



AI the Revolutionary Technology and its Impact in Retail Pharmacy

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ABSTRACT

This research seeks to explore the potential of AI in the retail pharmacy industry, examining both its benefits and challenges. Specifically, we will investigate how AI is improving patient outcomes, enhancing operational performance, and shaping the future landscape of the pharmacy profession. Additionally, we will address issues such as data privacy, regulatory considerations, and the ethical implications of AI integration within pharmacy practice

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Introduction

Every couple of years, a few buzzwords go around in your day-to-day life. Do you know what is the most prominent buzzword from the last couple of years is?. You guessed it right: "Artificial Intelligence (AI). Artificial Intelligence (AI) has emerged as a transformative force across various industries, and the retail pharmacy sector is no exception. As pharmacies increasingly embrace technological innovations, AI is poised to revolutionize how services are delivered, operational efficiencies are achieved, and customer patient safety is enhanced. From automating routine tasks to improving decision-making for enhanced customer experience and personalized care, AI's applications in retail pharmacy are diverse and rapidly evolving [1].

AI can be applied in many ways within the retail pharmacy space. Pharmacists can improve pharmacy workflow with the help of AI technologies. One of the most significant applications is medication management, where AI-powered systems can assist pharmacists in accurately dispensing prescriptions, identifying potential drug interactions, and ensuring adherence to clinical guidelines. Machine learning algorithms, for example, can analyze vast amounts of patient data to provide tailored medication recommendations, ensuring that therapies are safe and effective for individual patients. AI can be a powerful tool for automating repetitive tasks, which allows the pharmacist to better utilize the time for more patient-focused activities. Retail pharmacy has evolved from compounding medications to counting pills to clinical-focused services. And to achieve those most effective clinical services, AI will be an integral part of the system [2,3].

Furthermore, AI is enabling retail pharmacies to better meet the growing demand for personalized healthcare Through predictive analytics. retail pharmacy is all about taking care of each individual patients Through personalized solutions. AI systems can assist pharmacists in identifying at-risk patients, offering tailored recommendations, and providing proactive health management. With the rise of tele pharmacies and digital health services, AI tools are also enhancing remote consultations, making healthcare

more accessible to underserved populations. AI powered Chatbots and virtual assistants which uses natural language processing are also making it easier for patients to engage with pharmacy services, ask questions, and receive real-time support without the need for face-to-face interaction [4].

Beyond direct patient care, AI's role in optimizing pharmacy operations is equally compelling. After patient care most of the energy is spent on efficient inventory management. Advanced AI algorithms can streamline supply chain management, forecast demand, and minimize stockouts and wastage, ultimately reducing operational costs. Automation powered by AI is also being utilized in inventory tracking and management, ensuring that every step of the supply chain including manufacturer wholesaler distributors and pharmacies maintain appropriate stock levels while minimizing the need for manual oversight. This automation allows pharmacists to spend more time on value-added services, such as patient education and health consultations [5].

However, despite AI's tremendous promise in retail pharmacy, the integration of these technologies must be approached with caution. Any technology has pros and cons. The need for regulatory frameworks, ethical considerations around patient privacy, and the training of pharmacy professionals to utilize AI tools effectively are critical factors that must be addressed for AI to reach its full potential. Moreover, the evolving nature of AI technology requires ongoing research and adaptation to ensure that innovations remain aligned with both patient safety and clinical best practices.

Direct Patient Care Involvement

Medication Therapy Management

As we discussed earlier, the most significant impact AI can have is direct patient care involvement with medication therapy management. Any time AI helps pharmacists help patients adhere to medication therapy, it will positively impact patient health. The Pharmacist spends most of the time reviewing the patient's medication lists. When they go through the patient list, they

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look for all the way the patient can benefit from the medication management. This includes refilling medication on time, so patients have all the medication on hand. This helps patients avoid any delays or missing any dose of medications. With the help of AI, some of the tasks can be automated very efficiently. AI algorithms are trained to recognize the medication list with maintenance doses, like diabetes, blood pressure, and cholesterol. So if the patient is delayed in refilling any of this medication, AI will prompt the Pharmacist to check for the particular missed or delayed refills. When pharmacists get such notification, they can promptly consult the patient. They can find their reasons, like why the refills are missed or delayed. Is it because there are no refills on the medication and do they need new authorization from the doctor's office, or are they just missing a few doses of medication and need reminder tools to take their medication on time? In that scenario, to recognize those medication gaps promptly and efficiently, the Pharmacist would have to scroll through each patient profile to find any gaps in any patient. Now, with AI, this task can be done in a fraction of the time instead of manually scrolling. This not only creates an opportunity for pharmacists to adhere to the STAR measures but also helps to increase the fill numbers of the retail pharmacists' prescriptions. In both cases, it will lead to higher economic gains for the pharmacy [6].

Medication Adherence and Guideline Adherence

The second direct impact AI has on direct patient care access is helping pharmacists recommend medication regimens according to the guidelines. For example, The American Diabetes Association (ADA) guidelines recommend when to start statin therapy in patients with diabetes and cardiovascular risk. These recommendations are based on age, cardiovascular disease (CVD), and overall cardiovascular event risk. So, based on the guideline, if the patient is at higher cardiovascular risk based on the criteria, the AI will prompt the Pharmacist to start the patient on statin drugs to decrease the cardiovascular risk in patients. Now, if the provider approves these recommendations based on the patient's conditions, they will help the patient reduce the chance of serious cardiovascular events. So, AI will help pharmacists design medication regimens according to international guidelines. This will not only increase patient safety, but it will decrease the financial burden on the healthcare systems. To understand this, we can take a simple scenario of a patient age 55 with a history of diabetes and high blood pressure. When the AI recognizes the patient according to their age and medication list, it will be recommended that the Pharmacist initiate low to mid-intensity statins for the patient's therapy. Suppose the doctor approves the recommendation and starts new therapy on statins. In that case, there will be fewer chances of acute cardiac events such as coronary syndrome (ACS), myocardial infarction (MI), cardiac arrest, and heart failure. If we save any occurrence of this kind of event, it is better for patients' safety and healthcare systems overall [7].

Drug-Drug Interaction

The third and most significant impact AI has on direct patient access is checking drug-drug interactions. Drugs are potent chemicals that we put into our bodies. They will have lots of different interactions with other drugs or food in the body. When a patient is taking one or more drugs, there is always a chance of drug-drug interactions. Some of the interactions are mild to

moderate in their effects, but some are serious. A patient taking more medications will increase the Pharmacist's verification time on any medication. The Pharmacist has to check each interaction. This can be time-consuming, but now, drug interaction is easily identified with the help of AI and its algorithms. Because of this, Pharmacists can always weigh all the pros and cons regarding any medication therapy. If deemed necessary, the Pharmacist can recommend a new medication or a new dose of the prescribed medicines. Sometimes, the AI will help to show the alternate options to the Pharmacist that can be better suited for that particular patient.

Indirect Patient Care Involvement

Inventory Management

AI technology will help pharmacists manage inventories of drugs. AI will predict the usage of the medication and its usage, and by doing that, any pharmacist can cut inventory costs and expiration of medications. Inventory cost is any pharmacy's second most significant expense after its labor cost. If the Pharmacist can efficiently manage the ordering schedule of the branded expensive drugs, he can manage at least savings of 15 to 20 % on the inventory costs. This way, pharmacists can allocate the money differently, meaningfully, rather than just letting it sit on the pharmacy's shelves [8].

Pill Counting and Identification

The augmented utilization of AI is also integrated into pharmacy workflows. Machines exist that can precisely match the description and image of the medication from the database. This provides an additional layer of verification for the drug during the counting process. Upon a technician retrieving a stock bottle and scanning it within the system, the image of the tablets or capsules becomes visible. As the pharmacy personnel conduct a count, the medication system will capture an image of the process. It will facilitate the identification of the precise medication and ensure the accurate dosage is matched. It will also identify any discrepancies in the medication within stock bottles or detect broken or fragmented parts of medicine in the stock bottle [8].

Virtual Assistant and Chatbots

The initial applications of AI were chatbots and voice-recognition answering systems. AI-assisted chatbots enable the pharmacy to promptly reply basic inquiries, such as operating hours and location. Previously, the patient would attempt to call to inquire on the readiness of the drug. Currently, chatbots address these inquiries, so conserving considerable time for pharmacy personnel. A pharmacy chain has adopted voice-to-text AI recognition technology. This enables the pharmaceutical personnel to review all calls in textual format. This approach minimizes their interaction with all patients. This will help pharmacists to prioritize phone calls; those pertaining to drug refills can be addressed swiftly later, enabling the staff to concentrate on more urgent matters.

Challenges with AI Technology

Despite these promising benefits, the fear of AI replacing human pharmacists is a genuine concern. Let's discuss some prominent worries the industry faces with AI technology

Job Displacement

As AI systems advance in sophistication, it is natural to question whether there would be a reduction in opportunities for human pharmacists, particularly in retail pharmacy environments. Concerns exist that technology, including robotic pill dispensers and AI-driven patient contact systems, may diminish the demand for pharmacists in sectors primarily centered on prescription dispensing and addressing routine inquiries.

Loss of Human Touch

Although AI excels at information processing and doing repetitive activities, it is devoid of the emotional intelligence and interpersonal connection that human pharmacists offer. Technological advancements will result in the absence of emotions such as compassion, gratitude, and the inclination to serve society. Patient counseling, necessitating empathy, comprehension, and communication, is essential to the pharmacist's position, which AI cannot readily imitate. Nonetheless, substituting human pharmacists with AI technology may present an appealing and feasible economic choice in a free-market society and capitalist framework, where efficiency supersedes compassion.

Ethical Concerns

AI decision-making relies on algorithms and extensive datasets that are currently available within a defined temporal scope. This may yield outcomes that are more interpretable, raising problems around accountability. This absence of transparency in healthcare is especially troubling. When AI systems err, it may be ambiguous who bears responsibility for the result—the algorithm, the drugstore chain that executed it, or the developers who created it. Conversely, human pharmacists bear legal and ethical accountability for patient safety and welfare.

Impact of AI on Patient Privacy

The incorporation of artificial intelligence (AI) into healthcare has transformed patient care delivery, providing opportunities for individualized therapy, predictive analytics, and enhanced clinical decision-making. Nonetheless, in conjunction with these advancements, there are increasing apprehensions over the effect of AI on patient privacy. As AI systems increasingly depend on extensive patient data, such as electronic health records (EHRs), genetic information, and real-time monitoring data, protecting patient anonymity and maintaining adherence to privacy standards become paramount. Data security to prevent any data leak is a critical concern in managing this data. A significant ethical issue is data ownership. Who is permitted access to this sensitive patient information when artificial intelligence is utilized? Establishing clarity on data ownership and control is essential to safeguard and uphold patients' privacy rights.

Conclusion

The advantages of artificial intelligence are obvious: it can boost innovation, reduce physical fatigue, improve workflow efficiency, and improve patient safety. But AI also has a lot of drawbacks, just like any revolutionary technology. As AI develops, legitimate worries about data security and privacy as well as the possibility of job displacement must be addressed. AI's future is probably

going to be a combination of the great potential it presents and the rigorous assessment of its drawbacks. Societies can guarantee that technology advances humanity by embracing AI's potential while taking action to lessen its drawbacks. In order to create a future where AI improves human existence without sacrificing fundamental ethical principles and values, cooperation between researchers, legislators, business executives, and engineers will be crucial. In the end, AI is a tool that, when applied responsibly and morally, may greatly increase human potential rather than a substitute for people [8, 9-13].

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