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REVIEW ON ARTIFICIAL INTELLIGECE IN HOSPITAL AND COMMUNITY PHARMACY

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ABSTRACT

Artificial Intelligence (AI) emerged as an intervention, for data safety problems. AI has an important role in analyzing patient care, safety, improving medication management and optimizing inventory in hospital pharmacies.[5] AI played an important role in hospital and community pharmacy`s in modern days. Various advancements in AI have been observed within hospital pharmacies, particularly in pharmacy supply chain management, Computerized Provider Order Entry (CPOE), Clinical Decision Support System (CDSS), automated dispensing systems, automated prescription filling and the identification of medication errors.[3] AI in clinical and hospital pharmacies has great ability to analyze how medications are prescribed, dispensed, administered, and monitored. However, we know AI systems use large amounts of patient data, privacy, and cybersecurity are major concerns. By analyzing large volumes of healthcare data, AI can identify patterns and predict outcomes, which is useful in healthcare organizations to make the professionals better decisions and achieve better results.[1] By using the AI algorithms, hospital pharmacists can analyze a vast amount of patient data, including laboratory results, medical records, and aiding them in recognize the potential drug–drug interactions, assessing the safety and efficacy of medicines. In Hospital and Health System pharmacies, the application of machine learning and natural language processing to access and analyse the unstructured, free-text information captured in millions of electronic health records may become an essential tool to improve patient care and perform real-time evaluations of the safety and efficacy of the available drugs.[3] Hospital pharmacists

who master AI will play a crucial role in future. The introduction of AI into clinical pharmacy and hospital settings appears an transformative factor, improve patient safety, and shape a more active and efficient future for the pharmacy professionals.

KEYWORDS: Supply chain management, automated dispensing systems, cybersecurity, natural language processing, electronic health records.

1. INTODUCTION

Artificial Intelligence (AI) is a stream of science related to machine learning, mainly intelligent computer programs, which provides results in the similar way to human attention process. The word artificial intelligence was first coined in the year 1956 at Dartmouth college.[1]

The potential benefits of AI in heath care sector are very high, but it`s implementations to pharmacy practise are at earlier stages. AI tools are very useful to perform the precise analysis and will provide the useful interpretations. Pharmacists are the front-line healthcare professionals available to patients without prior appointment during their working hours. AI has applications for dispencing in pharmacy outlets, and for reviewing the prescriptions, for reducing errors. Community pharmacies can benefit from AI through assistance and automation in monitoring medication adherence, stock management, disease management guidance, dose reminders, drug-related problem (DRP) detection, and prescription inquiries round the clock. Dosage adjustments based on real-time data can be free up the pharmacist time, and the pharmacist will have time to focus on direct patient care and counselling. AI reduces the risk of errors and give the healthy outcomes.[2]

2. METHODOLOGY

2. A. Study Design

The study was designed as a descriptive, observational, and literature-supported methodology to evaluate the applications of Artificial Intelligence (AI) in hospital pharmacy practice. The methodology integrates practical observation in hospital pharmacy settings with an extensive review of national and international research journals related to AI, clinical pharmacy, and pharmaceutical informatics. No experimental intervention was performed, and the study focused on practice-based and evidence-supported learning.[6]

2. B. Study Setting

The study was conducted in hospital pharmacy departments, including inpatient pharmacy, outpatient pharmacy, clinical pharmacy services, and medication distribution units. These settings were selected to understand AI applications across prescription screening, medication management, and patient-centered pharmaceutical care.[6]

2. C. Data Sources: Data were collected from both primary and secondary sources.

2. C. 1. Primary sources: included direct observation of hospital pharmacy workflows and informal discussions with hospital pharmacists and clinical pharmacy staff regarding the use of AI-based systems.[6]

2. D. 2. Secondary sources: included peer-reviewed research articles, systematic reviews, and journal publications related to AI in hospital pharmacy. Journals focusing on clinical decision support systems, medication safety, machine learning in healthcare, and hospital pharmacy practice were reviewed to provide scientific evidence for observed practices.[6]

2. E. ARTIFICIL INTELLIGENCE IN HOSPITAL PHARMACY

The advanced technologies of AI hold high transformative potential that is set to revolutionize clinical pharmacy practice by introducing their duties in a seamless and beautiful manner. AI-driven platforms enable smooth communication between pharmacists and clinicians by delivering time-time updates on patient medications, drug interactions, and dosage recommendations derived from patient data. AI ha the capacity to explain more data of patients and its clinical guidelines enables it to recommend suitable drug therapies, dosages, and combination medications used. AI also plays a very important role in quality management. By identifying patterns in medication errors and adverse drug effects, AI can offer understanding of potential systemic issues, thus improve the quality.

2. E. 1. Prescription Screening and Clinical Decision Support

AI-integrated electronic prescribing systems were observed for their role in identifying drug–drug interactions, drug–disease interactions, allergies, contraindications, and inappropriate dosing. Research articles were reviewed to understand how AI algorithms analyze large datasets to support accurate and timely clinical decisions.

2. E. 2. Medication Safety and Error Prevention

AI-based tools used in hospital pharmacies for reducing medication errors were studied. These included barcode-based medication verification systems and automated alerts generated through AI-supported CDSS. Journal studies describing the impact of AI on reducing adverse drug events were analyzed to support observational findings.

2. E. 3. Adverse Drug Reaction (ADR) Monitoring

The role of AI and machine learning models in detecting and predicting adverse drug reactions was studied through literature review. Observations were correlated with research findings that demonstrate how AI improves pharmacovigilance and patient safety in hospital settings.

2. E. 4. Automated Dispensing and Inventory Management

AI-supported automated dispensing systems and smart inventory management tools were observed. Research articles explaining the use of predictive analytics for stock optimization and reduction of medication wastage were reviewed to understand their effectiveness.

2. E. 5. Clinical Pharmacy and Personalized Medicine

AI applications in personalized medicine, including patient-specific dose adjustments and therapy optimization, were studied through journal literature. Observations focused on how AI assists clinical pharmacists in analyzing patient data, laboratory values, and treatment outcomes.

2. F. ARTIFICIAL INTELLIGENCE IN COMMUNITY PHARMACY

AI useful to revolutionize community pharmacy, by extending its impact beyond pharmacists' primary responsibilities. AI can enhance the supply chain management. AI algorithms can analyses the massive data, including seasonality, past health trends, past sales, and even external factors like weather patterns or disease outbreaks, to predict the medication demand. This helps the pharmacies to main the stock inventory. By monitoring the time to time stocks the AI is help full in managing the stock inventory and it is useful to generate the purchase order. AI tools can analyses the suppliers based on factors like cost, reliability, delivery speed and product quality. Al-driven chatbots and virtual assistants can provide the patients with medication information, refill reminders, and support for medication compliance, improving the overall patient care.

2. F. 1. Prescription Processing and Workflow Optimization

AI-enabled pharmacy software used for prescription handling, billing, and record management was observed. Journal studies describing the role of AI in reducing prescription errors and improving workflow efficiency were reviewed to support observational findings.

2. F. 2. Inventory Management and Demand Forecasting

AI-based inventory management systems were studied for their role in stock optimization, expiry management, and reduction of medicine shortages. Research articles explaining the use of machine learning algorithms for demand prediction were analyzed to understand their effectiveness in community pharmacy settings.

2. F. 3. Patient Engagement and Medication Adherence

AI-supported digital platforms, mobile applications, and automated reminder systems used for improving medication adherence were observed. Journal literature describing the impact of AI on patient engagement and adherence outcomes was reviewed to correlate practice-based observations.

2. F. 4. Patient Counseling and Drug Information Services

The role of AI tools in supporting patient counselling and providing drug information was studied. Research articles highlighting the use of chatbots and AI-driven decision aids in community pharmacy practice were reviewed to understand their contribution to patient education and safety.

2. F. 5. Pharmacovigilance and Safety Monitoring

The application of AI in identifying medication-related problems and supporting pharmacovigilance activities in community pharmacies was studied through journal literature. Observations were supported by studies demonstrating AI-based analysis of prescription and patient data to detect potential safety concerns.

3. RESULTS AND DISCUSSION

3.1. Results

The application of Artificial Intelligence (AI) in both hospital and community pharmacy settings demonstrated a measurable improvement in medication safety, workflow efficiency, and quality of pharmaceutical care. Observations from practice settings, supported by evidence from published research articles, indicate that AI technologies are increasingly

integrated into routine pharmacy operations, although the extent and nature of application differ between hospital and community pharmacies.[2]

3.1.1. Results in Hospital Pharmacy

In hospital pharmacy practice, AI-based clinical decision support systems (CDSS) were found to play a critical role in prescription screening and medication management. AI-enabled electronic prescribing systems effectively identified potential drug–drug interactions, contraindications, duplicate therapies, and dosing errors. Research studies reviewed in scientific journals consistently report a reduction in medication errors and adverse drug events following the implementation of AI-supported CDSS in hospital settings. AI applications in hospital pharmacies also showed significant benefits in adverse drug reaction (ADR) monitoring and pharmacovigilance. Machine learning models described in the literature demonstrated improved detection of ADR patterns through analysis of patient data, laboratory results, and medication histories. Automated dispensing systems supported by AI reduced human intervention in medication distribution, thereby minimizing dispensing errors and improving accuracy.

Additionally, AI-assisted tools contributed to personalized medicine by supporting patient-specific dose optimization and therapy monitoring. Journal findings indicate that AI integration with electronic health records enables better therapeutic decision-making and improved clinical outcomes.[3]

3.1.2. Results in Community Pharmacy

In community pharmacy settings, AI applications were primarily focused on pharmacy management, prescription processing, and patient engagement. AI-enabled pharmacy management systems improved efficiency in billing, inventory control, and prescription handling. Predictive analytics tools were effective in demand forecasting and stock optimization, leading to reduced medicine shortages and minimized expiry-related losses. AI-supported digital platforms and mobile applications were observed to improve medication adherence through automated reminders and follow-up systems. Studies published in community pharmacy and digital health journals report improved adherence rates and patient satisfaction with the use of AI-driven reminder systems.

AI applications also supported patient counseling and drug information services through chatbots and decision-support tools. Although the level of clinical complexity was lower

compared to hospital settings, these tools enhanced accessibility to pharmaceutical care and basic medication safety information.[7]

3.2. DISCUSSION

The findings from this study highlight the growing role of AI in transforming pharmacy practice across both hospital and community settings. However, the scope and depth of AI application vary significantly depending on the practice environment.

3.2.1. AI in Hospital Pharmacy: Clinical Impact

In hospital pharmacy, AI primarily functions as a clinical support system. The integration of AI with electronic health records and laboratory systems allows for real-time analysis of patient-specific data, supporting safer and more effective drug therapy. Journal evidence strongly supports the role of AI in reducing medication errors, improving ADR detection, and enhancing clinical decision-making. The ability of AI to process large volumes of complex clinical data makes it particularly valuable in hospital environments where polypharmacy and critically ill patients are common. However, research also highlights challenges such as high implementation costs, need for specialized training, and concerns related to data privacy and algorithm transparency.

3.2.2. AI in Community Pharmacy: Operational and Patient-Centered Benefits

In contrast, AI applications in community pharmacy are more focused on operational efficiency and patient engagement rather than advanced clinical decision-making. AI-based inventory management and workflow optimization tools improve pharmacy productivity and reduce workload for pharmacists. Journal studies emphasize that these applications allow pharmacists to dedicate more time to patient counseling and public health services. AI-driven adherence tools and digital counseling platforms enhance patient participation in therapy and improve continuity of care.

4. CONCLUSION

Artificial Intelligence (AI) has emerged as a powerful tool with the potential to significantly transform both hospital and community pharmacy practice. This study highlights how AI supports pharmacists by improving medication safety, enhancing clinical decision-making, increasing operational efficiency, and strengthening patient-centered care. Rather than replacing pharmacists, AI complements professional expertise by reducing routine workload and enabling greater focus on clinical and patient-focused responsibilities.

In hospital pharmacy settings, AI-driven technologies such as Clinical Decision Support Systems, automated dispensing systems, and pharmacovigilance tools contribute to improved therapeutic outcomes and reduced medication errors. By analyzing large volumes of patient-specific data, AI enables more accurate prescribing, early detection of adverse drug reactions, and personalized treatment optimization. Despite these benefits, challenges related to implementation costs, data privacy, workforce training, and ethical transparency must be carefully addressed to ensure safe and effective use.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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