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## **Artificial intelligence (AI) and its opportunity in healthcare organizations revenue cycle management (RCM)**

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**ARTIFICIAL INTELLIGENCE (AI) AND ITS OPPORTUNITY IN HEALTHCARE  
ORGANIZATIONS REVENUE CYCLE MANAGEMENT (RCM)**

**ABSTRACT**

*Introduction:* There has been the transformative potential of Artificial Intelligence (AI) in addressing challenges within the Revenue Cycle Management (RCM) of healthcare organizations. The RCM process, laden with delays, inefficiencies, and high costs, has prompted a search for innovative solutions. With \$400 billion of the country's healthcare spending that went toward RCM processes, 80% of healthcare leaders that reported staff stress and burnout from RCM processes, and 80% of patients that reported anger or confusion with their medical bills, RCM has posed as a great candidate for AI.

*Methodology:* The study utilized a literature review and a semi-structured virtual interview. Four databases were used to collect 102 total sources. These sources were reviewed and reduced to 36 total sources that were used in the written search. Of these 15 were used in the results section.

*Purpose of the Study:* The purpose of this research was to analyze the effects of Artificial Intelligence implemented in Revenue Cycle Management that would impact administrative costs, staff burnout rate, and the quality of customer experience.

*Results:* The integration of Artificial Intelligence (AI) in healthcare Revenue Cycle Management (RCM) has revolutionized various facets, including estimating out-of-pocket costs, coding claims, and significantly streamlining processes. AI adoption has led to a substantial reduction in the workload associated with claim billing and collection, addressing a previously estimated \$470 billion cost to RCM. Healthcare organizations implementing AI and automation have experienced accelerated payment cycles, with payments processed within 40 days instead of the

conventional 90 days. This has not only improved understanding of past denials but has also ensured better adherence to payer rules, resulting in a higher revenue percentage from claims.

Moreover, the impact of AI extended to Accounts Receivable (AR) management, with targeted recommendations that enhanced decision-making processes and increased AR collections by 1% of Net Patient Service Revenue (NPSR). AI's role in improving work quality, as indicated by a 1.3% enhancement in resolved customer problems, has positively influenced job satisfaction among RCM professionals. Case studies, such as those of Auburn Community Hospital and OhioHealth, showcased AI's effectiveness in computer-assisted coding, reduced unnecessary correspondences, improved staff experience, and generated personalized consumer profiles. Overall, AI's integration has not only addressed workforce shortages and burnout but has also significantly improved comprehensive patient data analysis resulting in better quality of customer experience.

*Discussion/ Conclusion:* The research on the implementation of Artificial Intelligence (AI) in Revenue Cycle Management (RCM) demonstrated significant positive outcomes. The study supported the hypothesis that AI adoption in healthcare organizations leads to a substantial reduction in administrative costs, decreased staff burnout rates, and a notable improvement in the quality of customer experience. The multifaceted advantages of AI in RCM are highlighted, including precise estimation of out-of-pocket costs, automation of claim coding processes, and optimization of labor-intensive billing tasks. Financially, organizations leveraging AI report improved revenue capture, contributing to a significant reduction in the estimated \$470 billion cost associated with RCM. The study emphasized the practical implications of AI, showcasing its ability to streamline processes, alleviate staff burnout, and enhance the overall patient financial experience. Despite certain limitations, the research underscored the transformative impact of AI

in healthcare RCM, paving the way for increased efficiency, improved job satisfaction, and enhanced financial well-being for healthcare institutions.

*Key Words:* ‘Revenue Cycle Management’, ‘Artificial Intelligence’, ‘Healthcare Organization’, ‘Quality Customer Experience’, ‘Administrative Costs’, and ‘Staff Burnout Rate’.

## INTRODUCTION

Revenue Cycle Management (RCM) in healthcare organizations has involved administrative and clinical capturing, managing, and collecting of revenue generated from patient services that have been importantly used to ensure appropriate reimbursement and thus has allowed financial stability (Kilanko, 2023). RCM has been one of the main bottlenecks that have made healthcare be labeled as expensive, slow, and cumbersome, with claims that have taken an average of 48 days to get paid after a service is performed and have cost 7.5% of all revenue (Kelly, 2022). However, efficient RCMs in healthcare organizations have been a crucial component because efficient RCMs have proven to have a secure flow of financial transactions and had optimized revenue captures by managers that have deep understandings of healthcare regulations, coding guidelines, medical billing, and coding and reimbursement systems and technologies to streamline the process (Ahmed, 2023).

The revenue cycle has included burdensome processes like prior authorization, which has been transaction-heavy with repetitive tasks though for that reason, it has posed a candidate for automation and Artificial Intelligence (AI) (LaPointe, 2020). The processes of RCM that needed to be followed precisely have caused pain points that produced all too familiar issues such as inefficiencies that left cash in Accounts Receivable, coding errors, and billing errors (Advata, 2023). The complexity of the healthcare industry has made Accounts Receivable processes too complex and outdated, as well as the fact that it has put too much pressure to do more in less

time for proper coding and has made any billing errors detrimental due to the financial impact”(Advata, 2023).

Artificial Intelligence has been a rapidly evolving field of computer science that has aimed to create machines that perform tasks that typically require human intelligence (Alowais et al., 2023). AI has produced various lab results that proved it has been effective in the clinical side of healthcare like early detection of illnesses such as cancer, and retinal disease, and healthcare organizations' administrations have seen an opportunity for the same technology to be implemented into RCM to solve pain points (Davenport, 2021). Traditional AI and Generative AI have been applied to RCM where traditional AI was used for learning data and making predictions or decisions based on the data, and Generative AI was trained on a set of data and learned the underlying patterns to generate new data that mirrors the training set (Marr, 2023). Successful healthcare organizations that implemented AI and Robotic Automation Process (RPA) into their RCM understood how the whole system was connected and had established oversight and monitoring that ensured that the output was accurate as well as having had established metrics for automation that included impact on quality of customer experience scores, the percentage decreased in denials, and improvement in prior authorization (HFMA, 2021). AI and RPA have required mindfulness in rewriting scripts for an upgraded system because some bots have been sensitive to changes and it has been important to be aware of dependencies (HFMA, 2021).

Most hospitals have experienced significant cost increases associated with the revenue cycle as 15% of every United States healthcare dollar spent went toward revenue cycle inefficiencies and around \$400 billion of the country’s annual healthcare spending went to claims processing, payments, billing, revenue cycle management, and bad debt (Allnutt, 2023). Another expensive aspect of RCM has been hiring staff and having them trained, and if untrained has led

to inefficiencies and errors that resulted in increased costs and decreased revenue that hurt the bottom line (H., 2023).

In 2022, 80% of healthcare leaders reported increased stress or burnout in RCM and reported it was due to staffing issues that led to an increased workload coupled with the rapid changes of big data in healthcare (H., 2023). Burnout has been a massive problem in the industry for clinicians and billing teams and has left healthcare organizations with employee gaps and communities with fewer physicians with the primary driver being administration work and specifically prior authorization (Graham, 2023). Healthcare organizations have been desperate to fill staffing gaps in RCM which has led to the “warm body syndrome” method of hiring that created even more damage and expense instead of looking at the long run of optimizing the productivity of the existing team (Cruver, 2022).

Clinical outcomes have become inextricably linked with the patient’s financial experience with increased out-of-pocket costs and 90% of healthcare consumers said a good financial experience has been a deciding factor on whether to return (Lynn, 2023). Patients have generally been dissatisfied with RCM due to billing systems that are complex, patients low expectations that bill will be accurate, and reduced sense of responsibility for paying them that has led to 40% of patients that did not pay their bills because they did not understand them and 80% of patients that reported anger and frustration related to medical bills (Blair et al., 2015).

The purpose of this research was to analyze the effects of Artificial Intelligence implemented in Revenue Cycle Management would impact administrative costs, staff burnout rate, and the quality of customer experience.

## METHODOLOGY

The hypothesis was that implementing AI in Revenue Cycle Management would reduce administrative costs, staff burnout rate, and increased the quality of customer experience.

The conceptual framework explains the impact of AI in RCM for an investigation on whether AI in RCM would influence decreased administrative costs, lower staff burnout rate, and better customer experience. It evaluates the benefits AI would have in RCM and the capabilities that it has brought. Figure 1 elaborates on AI entering RCM, the effects, and the outcome of a successful healthcare organization's RCM. This conceptual framework is suitable for the present study as it concentrates on the means of application of new technology in healthcare settings.

The intended methodology used was a literature review complemented by a semi-structured interview with a Registered Nurse who worked in revenue cycle management. IRB approval was granted before the interview. Only relevant answers were used to support the information found in the literature review to provide a contextualized understanding of the impact AI has on Revenue Cycle Management. The interview was conducted virtually. The recording process took place over Zoom, the recording was transcribed, and after transcription, the video was permanently deleted along with the transcription notes. The participants were 18 years of age or older and consent was given verbally before survey questions were asked. Interview questions have been included after references.

The systematic literature review utilized the PRISMA flow chart (Figure 2) which shows how many websites, databases, and registers were used. Also displayed were how many articles were excluded from the literature review for not meeting inclusion criteria. In total, there were sixty-two sources placed in the PRISMA diagram and only thirty-four sources were used in the creation of this study. The databases, registers, and websites were utilized to determine the effects of implementing AI in Revenue Cycle Management.

Google was used to gather a broad range of articles from various databases registers, and websites. Vast amounts of information were obtained from sources such as Google Scholar, Statista, EBSCOhost, and ProQuest articles used came from credible sources identified as Continuum, BMC Medical Education, Healthcare IT, and others. In total, there were thirty-four references obtained from the collection of information. Forty-two articles had to be discarded due to not meeting inclusion criteria; six were duplicate articles and twenty did not meet inclusion criteria. Fifteen sources were used in the introduction portion of the paper and fifteen sources were used in the results section. Keywords used in the search were: ‘Revenue Cycle Management’ and ‘Artificial Intelligence’ and ‘Healthcare Organization’ OR ‘Quality Customer Experience’ and ‘Administrative Costs’ and ‘Staff Burnout Rate.’

The literature was obtained based on facts that related to combating RCM’s major issues such as expense, staff burnout, and customer experience with advanced AI systems. The search was limited to articles published between 2017 and 2023. Articles identified in the search were also discarded if they were duplicates of information. The literature search was conducted by R.P. and validated by A.C., who acted as a secondary reader and verified that references met the inclusion criteria.

## RESULTS

### *RCM Administrative Costs*

Artificial intelligence has been able to estimate out-of-pocket costs, has coded claims for RCM, and has been able to improve the process with success to reduce the amount of work that went into getting a claim billed and collecting the claim that has previously estimated to cost RCM \$470 billion (Greco, 2023). Healthcare Organizations that implemented AI and automation found that the organization has been paid within 40 days rather than 90 days which has helped organizations understand past denials and better follow



a payer's rules and regulations thus has led to a higher percentage of revenue from a large group of claims (Thomas, 2023). According to a survey conducted in 2020, 79% of large healthcare organizations reported that revenue cycle management was the most beneficial segment of Artificial Intelligence within the sector which was the highest percentage listed compared to supply chain, clinical administration, Finance, IT, Human Resources, Pharmacy, and others according to Table 1 (Olive, 2023).

Up to 85% of Accounts Receivable (AR) volume remained unworked leaving 4% of financial value unrealized thus AI has been introduced to have made suggested actions to resolve outstanding receivables, assisted in workflow sequences, and determined appropriate workflow prioritization (Lamons, 2022). Targeted recommendations have made the decision-making process faster and less expensive with teams that have worked 100% on AR and increased AR collections of 1% of the total Net Patient Service Revenue (NPSR) that made it possible for some companies to have individually generated over \$500 million of NPSR benefits to its customers (Lamons, 2022). A report from AKASA, based on a survey of RCM executives, that the most important measures of RCM operations success were net days in accounts receivable (Hagland, 2021). Table 2 has revealed from most important to least important of an RCM's financially successful operations the top five are as follows: net days in accounts receivable (in general), aged accounts receivable (billed more or equal to 90 days) initial denials rate, discharged not final billed, and final write of rates (AKASA, 2022).

#### *Staff Burnout Rate*

Work quality had improved by 1.3% compared to that of the RCM workers not using AI measured by the share of customer problems that were successfully resolved (Nielson, 2023). Salesforce surveyed 773 automation users in RCM and found that 89 percent reported higher job satisfaction after automation implementation, 84 percent were more satisfied with their company

in general, and 79 percent felt automation tools helped them be more productive (Delzio, 2023). Cloud-based AI-driven software has been integrated bi-directionally so that tests requiring prior authorization in laboratories have been identified electronically; provider/facility detail, patient demographics, and test diagnosis information have been collected; and the request has been submitted to the insurance payor electronically, in real-time (Halasey, 2021). AI and automation have been a solution to close the worker shortage gap in RCM as a Medical Group Management Association poll found that 73% of medical practice leaders nationwide said staffing has been their biggest “pandemic challenge” for 2022 (Hayhurst, 2022).

Auburn Community Hospital has implemented AI in the form of computer-assisted coding that suggested appropriate medical codes based on relevant clinical data in the chart allowed them to add service lines without additional labor and helped to obtain and attract more coders with 50% decreased-nonfinal-billed cases, more than 40% improvement in coder productivity, and a 4.6% increased case mix index (Eramo, 2023). AI has reduced unnecessary correspondents between payers and providers, improved staff experience, reduced manual tasks 50%-75% of manual tasks that contributed to staff burnout, and reduced stress that denial of patients created though staff needed to be retrained on how to preemptively attach additional documentation, clinicians needed to update their approaches to documentation, and payor contracting teams needed to understand how changes in the operating model improved collaboration with the insurers that requested documentation or denied payment (Baxi et al., 2023).

### *Quality of Customer Experience*

HFMA's 2018 MAP Award for High Performance in Revenue Cycle went to OhioHealth for their demonstration of a strong commitment that promoted greater efficiency and improved patient access and convenience through their boosted revenue cycle technology of AI robots that have taken the friction out of the (Hegwer, 2018). OhioHealth has used AI to generate patient

statements that have allowed patients to see all their liability balances on one statement, expanded its usage of TVR (interactive voice response) functionality including bill pay and the information requested, and established a “price hotline” for consumers' shopping for services (Hegwer, 2018).

Other AI technology has created and analyzed personalized consumer profiles at scale because they pulled data from disparate data sources that identified patterns in behavior for every patient and directed staff to create a personalized financial experience for them (RevCycleIntelligence, 2021). Additionally, major impediments to patient experience, physician well-being, and health system performance that AI has addressed have been call systems that improved their efficiencies by 15 to 30 percent, identified duplicate patient records, coordinated prior authorizations from health insurance companies, and proposed solutions for administrative gaps (Baxi, 2023).

In RCM comprehensive patient data has been invaluable because it has allowed providers to submit accurate claims, reduced the likelihood of denials and delays in reimbursement by 4.6% monthly, and interoperable AI solutions have analyzed patient data to identify potential coverage gaps or eligibility issues that have enabled providers to protectively address billing concerns and enhanced the revenue cycle capturing (Patel, 2023).

## DISCUSSION

The results supported the hypothesis that implementing Artificial Intelligence in Revenue Cycle Management has led to a significant reduction in administrative costs, a notable decrease in staff burnout rates, and a substantial improvement in the quality of customer experience.

### *Summary of Results*

The findings underscore the multifaceted advantages of AI in RCM, showcasing its ability to estimate out-of-pocket costs with precision, automate claim coding processes, and

significantly optimize the labor-intensive tasks associated with billing and collections. The adoption of AI in healthcare organizations has not only streamlined claim processing but has also led to a substantial reduction in the time taken for payment realization, shifting from a previous average of 90 days to a more efficient 40 days.

Moreover, the study highlights the financial impact of AI implementation, revealing a notable reduction in the estimated \$470 billion cost associated with RCM. Organizations leveraging AI and automation have reported improved revenue capture, showcasing the technology's potential to positively influence the financial health of healthcare institutions. The introduction of targeted AI-driven recommendations has not only expedited decision-making processes but has also contributed to a remarkable 1% increase in Accounts Receivable (AR) collections as a percentage of Net Patient Service Revenue (NPSR).

The research delves into the qualitative aspects of AI's impact, emphasizing the improvement in work quality and job satisfaction among RCM professionals. The integration of cloud-based AI-driven software has streamlined prior authorization processes, providing real-time interactions with insurance payors and reducing unnecessary correspondence between payers and providers. The study also acknowledges the pivotal role of AI in addressing the critical issue of staffing shortages in RCM, offering solutions that mitigate the challenges posed by the evolving healthcare landscape.

Furthermore, the success stories of organizations like Auburn Community Hospital and OhioHealth serve as practical examples of AI's transformative power. From computer-assisted coding that enhances coder productivity to the creation of personalized consumer profiles at scale, these cases demonstrate AI's ability to drive efficiency, reduce manual tasks, and improve overall patient and provider experiences.

The leading barriers to the adoption of AI in healthcare organizations in RCM have been budgetary and trust obstacles that could have harmed the patient's privacy (Change, 2020). Also, Employees have been wary that AI would take their jobs or require them to become data scientists, but experts contended that a decrease healthcare labor force was unlikely, and AI has been used to overcome labor shortages and redeploy staff of roles that have tasks only humans have done (AI, 2023).

### *Opinions*

In the semi-structured interview, the person interviewed was both a registered nurse and a Revenue Cycle Manager. She described her dynamic duties as scheduling appointments every three months with clients, visiting and/or calling the clients for the appointments, and then submitting billing logs to their billing person who then bills it to the state for reimbursement to the company. The company does not have AI in its revenue cycle currently but plans to in the next year due to the state regulations. The interviewee agreed that there are processes in RCM that are repetitive and transaction heavy. Specifically, the same processes must be performed every month and their biller manually has to enter in paperwork for reimbursement from the state. When asked how their company could benefit from AI in their RCM the interviewee stated that it would cut out the paperwork of the manual billing saving time and money. Also, when asked about the challenges of implanting AI into RCM, she answered that AI does not have actual healthcare experience and some automation might not consider issues unique to places like rural West Virginia. The interviewee agreed the processes in RCM without AI have led to staff burnout. She noted that the repetitive tasks lead people to burn out more quickly and the task gets boring. Finally, the interviewee stated that the quality of customer experience with RCM could improve if AI were involved by not making patients wait as long for care that they

need. She mentioned it would be easier on the doctors as well and that there would be fewer mistakes.

### *Limitations*

The research on the impact of Artificial Intelligence (AI) in Revenue Cycle Management (RCM) provided valuable insights, but it is essential to acknowledge certain limitations in the study. One notable limitation lay in the search strategy bias, as the study primarily relied on a literature review and a semi-structured virtual interview. The reliance on specific databases, such as Google Scholar, Statista, EBSCOhost, and ProQuest, may have introduced bias by excluding relevant sources from other databases. Additionally, the exclusion of articles published before 2017 and after 2023 may have resulted in a limited timeframe, potentially missing out on earlier or more recent developments in AI implementation in RCM.

Furthermore, the study's potential susceptibility to publication bias should be acknowledged. The inclusion of only articles meeting specific criteria may have introduced a bias toward positive results, potentially overlooking studies with contrasting findings. The limited number of databases used in the systematic literature review might have contributed to this bias, as certain databases might have had unique perspectives or findings. Additionally, the semi-structured virtual interview involved a single participant—a Registered Nurse working in revenue cycle management—introducing potential research bias due to the singular perspective.

Moreover, the generalizability of the findings may have been impacted by the focus on specific healthcare organizations and their experiences with AI in RCM. The study's emphasis on successful cases, while providing valuable insights, might not have captured the challenges faced by organizations that did not experience the same positive outcomes. Future research should aim for a more diverse and extensive sampling to enhance the generalizability and robustness of the findings. Overall, while the past study contributed significantly to understanding the benefits of

AI in healthcare RCM, acknowledging and addressing these limitations was crucial for ensuring a more comprehensive and unbiased evaluation of the topic.

### *Practical Implications*

The implementation of Artificial Intelligence (AI) in Revenue Cycle Management (RCM) has resulted in several practical implications for healthcare organizations. It offered substantial cost savings by automating administrative processes, leading to increased efficiency and accelerated payment cycles. The integration of AI alleviated staff burnout by automating repetitive tasks, enhancing job satisfaction, and allowing employees to focus on more complex responsibilities. The quality of customer experience improved through streamlined billing processes and personalized consumer profiles, contributing to patient-centric financial interactions. AI-driven recommendations expedited decision-making in areas such as Accounts Receivable (AR) management, optimizing workflows and prioritizing tasks. The adaptability of AI to regulatory changes ensured compliance, and interoperability with existing systems facilitated comprehensive data analysis for accurate claim submissions. Opportunities for staff training and upskilling arose, fostering collaboration across departments, while robust security measures mitigated risks associated with handling sensitive patient information. Continuous monitoring and evaluation ensured the ongoing success and alignment of AI systems with organizational goals. Overall, these practical implications emphasized the transformative impact of AI in enhancing RCM efficiency, staff well-being, and the overall patient financial experience.

### CONCLUSION

In conclusion, the research findings offer a comprehensive view of the positive outcomes resulting from the integration of AI in healthcare RCM. From financial benefits to workforce optimization and enhanced patient experiences, AI emerges as a pivotal solution in overcoming the complex challenges faced by the healthcare revenue cycle.

