

# **Integration of Artificial Intelligence into Healthcare Administration Systems**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## **Introduction**

Over the past two decades, artificial intelligence has become more deeply integrated into healthcare services. The rapidly growing array of applications in healthcare includes improving diagnostic accuracy, efficiency in workflow and operations, disease and therapeutic monitoring, and procedure accuracy (Kaul et al, 2020). One of the systems that has the potential for significant transformation through artificial intelligence is healthcare administration, although some people are unaware of how exactly it can be integrated and what changes it entails. When most people think about artificial intelligence in the healthcare field, the mind goes to surgical robots, predictive analytics, or accelerating the development of medicine, but healthcare administration contains many systems that could be automated or made more efficient with artificial intelligence tools. Some of the major changes that AI can bring to healthcare administration comes from the decrease in burden on healthcare workers, the increase in provider productivity, and the reduction of costs. It brings the potential to improve efficiencies of healthcare systems so that healthcare providers are put under less stress and patients are then able to receive better care. However, there remain barriers to the actual implementation of AI technologies in healthcare services such as human acceptance and hospital readiness. It also remains unclear how the integration of artificial intelligence may reshape hospital structures and change the roles that hospital staff play. This paper will analyze the roles that artificial intelligence can take in healthcare administration and what factors need to be considered before it can be successfully implemented.

## **Background**

In recent years, administrative tasks have become increasingly time consuming and complex given the interconnected network of healthcare providers, patients, and agencies involved in the process. However, the advancement of electronic health record systems has provided data available for advanced algorithms to use to learn workflows and systems to help optimize behavior in order to reduce the administrative burden for health care providers. Artificial intelligence is the ability of machines to perform tasks that traditionally require human input or human intelligence, and AI works by using

algorithms and data to learn and make predictions and decisions. There are several AI tools and algorithms that could be applied to improve healthcare systems such as machine learning (ML) algorithms, which takes data to generate predictions based on what it learned from the data; natural language processing (NLP) algorithms that focus on learning from text data; and optimization algorithms which analyze metrics to optimize systems. (Glover et al., 2022) Machine learning algorithms are able to process large volumes of data quickly and identify patterns in order to make predictions. In clinical settings, ML can be used to analyze medical imaging and medical records to aid in disease diagnosis and help customize treatments for patients (Barth, 2022). On the administrative side, ML can be used to automate processes such as prior authorization and bill estimation that typically are time consuming and prone to error. Natural language processing is a useful tool that can extract information from health data in order to make more accurate diagnoses and identify treatment and medication options. Given its capabilities in interpreting human language, NLP can be especially useful for reviewing and extracting data for documentation review for processes such as prior authorization (Barth, 2022). ML and NLP as well as other AI techniques can be implemented to manage and automate administrative tasks. If a hospital system determines that AI tools would help optimize their workflow, they then need to evaluate where and how to integrate these tools in a way that is beneficial for the system and appropriate with the given data. Hospital systems can development different frameworks to approach the process of implementing AI for administrative management, and one such framework for optimizing system behavior for administrative tasks through AI was developed by Glover, Li, and Dessislava and is called ISUMO, which included five steps: identifying events, tasks, and workflows; standardizing system events; uncovering hidden network structure; measuring administrative burden; and optimizing network flows and redefining roles (Glover et al., 2022). This kind of approach breaks down the process in several different steps, making the implementation of AI more manageable and ensuring that appropriate AI techniques are used at each point.

The healthcare sector and healthcare systems across the globe have been challenged by the COVID-19 pandemic in the past couple of years. The pandemic exacerbated issues of burnout of healthcare workers and greatly increased the level of stress on hospital resources to the point where 25% of clinicians in the United States have considered switching careers entirely primarily due to burnout, followed by a lack of resources and lack of effective workflow (Ney, Brookshire, and Weisbrod, 2022). Hospital staff turnover increased by 6.4% in 2022 alone, which further emphasizes the worker shortage among the healthcare system. Clinicians agreed that some of the most important job criteria that need to change in order to increase their well-being and job satisfaction include better compensation, a more manageable workload, more flexible work arrangements, and more clinically focused responsibilities (Ney, Brookshire, and Weisbrod, 2022). Health care providers have shown that they recognize the potential value in adopting artificial intelligence within their administrative systems in the interest of reducing physician burnout, increasing efficiency, and reducing costs.

## **Methods**

Secondary literature was reviewed as the research method for this paper. I searched through databases for papers on hospitals that have either already implemented AI techniques and technologies into their administrative systems or that have an interest in implementing AI. For systems that have not already implemented AI, I focused on the reasoning behind why employees were interested in AI and how they believed their hospital structure and their daily duties would change. I was also interested in if they had any particular concerns about how their environment would change or if they perceived any barriers to adoption. For hospital systems that implemented some form of AI already, I focused on what the experience was like for the various parties involved and how the hospital system has changed with the incorporation of new systems.

## **Results**

Many healthcare workers recognize that AI tools that automate administrative tasks have potential to help relieve some of their burden because many workers reported having been overworked and are burnt out from the increased workload that came with the COVID-19 pandemic (Hazarika, 2020). Even before the COVID-19 pandemic, over 40% of physicians reported being burned out, with the top contributor being having to complete too many bureaucratic tasks (Insider Intelligence Health, 2022). Physician burnout has been estimated to have cost the healthcare system around \$4.6 billion in the past year and the Association of American Medical Colleges has also predicted that the United States will face a clinician shortage in the coming decade (Insider Intelligence Health, 2022). The high cost of burnout combined with the clinician shortage and increased pressure on the healthcare system caused by the COVID-19 pandemic has pushed providers to combat these issues with AI-based healthcare administration. These AI tools seek to automate administrative tasks that are often repetitive and tedious to allow for some of the burden previously carried by physicians to be transferred to AI, which has helped slow burnout in the field and gives healthcare workers more time to spend in patient care. A 2018 study found that nurses spend 25% of their time working on administrative tasks, and these many of these tasks, from claims processing to revenue cycle management to medical records documentation, could be done with artificial intelligence tools and algorithms and nurses could instead be able to focus on patient care (Davenport and Kalakota, 2019). This increased time with patients is highly valued by clinicians, as a 2022 study found that a more manageable workload along with more clinically focused responsibilities were among the top job criteria that were most important to clinicians (Ney, Brookshire, and Weisbrod, 2022). A study found that for every 2 hours outpatient physicians spend on the electronic health record and desk work they spend 1 hour with patients, which emphasizes the overwhelming amount of time that administrative tasks take away from physicians (Murthy, 2022).

Artificial intelligence tools for healthcare administration have potential to optimize administrative workflows and allow healthcare systems to achieve greater operational efficiency. Given the increasing

pressure on many hospital systems from increasing costs and clinician shortages, the capabilities of AI tools to automate processes, enhance productivity, and increase administrative efficiency has become an increasingly necessary and important asset. The Brookings Institution found that around 40% of tasks performed by healthcare support staff has the potential to be automated in areas from hospital admissions to billing and documentation (Muro et al, 2019). Data mining and machine learning methods have been applied to logistical problems such as bed management, resource allocation, and scheduling that all have the potential to make hospital management more efficient. Currently, most of these approaches have only been tested and have not yet been deployed in healthcare settings (Reuter-Oppermann & Kuhl, 2020).

One area of hospital management that could be automated with AI tools is resource allocation and scheduling for managing both staff and space more efficiently. AI scheduling software can also be applied to hospital scheduling systems to allow them to fill more shifts and utilize their staff more effectively. The Mayo Clinic implemented AI techniques to efficiently organize staff and space for spinal surgical scheduling and found that they were able to reduce physician overtime by 10% and increase utilization of space by 19% (Davenport and Bean, 2020). The Norwegian scheduling software company Global.AI, has created scheduling software that allows hospitals to fill 40% more of their shifts (Davenport and Bean, 2021). These AI implementations show that artificial intelligence can make scheduling more efficient by first reducing the amount of time it takes to make schedules by allowing this task to be done with AI tools and then also increasing the amount of shifts filled and using space more efficiently. Artificial intelligence tools can also be implemented in the health care supply chain by matching supply and demand to predict how many patients will arrive and what health care needs will occur, and subsequently match the predictions with hospital inventories (Davenport and Bean, 2020). AI can also aid supply chain managers in ordering supplies along with the management of transportation methods, frequency, and routing of supplies. Given that a study found that U.S. hospitals spend over \$25 billion annually in unnecessary supply chain costs, AI could help minimize excess inventory while acquiring appropriate and useful supplies (Davenport and Bean, 2020).

A domain that many physicians have highlighted as a priority for automation is prior authorization, which includes tasks such as identifying a patient's health plan, which services or medication require authorization, and collecting documentation for approval. A 2020 study by the American Medical Association found that 94% of physicians report care delays due to prior authorization requirements from insurance companies. These prior authorizations can take physicians up to 16 hours, as they complete an average of around 40 a week. AI tools that can aid in automation include robotic process automation (RPA), which has machine learning capabilities that can automate functions, and natural language processing (NLP), which can understand and process human language to help automate workflow for documentation (EviCore, 2020). RPA and NLP could identify the patient's health plan and benefits along with what services and medications will require prior authorization. From there, the AI tools could collect the necessary documentation from the data and thereby automate a tedious process and give physicians more time to spend with patients (EviCore, 2020).

In addition, RPA can be used to handle claims and billing with the potential to reduce turnaround time by 85% and eliminate repetitive tasks (Davenport and Bean, 2020). The estimation of medical bills is complex and time-consuming process that also serves as a barrier for patients to pay their hospital bills, as patients are less likely to pay when they don't receive accurate estimates. However, some providers have begun using machine learning algorithms to create these estimates based on past data, generating up to 70% of bill estimates without human intervention (Davenport and Bean, 2020). The speed and accuracy at which these estimates are created has also allowed for a 60%-100% increase in point of service collections, which has helped improve revenue cycles for hospitals.

Claims denials are costly and time-consuming and AI techniques can be used to prevent them from happening. When claims are denied, providers have to pay a fee, and a study by the Kaiser Family Foundation found that around 18% of medical claims are denied (Sable, 2023). Machine learning algorithms can use data on past payments to identify patterns that indicate which claims will need specific edits to reduce the number of claims that are denied (Sable, 2023).

Fraud detection is another area that could be supported and improved with AI tools. Healthcare fraud is estimated to cost around \$68 billion annually in the United States, and AI tools have the potential to greatly increase the speed and accuracy at which fraud is detected (Sable, 2023). Data mining and AI based neural networks can search for patterns that indicate fraud and detect suspicious activity faster than manual reviews and audits could. However, there are limitations to the accuracy of these algorithms as AI tools will sometimes find false positives, and this limitation is one of the reasons this system not yet seen widespread adoption (Sable, 2023).

While artificial intelligence has the potential to provide value in healthcare in terms of reducing burnout, lowering costs, and increasing efficiency, there are barriers that lead some healthcare systems to lose interest in the idea of AI tools in their hospitals. The first barrier of AI in hospitals is human acceptance of AI tools from several relevant parties. There is often resistance towards AI tools because it can be unclear how exactly they work to the people using them, leading to a certain distrust. Physicians and other medical personnel have shown a low level of trust for AI tools used in diagnosis, care, and treatment of patients, but there has been less resistance towards use of AI tools in management services (Klumpp et al, 2021). One particular issue that often causes healthcare workers to hesitate in accepting AI tools is the concern that these technologies will end up taking over their responsibilities and pushing them out of a job. For AI tools regarding healthcare administration, the majority of jobs that would be automated with AI would involve primarily administrative duties or dealing with digital information rather than jobs that involve direct patient contact (Davenport and Kalakota, 2019). This means that there would likely not be a high level of job loss for healthcare workers such as physicians or nurses, as they would instead experience increased time in patient care and less time completing administrative tasks with the integration of more AI tools. The increase in time spent in patient care could help reduce the job shortage in the healthcare field if healthcare workers have more time to spend with more patients. However, for those whose jobs could be automated with artificial intelligence, such as administrative personnel or those involved with billing and claims, there could be a shift in responsibilities as they adapt



to work alongside AI or a reduction in the number of such jobs (Davenport and Kalakota, 2019).

Currently, the industry hasn't seen significant job elimination by AI yet in part due to a limited adoption of AI in the industry (Davenport and Kalakota, 2019). There is also the potential for the creation of new jobs for people to work with or develop more AI technologies that could offset job loss by AI.

Another factor that places limitations on AI tools in healthcare is data access limitations due to the nature of the data used. Medical data can be difficult to collect and access and it can be hard to pool data across hospitals, which means that data that is collected may be more localized and not large enough to build useful AI algorithms (Goldfarb and Teodoridis, 2022). There are also privacy regulations regarding medical data that can make it harder to access the data necessary for algorithms. In the case where the data can be accessed, there is also a strict regulatory process for medical technology that can cause significant delays (Goldfarb and Teodoridis, 2022). While people may be eager to develop new technologies, it is important to keep in mind that these regulations and the caution they represent must be respected in order to protect patient and privacy rights.

Another barrier in the integration of AI tools is hospital readiness. A study of 40 German hospitals found that 90% of the participants believed that they lacked the resources in terms of staff, knowledge, and finances in order to integrate AI tools into their hospital systems (Weinert et al., 2022). 83% of the participants also believed that they lacked the compatibility with existing IT infrastructure to be able to adopt new AI technologies. Participants also raised some of their own concerns regarding immaturity of AI technologies as well as high training and learning phase costs. The idea of artificial intelligence can be intimidating especially when the staff do not feel prepared to learn how to navigate new systems when they are comfortable with existing ones. Although they did still have concerns, many of the participants recognized that AI tools had the potential to increase efficiency and save time, increase the quality of care for patients, ease the burden on employees, and allow for financial savings (Weinert et al., 2022). Overall, while many of the participants recognized the value that these new technologies could bring to their hospitals, they were not sure if their systems were prepared to handle the changes that

would need to be made and if these changes would be necessary and worth the cost of training and learning.

## **Conclusion**

The recent COVID-19 pandemic has highlighted gaps in healthcare management and the need for better resource management as well as the shortage of healthcare workers. Physician burnout and a lack of resources have made it clear that taking the burden of administrative tasks and allowing more time for direct patient care would improve healthcare experiences for both healthcare workers and patients.

Artificial intelligence in healthcare management has the potential to resolve these issues by increasing the efficiency in hospitals through better management of resources and staff along with the automation of repetitive administrative tasks. There have been many AI tools developed for hospital administration as solutions for logistical areas such as appointment planning, resource and patient scheduling, and predicting demand (Klumpp et al, 2021). There are also tools that have been developed to better manage the revenue cycle and reduce the time and cost for bill estimates, pre-authorization, and other tasks.

Although there are many technologies that have been developed, the incorporation of AI into healthcare systems has been slower due to barriers such as human acceptance, privacy regulations, and hospital readiness. Hospital systems that have incorporated AI in some form have been doing so in small steps, starting with one system and seeing the results rather than engaging in larger overhauls. It appears that the slow adoption of artificial intelligence in healthcare systems is not due to a lack of technology or tools but rather how prepared hospitals are to adopt AI in terms of staff acceptance, finances, and existing technology.

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