with those that embrace the needs of their staff while concurrently maintaining high standards of patient care.

The pandemic also showed how shifting case mix can significantly impact the needs of a practice. While ED and inpatient volumes were maintained, the case mix for many practices shifted towards chest imaging. At the same time, outpatient imaging volume, especially in breast imaging, fell significantly. Those volumes have rebounded over the last year, in some cases exceeding pre-pandemic volumes.[31] Meanwhile, understanding the capacity of imaging equipment and personnel became more important with the addition of social distancing and sanitizing measures between patients.

A Potential Way Forward

No perfect solution to radiologist scheduling exists; indeed, there are many potential confounders for schedulers. However, scheduling is one of the most important considerations for any radiologic practice. Here are five steps to consider taking when devising and implementing a 24-hour staffing model:

1. **Track time-of-day imaging volume.**
   A retrospective analysis of imaging volumes across the entire practice for 24 hours can reveal practice-specific trends and illuminate the number and types of radiologists required for each period of the day. Year-over-year data can also show typical peaks and valleys in volume. For example, imaging volume may peak during flu season or other predictable times of increased hospital census. Imaging may also increase during certain local events or fall during quieter times of community activity (eg, summer in a college town).

   An understanding of volume demand variation is needed to optimize staffing models. New tools that leverage statistical modeling and machine learning can be leveraged to further evaluate and predict practice specific patterns and allow leaders to make novel changes in staffing and scheduling of both procedures and physicians.
2. **Define productivity.**
   Defining productivity for a radiology department or practice means considering clinical and nonclinical work when creating clinical schedules. Multi-disciplinary conference preparation and attendance, reading-room consultations, teaching, and other responsibilities should be among these considerations. It is also important to know who in a practice excels at what, and how to maximize those skillsets for the practice. At the same time, valuing administrative duties—phone calls into the reading room, etc — is important, as these tasks may require dedicated support.
3. **Think outside the box.**
   Shift schedules do not necessarily have to adhere to the traditional 8-hour or 8 am to 5 pm templates. Consider shorter shifts that maximize the cognitive abilities of radiologists or flex shift for periods of increased need. This could include adding back-up radiologists and shifts that can be leveraged for the unexpected. Which shifts can be worked remotely, and which ones need to be on site? The answers to questions like these, as well as a recognition of changing workforce needs and preferences, is helpful in devising a schedule that works for everyone.
4. **Remember that radiologists are not widgets.**
   It is important to create space for increased flexibility, and this can be accomplished by understanding the needs and preferences of individual members of the department or practice. One radiologist may need to get his kids off to school in the morning, while another radiologist prefers to work early and finish early to engage in a favorite activity in the afternoon. One radiologist may enjoy a night schedule while another radiologist struggles with consecutive overnights. Building schedules far in advance allows for internal switching and for physicians to plan personal and downtime appropriately.
5. **Define and value.**
   Identifying what work equity looks like across the practice and taking care not to devalue overnight staff are essential. Off-hours workers are vital to a practice and should be treated as full participants.

Conclusion

The COVID-19 pandemic necessitated workflow changes across health care. Change is not always bad; indeed, embracing change and evolving accordingly can enable radiology to lead the way in identifying workable solutions to maintain patient care and work-life integration.

Understanding how to staff a radiologic practice for 24-hour coverage is difficult; it depends heavily on practice type, expectations of those who refer for imaging studies, and preferences within the radiology group itself.

However, taking a strategic and transparent approach to shift scheduling offers an invaluable opportunity to optimize around-the-clock radiology coverage of the emergency department.

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