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Review Article

Evaluating the Pros and Cons of Evening and Weekend Outpatient Medical Imaging: Implications for Patients and Radiology Professionals

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Abstract

Evening and weekend imaging services at outpatient radiology centers offer extended access to diagnostic imaging, potentially increasing patient satisfaction and accessibility, especially for underserved populations. This review explores the benefits and challenges associated with these after-hours operations, focusing on health equity, patient satisfaction, economic considerations, energy and cost savings, and the impact on healthcare professionals. Findings indicate that while after-hours operations can enhance patient satisfaction and access, they also pose challenges such as increased operational costs and staff fatigue. Strategies for improvement include optimizing shift schedules, leveraging technology for better scheduling and communication, and enhancing patient-centered care. Collaborative efforts among imaging centers can further improve service delivery and efficiency.

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Introduction

Medical imaging is a cornerstone of modern healthcare, providing critical diagnostic information that guides treatment decisions and improves patient outcomes. The demand for diagnostic imaging services has grown dramatically over recent years, driven mainly by advancements in medical technology and an aging population [1-3]. As healthcare demands increase, many outpatient imaging centers have extended their operational hours to include evening and weekend services (hereafter referred to as "after-hours" operations). This practice aims to enhance patient access, optimize the use of expensive imaging equipment, and improve financial performance. However, the benefits of after-hours operations must be carefully weighed against the challenges they present, such as the impact on healthcare professionals' well-being, increased operational costs, and the potential environmental implications of extended hours.

This review explores the pros and cons of after-hours radiology services for outpatients, as supported by recent studies and analyses. It examines accessibility and health equity, patient satisfaction, economic considerations, energy and cost savings, and the impact on healthcare professionals. By evaluating these factors, we can better understand how to balance the advantages and drawbacks of after-hour imaging services, ultimately aiming to provide high-quality care while ensuring the sustainability and efficiency of radiology practices.

Accessibility and health equity

Perhaps the most important aspect of after-hours outpatient imaging to consider is its effect on accessibility and health equity. A very recent study by Rossi, et al. evaluated outpatient utilization of after-hours mammography appointments and how these extended hours affected access among various demographic groups [4]. The authors observed an increase in weekend and evening appointments after the COVID-19 pandemic. This allowed patients who were unable to visit during regular hours due to personal schedules or other concerns to be accommodated. The study found that younger patients, non-White races, non-English speakers, and individuals from lower-income zip codes were more likely to utilize after-hours appointments. Younger patients benefit from after-hours appointments because they may have more demanding work or family commitments during regular daytime hours. Non-White

races had a higher utilization of after-hours appointments highlighting a potential inequality in access to traditional healthcare services and pointing out the importance of after-hours scheduling in resolving these inequalities. Non-English speakers showed a preference for after-hours appointments due to barriers during regular hours such as needing a family member or interpreter to accompany them, and those individuals might have other daytime responsibilities. Those from lower-income zip codes were more likely to utilize after-hours appointments, suggesting an economic inability to take time off from work. Offering after-hours appointments could significantly improve access for underserved populations and provide more opportunities for these groups to receive essential imaging services.

A comparable study by Miles, et al. in 2022 drew similar conclusions [5]. They evaluated 53,695 patients who underwent screening mammography and 10,363 patients who underwent diagnostic breast imaging between January 2016 and December 2017. Importantly, 5135 screening mammogram patients and 209 diagnostic patients were imaged on a Saturday, while the remainder were imaged during traditional Monday through Friday business hours. They found that racial/ethnic minorities and patients who spoke English as a second language were more likely to be imaged on Saturday (OR, 1.1; 95% CI: 1.0 - 1.3; $p = 0.03$). Again, these data reinforce the point that after-hours appointments can significantly improve access for underserved populations.

Not all the data are specific to breast radiology. In 2023, Maki, et al. compared the differences in scheduling lung cancer screenings between African American and White populations [6]. Their study found that 10.5% of African American individuals reported difficulty scheduling their lung cancer screenings while only 6.6% of White individuals found difficulty. This could suggest additional stressors such as a lack of flexible work schedules and less access to healthcare facilities in predominantly African American communities. Within the same study, 11.1% of African American individuals reported a lack of transportation as a barrier compared to 3.6% of White individuals. By implementing after-hours screenings for lung cancer, accommodations for those patients who cannot receive care during traditional business hours can be more easily accomplished. For example, for those with a lack of transportation, a family member or friend might be more readily available to accompany the patient outside of regular work hours.

Also in 2023, Mateo, et al. explored factors contributing to a higher likelihood of missed or canceled outpatient neonatal ultrasound appointments during normal business hours [7]. This study focused primarily on minority populations and individuals with public insurance. Both minority populations and individuals with public health insurance were disproportionately more likely to miss their appointments than those from majority populations and those with private health insurance. Minority populations in their study faced obstacles such as lower income, higher job insecurity, and reduced access to supportive workplace policies that allow for time off for medical examinations, which all contributed to the higher likelihood of their missed neonatal ultrasound appointments. Also, for those with public health insurance, fewer healthcare provider options and longer distances to travel to the available healthcare providers were implicated as prohibiting those individuals from attending their appointments.

Overall, the data suggest that after-hours outpatient imaging may play a key role in increasing access to timely radiology services for all patients. This is important to remember when considering the current state of health inequity [8].

Patient satisfaction

The importance of patient satisfaction in healthcare services has been recognized for decades. A survey conducted in 1995 at the C.T. Scanning unit at the Royal Infirmary, Edinburgh, Scotland, highlighted the impact of after-hours services on patient satisfaction [9]. The authors questioned 211 patients about their preferences for outpatient appointment times and assessed the acceptability of receiving an evening appointment. Of those surveyed, 189 (90%), were satisfied with their appointment times. Preferences varied, with 29% favoring morning appointments, 20% preferring afternoon slots, and 42% expressing no preference. Notably, 20% of patients expressed a desire for evening appointments, particularly between 6:00 pm and 8:00 pm. Moreover, if offered an evening appointment, a substantial 78% indicated they would accept it. Those who would decline an evening appointment cited family, social, and transportation reasons for not preferring evening appointments, underscoring the diverse factors influencing patient satisfaction. These early findings highlight the value of after-hours services in meeting patient needs and preferences, which continues to be a critical factor in healthcare delivery today.

In more recent research, North, et al. found that 24.4% (3286 of 13,454) of self-scheduled imaging examinations occurred after normal business hours or on weekends, highlighting the demand for these time slots [10]. However, they also observed a slightly higher no-show rate for these appointments. Similarly, Offman, et al. found that when patients were initially scheduled for screening mammography during traditional office hours but were given the option to change to non-traditional times, including evenings and weekends, about 7% of patients opted for these after-hours appointments [11].

Interestingly, an imaging center's examination volumes also correlate with patient satisfaction. A retrospective study from 2022 analyzed patient visits at outpatient MRI sites within a university-affiliated hospital system [12]. The

authors categorized sites into three groups based on quarterly volume trends: "decreasing," "stable," or "increasing." The association between patient volume and satisfaction scores, as measured by Press Ganey outpatient services surveys, was assessed. Results showed that sites with increasing volume trends had significantly higher improvements in satisfaction scores across all domains, including overall assessment, facilities, personal issues, registration, and test or treatment.

The availability of after-hours services can significantly enhance patient satisfaction by offering greater flexibility and convenience [10-13]. Patients who cannot attend appointments during regular hours due to work or other commitments may find after-hours services particularly valuable. This increased accessibility can lead to higher patient satisfaction, as it addresses their specific needs and preferences. As satisfaction increases, so does the likelihood of higher patient volume, as satisfied patients are more likely to choose and recommend these services [12]. The convenience of after-hours availability can thus attract a broader patient base, contributing to increased utilization of imaging services.

High patient experience scores in outpatient radiology are not only important for improving patient care and compliance but also have secondary positive effects on employee engagement, retention, and even reimbursement [14]. Effective administrative and physician leadership is critical in obtaining employee buy-in to the importance of customer experience. Training employees at all levels to understand the patient psyche empowers them to offer personalized care to a diverse patient population. For instance, in breast imaging centers, creating a welcoming environment and providing clear communication can build patient trust and loyalty [14]. This not only enhances patient satisfaction but also potentially impacts downstream revenue from other related services, such as surgery or oncology.

Patients' subjective experiences during clinical interactions significantly impact their engagement and satisfaction. A study by Ajam, et al. analyzed Press-Ganey survey data from 69,319 respondents over nine years to identify factors driving patient satisfaction in outpatient radiology [15]. The study found that the most predictive factors for favorable overall ratings and the likelihood of recommending a facility were related to patient-centered empathic communication. Specifically, responsiveness to patient concerns or complaints and sensitivity to patient needs were the strongest predictors. Additionally, logistical issues such as the helpfulness of registration desk personnel, comfort of waiting areas, and ease of obtaining an appointment at the desired time were more predictive of patient satisfaction in radiology settings than in non-radiology settings.

These findings suggest that addressing these elements can significantly enhance patient satisfaction. Implementing after-hours services may further improve patient experiences by accommodating diverse schedules and needs, reducing logistical barriers, and ensuring a more patient-centered approach. As patient satisfaction is linked to patient volume [12], offering after-hours imaging could lead to increased patient retention and loyalty, benefiting both patients and imaging centers.

Economic considerations

Multiple economic factors deserve specific mention when evaluating the benefits of after-hours outpatient imaging. Rent for outpatient imaging centers in the United States typically ranges from 20 to 50 USD per square foot annually varying on geographical location, with urban metropolitan centers and higher-demand areas typically having higher rents [16]. For instance, imaging centers in metropolitan areas such as New York City, Los Angeles, or Chicago often have rents at the higher end of the range or possibly even exceeding it, while imaging centers in rural or suburban areas tend to fall around the lower end of the range [16]. Typically, this is a fixed expense that cannot be adjusted and should be accounted for in each facility's budget.

Alternatively, operational expenses are less fixed and represent another major component of the cost of outpatient imaging [17]. They include utilities, maintenance, equipment depreciation, administrative costs, insurance, marketing, and other miscellaneous expenses. By utilizing after-hours outpatient imaging, centers can significantly enhance profitability by leveraging their existing rent and operational expenses to drive financial performance.

Cost variability for imaging services is another significant economic consideration. Pasalic, et al. examined out-of-pocket expenses for non-contrast knee MRIs across various geographic locations and populations in the United States [18]. The study found that costs ranged from 259 to 2,042 USD across 122 analyzed centers, with substantial variability even within the same locality—ranging from 0 to 1,592 USD. The median cost differences between regions were also notable, with the West having a median cost of 690 USD, the Northeast at 500 USD, the Midwest at 550 USD, and the South at 550 USD. Imaging centers in more densely populated areas generally offered lower prices, likely due to increased competition and higher patient volumes. This cost variability can influence the economic feasibility of offering after-hours imaging services. In areas with lower out-of-pocket costs, providers might be more inclined to offer extended hours to attract a broader patient base, including those who cannot attend during standard business hours. Conversely, in regions with higher costs, the economic burden on patients may limit the demand for after-hours services, potentially affecting the viability of maintaining such extended hours.

The implementation of bundled payment models by

the Centers for Medicare and Medicaid Services (CMS) has significant implications for after-hours outpatient imaging services. As discussed by Liao, et al., the shift towards bundled payments, particularly in areas such as breast and lung cancer screenings, aims to improve coordination between primary care providers, radiologists, and other healthcare professionals [19]. By creating standards for the use of imaging, this model not only standardizes patient care but also makes these essential screenings more accessible to patients.

One potential benefit of bundling is the facilitation of after-hours imaging services. Since bundled payments cover a range of services, including necessary screenings, healthcare providers are incentivized to offer flexible scheduling, including after-hours appointments, to ensure patients complete all aspects of their care bundle. This is especially important for working patients who may not be able to attend appointments during traditional business hours. Therefore, the bundled payment model could indirectly encourage the expansion of after-hours services, thereby enhancing patient access and ensuring timely medical imaging.

Operational efficiency and patient care benefits of after-hours imaging services are also significant. Ahmed, et al. conducted a retrospective review of 453 non-urgent procedures performed on 100 weekend days over 12 months [20]. The study reported an additional 174 hospital days gained and 415 days of progression of care achieved due to the availability of after-hours services. Though this study evaluated inpatient procedures, the findings underscore the point that extended operational hours can significantly improve patient care and overall healthcare system efficiency.

Employee expenses also deserve specific mention here. Motivating radiology professionals to work beyond regular business hours can be challenging but might be solved with augmented salaries or hourly wages. Suggested wage increases include 20% - 30% for the radiologist, 15% - 25% for the radiology technologist, 10-20% for front desk staff, and 10% - 15% for imaging center managers [21-24]. With after-hours outpatient imaging, these augmented expenses should be outweighed by higher profits from increased imaging volumes. Another economic consideration with after-hours imaging is urgent equipment failure and subsequent repair, which might be unavailable outside of normal business hours. These issues could potentially lead to significant delays in patient care and must be prepared for.

A final caveat to consider under economic considerations involves the 2017 retrospective study by Weilburg, et al. that evaluated the impact of a resource utilization management program on the use of high-cost outpatient imaging tests [25]. The study goal was to understand how such a program could affect the frequency of expensive imaging procedures, and they found a 21.33% decrease in the usage of high-cost imaging tests per patient per year following the implementation of the program. While the after-hours operations could benefit from the decreased demand for high-cost imaging services with respect to the imaging center's limited staffing and resources, the reduction of usage presents a potential drawback by making after-hours operations less necessary and potentially redundant. With fewer high-cost imaging procedures needed, the necessity for extended operational hours diminishes and leads one to question the cost-effectiveness and overall benefit of maintaining after-hours operations if the demand is not sufficient to justify the additional operational costs and staffing.

Energy and cost savings

Also important to highlight in this review is the energy expenditure and cost of nonoperational radiology equipment, expenses that many outpatient imaging centers neglect to mitigate [26]. In 2023, Brown, et al. conducted a detailed analysis of the energy consumption and potential cost savings associated with turning off CT scanners during nonoperational hours [26]. They concluded that approximately 14,000 kWh of power could be saved by turning off CT scanners during nonoperational hours (95% CI: 13,889 - 14,464 kWh). The study also suggested potential environmental benefits, including reduced carbon footprint and decreased demand for energy resources that further pollute the environment. Implementation of these energy-saving strategies could lead to substantial cost savings for radiology departments that decide to remain closed after hours, though many centers ignore this potential benefit [26]. While the study focused on CT scanners, similar energy-saving strategies should apply to other high-energy-consuming devices such as MRI and radiography units. With outpatient imaging during after-hours operations, these strategies cannot be implemented fully and thereby fail to save power. However, this unrealized benefit should be eased by the overall gains associated with higher patient and imaging examination volumes.

A similar supporting study by Roletto, et al. performed a systematic review to examine the environmental sustainability of radiology practices [27]. The authors found that 40% - 91% of the energy used by radiology devices is nonproductive, and by implementing energy-saving measures, an estimated 9,225 to 14,328 USD can be saved per device per year. After-hours outpatient imaging challenges the ability to shut down devices, but radiology departments could develop protocols for powering down equipment during non-peak hours. Thrall, et al. explored the implications of extending operational hours for MRI machines, focusing on the potential benefits in terms of resource utilization [28]. By extending operational hours for MRI machines into after-hours and optimizing the use of the MRI machines, radiology departments can maximize the use of the existing equipment, allowing the same machines to accommodate more patients,

reducing the need for additional MRI machines, and thereby increasing energy savings.

Impact on healthcare professionals

After-hours outpatient imaging can create difficulties for radiologists and other radiology professionals that do not exist for their counterparts working during normal business hours. Rohatgi, et al. evaluated the challenges and hardships of having radiology professionals work during after-hours and drew many important conclusions [29]. First, those working these nontraditional hours often experience disturbances in their sleep patterns. Also, their lack of sleep could impair cognitive functions affecting memory, attention, and decision-making abilities. The demanding nature of after-hours work can lead to higher rates of absenteeism. Both sleep disturbances and cognitive decline could lead to job dissatisfaction, which may make the individual consider leaving their job and contribute to a higher staff turnover rate. The potential absenteeism and higher turnover rates would result in after-hours staffing shortages and could decrease the availability of services. This would oppose the primary goal of increasing access and delivering timely service.

The cognitive decline and job dissatisfaction could negatively impact the performance of the radiology professional and could compromise the quality of care in the imaging center. Similarly, the same issues can reduce efficiency during these nontraditional hours, while the increased staff turnover would lead to increased recruitment demands and training costs, impacting the overall financial performance of the imaging center [29].

Recruitment for after-hours shifts is another challenge. Younger radiology professionals might be better equipped to handle the straining hours but may lack the experience to handle the cases [29]. Ultimately, their lack of experience can affect their confidence and decision-making abilities and potentially lead to diagnostic errors or delays in patient care. On the other hand, older radiology professionals tend to have less flexibility in their circadian rhythms, posing a challenge when adjusting to these shifts, especially the overnight shifts. As age increases, the overall ability to work outside of normal business hours becomes compromised by slower reaction times and reduced alertness [29]. Individuals with family responsibilities often face challenges in balancing work and personal life. For the evening and night shifts, those with families who should have been sleeping during the day likely were awake fulfilling household duties and childcare demands. For the weekend shifts, those radiologists may feel bad for missing out on time with their families, increasing job dissatisfaction.

Recommendations for implementing after-hours outpatient imaging

There are many things to consider when expanding radiology scheduling templates to include after-hours operations, and though it will not occur overnight, alleviating many of the inherent stressors should ultimately lead to greater access to quality, timely imaging services as well as increased profitability. It is crucial to optimize the radiologist and non-radiologist shift schedules, which might be accomplished with shorter eight to ten-hour shifts instead of longer twelve-hour shifts or by adding 12 - 24+ hour rest periods between shifts to allow for full recovery before the next workday. For those with families, implementing flexible scheduling of the shifts could allow them to better balance their family and work demands.

Strategies like online scheduling, awareness campaigns, and mobile imaging units are important to ensure underserved populations are aware and able to schedule their imaging services. Online scheduling can make it easier for the patient to schedule and ensure they will not miss their appointment because they selected that date and time based on their commitments. Awareness campaigns can ensure that underserved populations know about the extended hours and might encourage them to schedule. Mobile imaging units are often very helpful for those with transportation issues. Staff training and awareness could help energy-saving practices such as powering down imaging equipment like CT and MRI units during nonoperational hours or when they are unused for substantial lengths of time.

Finally, collaboration between outpatient imaging centers can be a valuable strategy. For instance, the collaboration between Royal Philips and Akumin, Inc. created shared service models and integrated care solutions that have proven effective in enhancing service delivery across 130 outpatient imaging centers [30]. Similarly, on May 13, 2020, Jefferson Radiology and Center of Diagnostic Imaging announced their collaboration in Springfield, Massachusetts [31]. These partnerships include shared services and resources, which allow facilities to manage patient loads more efficiently, expand the range of available services, cope with staffing challenges, and maintain high-quality service standards. Most importantly, these types of collaborations can be leveraged to enhance patient outcomes by increasing the efficiency, sustainability, and quality of after-hours imaging services [32-34]. The success of these models serves as a robust example of how strategic partnerships can optimize healthcare delivery in the outpatient setting.

Summary

After-hours radiology imaging offers significant benefits such as improved patient access, optimized resource utilization, and potential cost savings. These services allow patients with daytime commitments to schedule appointments more conveniently and ensure high-cost imaging equipment is used efficiently. However, challenges include negative impacts on radiologists' well-being,

increased operational costs due to pay premiums, and the potential redundancy of services. Balancing these pros and cons is essential for maintaining high-quality, sustainable imaging services. Implementing flexible schedules, adequate rest periods, and energy-saving practices can enhance the overall effectiveness of after-hour radiology operations.

Conclusion

In summary, after-hours outpatient imaging offers a mixed array of benefits and challenges. While these services can significantly enhance patient satisfaction by providing more flexible scheduling options and increasing accessibility, they also introduce additional operational costs and complexities. The added strain on healthcare professionals, including potential disruptions to work-life balance and increased fatigue, requires careful management. Optimizing shift schedules, enhancing patient-centered care through technology and staff training, and fostering collaborations between imaging centers are critical strategies for improving the efficiency and quality of after-hours services. Moreover, patient satisfaction remains a vital metric, with responsiveness to concerns, sensitivity to needs, and efficient handling of logistical issues emerging as key factors. By addressing these aspects, outpatient imaging centers can better serve their communities, improve patient outcomes, and maintain operational sustainability.

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