



Automated Protocolling in Radiology: Enhancing Efficiency and Reducing Workload

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At a Glance

The increasing demand for medical imaging has placed a heavy workload on radiologists, leading to fatigue and potential errors. For example, the volume of medical imaging studies has been increasing annually in various regions. Automated protocolling (AP) using artificial intelligence (AI) promises to reduce this burden by automating routine tasks. Protocolling in radiology involves selecting the best imaging study for a patient based on their history and symptoms. AI can automate this process, ensuring consistent decisions and freeing radiologists to handle more complex cases. This article reviews the impact of AP in radiology, highlighting its benefits in improving workflow efficiency.

Keywords: Radiology, Automated protocolling, Artificial intelligence, Workload reduction

Introduction

Radiology faces unique challenges, including increased imaging demand due to ageing populations and rising chronic diseases. This growth results in higher workloads for radiologists, raising concerns about fatigue, interpretation errors, and delays in critical findings.¹ Automation and AI technologies, particularly in AP, have emerged as solutions to alleviate these issues by streamlining routine tasks while maintaining radiologists' workflow. AP uses AI to analyse patient data, clinical history, and symptoms. Based on this, it determines the best imaging modality (such as MRI, CT, or X-ray), the technique, and the scanning parameters. This ensures consistency, reduces radiologists' decision-making burden, and maintains diagnostic accuracy

while optimising workflow efficiency.

Radiology protocolling involves manually selecting imaging protocols based on patient data, a process prone to variability and errors due to human factors.² The manual method can be lengthy and often requires radiologists to spend significant time reviewing patient history and clinical indications, which can detract from their productivity and lead to delays in reporting critical findings.³

AP systems use advanced algorithms to process large volumes of clinical and imaging data, assigning and customising protocols intelligently.⁴ This automation saves time, ensures consistency, and enhances imaging quality and diagnostic accuracy by leveraging extensive datasets and clinical guidelines. However, challenges include the need for high-quality annotated data for AI training, integration with existing IT infrastructure, adaptability to various clinical scenarios, and initial implementation costs. Additionally, significant changes to workflow and radiologist training are required.

The need for AP arises from the increasing volume of imaging studies, complex medical cases, and the demand for personalised protocols.² This customisation ensures the most appropriate imaging modality and technique are used for each case, ultimately enhancing diagnostic accuracy and patient care. Regulatory pressures, such as compliance with guidelines from the American College of Radiology and the Food and Drug Administration, and cost containment efforts also drive this adoption. By addressing these challenges, AP can significantly improve operational efficiency, reduce errors, and enhance patient outcomes in radiology.

The Role of Automated Protocolling

AP leverages AI algorithms to analyse patient data and recommend the most appropriate imaging protocols.⁴ These systems can seamlessly integrate with hospital information systems (HIS) and radiology information systems (RIS)—digital platforms that manage patient medical data and imaging workflows—to streamline the imaging process. The AP system extracts relevant patient information from the HIS, including medical history, clinical indications, and prior imaging studies. Based on this data, the system uses AI algorithms to recommend specific imaging protocols, which are then communicated to the RIS. This integration ensures that all relevant patient information is automatically considered when selecting imaging protocols, reducing the need for manual intervention and minimising errors. This seamless workflow enhances efficiency and consistency in imaging practices as seen in Figure 1.⁵

AI algorithms process vast amounts of clinical data, including patient demographics, medical history, and specific clinical indications. These algorithms are trained on extensive datasets containing thousands of prior imaging studies and clinical guidelines. Through machine learning or deep learning or decision trees, the algorithms highlight patterns and correlations within the data. For example, they can identify which imaging protocols have been most effective for similar clinical scenarios. The algorithms then can provide suggestions for the radiographer on the most appropriate imaging protocol tailored to the specific clinical scenario. Factors such as

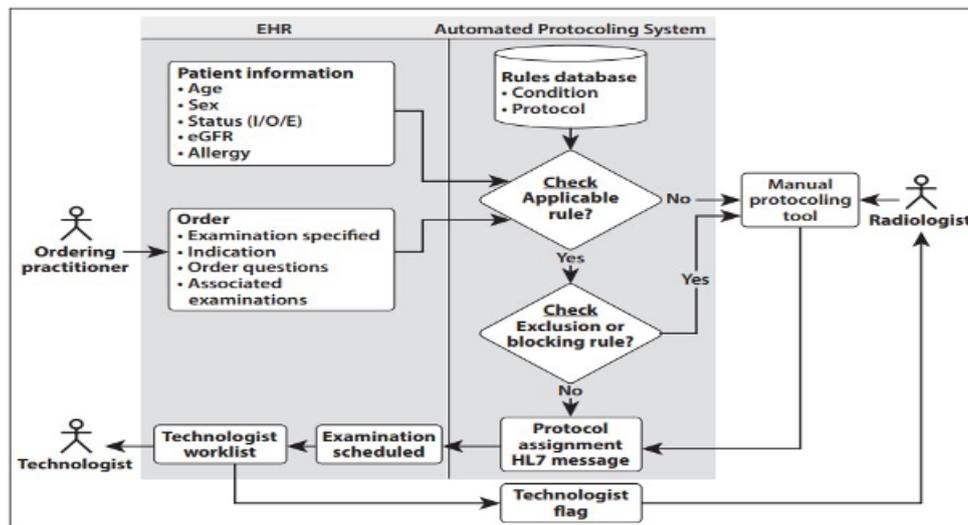


Figure 1: Workflow Diagram of AP System for Radiology Orders as Demonstrated by Chung et al.⁵

the patient’s condition, the type of imaging required, and current clinical guidelines are accounted for.

Furthermore, AI systems continuously learn from new data, refining their recommendations.⁴ As more imaging studies and outcomes are fed into the system, the algorithms become more accurate and effective in protocol selection. Integrating HIS and RIS, AP systems ensure that imaging protocols are consistently applied based on the latest clinical data and guidelines.

Impact on Radiologist Workload

Radiologists’ workloads are diverse. Image interpretation consumes 40-50% of their time, protocolling exams 20-25%, communication with healthcare professionals and patients 10-15%, administrative duties 10-15%, and continuous education and research 5-10%.⁶ AP aims to streamline the image acquisition process by using AI to select and optimise imaging protocols for various clinical scenarios. For patients, this can mean faster results, fewer repeat scans, and more personalised care. This would significantly reduce the 20-25% of radiologists’ time spent on protocolling and allow them to focus on more complex diagnostic tasks.

AP systems use AI and machine learning to support radiologists by analysing patient history, clinical indications, and exam types. They leverage datasets from prior studies, clinical guidelines, and expert input to recommend appropriate imaging protocols. Utilising natural language processing (NLP)—a type of AI that enables computers to understand human language—and predictive modelling, these systems tailor protocols to individual cases. Continuously learning from new data, the algorithms adapt to evolving clinical practices and demographics. This reduces manual workload, standardises imaging procedures, and enhances workflow efficiency.

Several institutions have successfully implemented AP systems, demonstrating notable improvements in workflow efficiency.^{2,7} For example, a study at a hospital-based academic medical centre analysed 4,244 MRI exams, identifying 140 protocolling-related issues and sig-

nificantly reducing protocolling time from 8 hours to 2 hours.² Another study developed and deployed an NLP model for AP of neuroradiology MRI exams, achieving accuracies of 83.38% for spine MRI and 85.43% for head MRI protocols.⁷

Another study at a sizeable quaternary-care institution analysed 317,597 CT examinations over two years, showing significant improvements in process efficiency and reductions in protocol errors.⁵ AP usage increased from 27.4% in the pilot phase to 64.5% in the post-implementation phase, with notable reductions in time from order entry to examination completion across emergency (2.1 to 0.2 hours), inpatient (3.5 to 0.5 hours), and outpatient (1289.9 to 361.7 hours) settings. However, while efficiency improved, the number of quality improvement reports (QIRs) and recalls also increased post-implementation—rising from 5 to 25 QIRs and from 0 to 3 recalls. These increases may reflect improved detection and documentation processes enabled by the system, rather than a deterioration in quality.⁵ These results highlight the AP system’s ability to reduce radiologists’ workload and enhance care efficiency, particularly in outpatient settings.

Addressing Staff Shortages

Radiologist shortages lead to increased workloads, delays in diagnosis, limited access to imaging services, higher healthcare costs, and pressure on training programs. Automating routine tasks with tools like NLP helps mitigate these issues by allowing radiologists to focus on higher-level tasks and improving efficiency.⁷ This allows radiologists to focus on higher-level tasks like interpretation and patient care, improving efficiency and mitigating workforce shortages.

Research shows that AP significantly increases efficiency and job satisfaction by streamlining workflows and maintaining patient satisfaction.⁶ By reducing the time radiologists and trainees spend on protocolling routine MRIs—saving 45-60 minutes per day—clinicians can focus on more complex diagnostic and interventional tasks, enhancing their job satisfaction. Patient satisfaction is also upheld, as evidenced by stable recall rates for additional post-contrast sequences, indicating that diagnostic quality remains high. This approach minimises disruptions and administrative burdens for medical staff while ensuring consistent patient care, demonstrating the overall benefits of AP in clinical settings. It also impacts radiologist training, allowing more focus on advanced skills while ensuring hands-on protocolling experience remains part of their education. This balance is crucial to maintaining comprehensive training for handling protocolling errors and variations.

Future Models of Care and Advanced Practice

AP significantly streamlines radiological processes by personalising imaging studies based on detailed patient data, enhancing accuracy and efficiency.³ This technology frees radiologists from routine tasks, allowing them to focus on complex diagnostics and patient interaction. It supports the trend toward specialisation, enabling radiologists to spend more time on challenging cases and less on standard protocol tasks. Hybrid practices that blend traditional dia-

gnostics with the refinement of automated algorithms improve accuracy and operational efficiency. This shift aligns with value-based care goals—healthcare models focused on delivering the best outcomes for patients relative to cost—emphasising better patient outcomes at lower costs. AP also facilitates deeper specialisation in areas like oncologic imaging and neuroimaging, as it reduces time spent on manual tasks, shifting the focus to advanced clinical activities. Additionally, it encourages cross-training and collaborative practices among healthcare professionals, integrating AI insights to enhance the radiology field further.

Ethical Considerations

Integrating AI, especially AP, transforms radiology but raises ethical issues like decision-making, accountability, and patient privacy.⁸ Establishing data protection and clear AI usage guidelines is essential to build trust and ensure patient care remains personalised. The EU AI Act, with its stringent requirements for high-risk AI systems and robust governance structures, provides a comprehensive framework to address these concerns and promote safe, ethical AI deployment in healthcare.

AI-driven protocolling streamlines imaging by analysing patient data, potentially enhancing diagnostic accuracy. However, it risks overreliance on technology, emphasising the need for continuous training and human oversight to maintain ethical standards and patient safety. Radiologists must balance AI's efficiency with their clinical judgment.

Ethical concerns include accountability for AI decisions and the shift in radiologists' roles towards more interpretive tasks. Privacy and data security require robust measures to protect patient information.

Future Prospects and Challenges

AP promises to refine radiology with customised, real-time adjustments based on patient data. Integration with broader healthcare systems and telemedicine can streamline processes. However, challenges include creating regulatory frameworks, ensuring data quality, overcoming initial resistance, and necessitating substantial knowledge and training for radiographers to facilitate clinical adoption.⁹

Embedding AI in radiology education and fostering collaboration among radiologists, data scientists, and AI engineers are crucial for effective implementation.¹⁰ Continuous professional development will help radiologists harness AI's benefits, enhancing diagnostic precision and operational efficiency.

Conclusion

AP in radiology can help reduce radiologist workload and enhance efficiency. By streamlining imaging procedures and enhancing diagnostic accuracy, AI-driven systems contribute to better patient outcomes. Balancing the capabilities of AI with human expertise will be vital to achieving seamless integration and advancing the field of radiology.

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Declaration of Interests

There is nothing to declare.

Author Bio

Yasser Hadi is a senior CT radiographer pursuing a PhD at University College Cork. Under the supervision of Professor Mark McEntee and Dr Andrew England, Yasser Hadi's research focuses on the application of artificial intelligence in CT imaging, specifically its impact on optimising radiation dose and imaging quality to provide the best patient care. With a background in clinical radiography and a passion for improving patient outcomes, Yasser Hadi is dedicated to advancing the field of radiography through evidence-based research and innovative practices.

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