

## **ARTIFICIAL INTELLIGENCE IN PHARMACY PRACTICE: TRANSFORMING DRUG DISCOVERY, CLINICAL DECISION- MAKING, AND PATIENT CARE**

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### **Abstract:**

The efficiency, precision, and quality of pharmaceutical care are all being improved by artificial intelligence (AI), which is having a major impact on current advancements in modern health care, including pharmacy practice. The growing use of AI-based technologies in pharmaceutical sciences is a result of several causes, including the growing complexity of pharmaceutical care, improvements in health care data, and an increasing need for personalized healthcare. The current article addresses artificial intelligence in pharmacy practice with regard to patient care, pharmacovigilance, drug discovery, and healthcare decision-making. Through data analytics tools and techniques like virtual screening and target identification, the use of AI in pharmaceuticals has significantly enhanced the process of pharmaceutical discovery and development. AI-assisted decision support technologies assist pharmacists in managing drugs and avoiding prescription errors in the pharmaceutical industry, particularly in clinical pharmacy practice. Furthermore, using real-world data analysis, AI plays a significant role in pharmacovigilance duties like early detection and reporting of adverse medication occurrences. The usefulness and efficacy of AI are further demonstrated by applications in hospital and retail pharmacy environments. However, despite the many advantages of using artificial intelligence in pharmacy practice, it has been connected to problems including privacy concerns. However, despite the many advantages of using artificial intelligence in pharmacy practice, it has been connected to problems including data privacy concerns, ethical dilemmas, problems with healthcare professional training, and the like. The provided article also discusses future prospects for the use of AI in pharmacy practice. The practice of pharmacy can greatly benefit from artificial intelligence.

### **Key Words:**

Artificial Intelligence; Pharmacy Practice; Drug Discovery; Clinical Decision Support; Pharmacovigilance; Personalized Medicine; Patient Care.

## 1. Introduction:

The practice of pharmacy has also observed an extensive transition from a product-oriented and technically based activity for dispensing and compounding medicines to a knowledge-intensive and patient-focused field involving primary medicine management and related healthcare services because of aging populations, increasing prevalence of chronic illnesses, growing complexities and prices associated with medicines, and pressure on healthcare systems for better outcomes and resource efficiency, along with an understanding and appreciation for the expertise that pharmacists can offer for medicines<sup>[1-2-3]</sup>. Although there has been relatively more advancement in pharmacy practice in countries such as the United States and European countries in fully integrating pharmacists in healthcare for reimbursement purposes, there has been uneven development across the world because of differences in policy and support for pharmacy development and implementation in other countries and regions <sup>[4-5]</sup>. To support and amplify these enhanced roles, healthcare systems have developed standardized practice models, residency and education programming, credentialing systems, and funding, in addition to a rising literature of research about pharmacy practice that has elucidated and documented value for pharmacist-delivered care, even in the face of challenges in large-scale practice implementation<sup>[6]</sup>. At the same time, the current healthcare environment's proliferation of electronic health records, claims, genomic, and monitoring data has occasioned a pressing need for artificial intelligence and machine-learning solutions that can be utilized for predictive analytics and decision support, automation, and population-based medication management, allowing pharmacists to make predictive identification of at-risk patients and optimize their practice by focusing efforts on high-value patient care<sup>[7]</sup>. However, it is important to note, as has been underlined in existing literature, that to unlock potential in pharmacy, there needs to be data systems interoperability, quality, explainability, workflow implementation, and an appreciation for ethical implementation, among other factors, among existing data on readiness among pharmacists/pharmacy interns, among others, as has been identified in recent studies.

## 2. Concept and Fundamentals of Artificial Intelligence:

Computer programs that carry out activities like perception, cognition, learning, and decision-making that call for human intellect are referred to as artificial intelligence. All this entails a series of tasks ranging from models of knowledge for learning statistics from knowledge to symbolic cognition <sup>[8-9]</sup>. Although the degree of autonomy that exists today includes intensive levels of the above models for governance reviews, the use of narrow/weak AI applied to computer programs for risk analysis, image recognition, and language processing remains today's greatest utilization of AI technology <sup>[10]</sup>. The center for the application of artificial intelligence is provided for the machine learning application since it is the practical translation of the capability for artificial intelligence on learning from the patterns from the data for the supervised, unsupervised, and reinforcement learning; which has the direct consequence for the sustainability and application for the healthcare on the predictive outcomes, stratification on the patients, and making of the decision-making processes. Deep learning, a subset of ML based on multi-layer neural networks, has further shown superior performance in managing unstructured and high-dimensional data, notably in medical

imaging, natural language processing of clinical notes, and multimodal precision-medicine applications, although data intensity and limited transparency raise important challenges for clinical trust and adoption. Healthcare "big data," which characterizes the high volume, velocity, and variety emanating from sources such as electronic health records, imaging, genomics, wearables, and administrative systems, enables these AI methods by providing the scale required for robust ML and DL model development. However, this advantage introduces additional issues of interoperability, data quality, privacy, and governance <sup>[11]</sup>. Conceptually, healthcare AI works as a combined pipeline from data acquisition and curation through model training, validation, and explainability to deployment within clinical workflows, with increasing emphasis on explainable and concept-based AI in support of transparency, clinician trust, and human–AI collaboration rather than replacement.

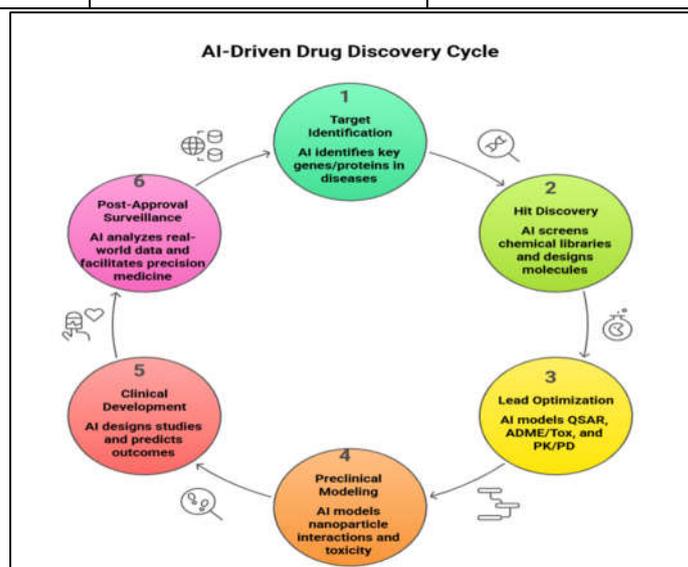
### **3. Role of Artificial Intelligence in Drug Discovery and Development:**

As shown in (Figure 1), AI tools are increasingly embedded across the entire drug discovery cycle, from target identification to post-marketing surveillance. Artificial intelligence (AI) is being steadily harnessed at all-comers in drug discovery/development, from target identification to post-marketing surveillance, to solve longstanding current gaps in cost-effectiveness, speed, and high efficacy drop-off in pharmaceutical R&D<sup>[12,13]</sup>. In target discover/validation, AI tools corral multi-omics, pathway, published data, and phenotypia to prioritize jeopardy genes/proteins in diseases, illustrated by identifying key targets of SARS-CoV-2, unravelling intricate-signalling networks <sup>[14]</sup>. In AI-ML-held hit discovery & in-silico screening, like drug repurposing, AI-ML already allows in-silico screening of enormous chemical libraries & their screening targets & automated design of novel drug molecules, including repurpose of Alzheimer drugs (DRIAD) & ML-driven ranking of already-approved drugs targeting COVID-19 proteases<sup>[15]</sup>. In lead optimization, AI helps to model QSAR, ADME/Tox predictions, PK/PD optimization, and is used to predict AI models for drug-induced liver injury (DILI), late-stage project failures <sup>[16]</sup>. AI is also used for preclinical modelling and formulation science, including nanomedicine, to model nanoparticle-protein interaction, biodistribution, and toxicity. On clinical development, AI helps to design clinical studies through patient stratification, outcome prediction, and endpoint optimization, especially those that are heterogeneous like dementia, though a clear context of use is encouraged <sup>[17]</sup>. Post-approval AI helps to analyze real-world data on pharmacovigilance, signals, and regulatory submissions, while also facilitating precision medicine through genomic, phenotypic, and response modelling to address resistances, especially in cancer. Taken together, these applications individually expedite development time, decrease expenditures, foster drug repositioning, and enhance success rates because these applications can address intricate multimodal datasets; notwithstanding these applications' potential benefits, their success is also conditional to the quality of the data used in the application processes, the degree of bias correction in the datasets, explanations based on the application processes, intensive validations of these applications, computing capabilities, as well as the capabilities of these applications to suit the expectations of the corresponding regulations, as has been cited in the guidance provided by the IQ Consortium regarding the acceptable applications using AI in the IQ Consortium's model-informed drug development The

integration of AI across various stages of drug discovery has significantly improved efficiency and success rates as shown in (Table 1).

**TABLE 1: ROLE OF ARTIFICIAL INTELLIGENCE IN DRUG DISCOVERY AND DEVELOPMENT**

Stage of Drug Development	AI-Based Approach	Outcome
Target Identification	Machine learning algorithms	Accurate identification of novel drug targets
Lead Discovery	AI-driven virtual screening	Faster identification of potential drug candidates
Lead Optimization	Predictive modelling	Improved efficacy and safety profiles
Clinical Trials	AI-assisted patient selection	Enhanced trial efficiency and success rate



**FIGURE 1: AI-DRIVEN DRUG DISCOVERY CYCLE**

#### 4. Artificial Intelligence in Clinical Pharmacy Practice:

In order to standardize treatment, improve medication safety, and make well-informed clinical decisions, Clinical Decision Support Systems (CDSS) are computer-based systems designed to deliver patient-specific assessments or recommendations in a timely manner at the point-of-care. They do this by integrating current data into the best available medical knowledge [18]. The knowledge base (guidelines, rules, or models/predictive models/artificial intelligence models), inference engine, data integration component connecting EHRs, lab, and pharmacy systems, and user interface designed and integrated into workflows for

minimizing alert fatigue & user-centric design are the five functional components of CDSS [19]. Observational studies, like the Medicaid group's AI-assisted pharmacist programs, indicate potential reductions in spending and utilization [20]. In addition to using pharmacokinetic/pharmacodynamic models, laboratory concentrations, patient variables, and/or pharmacogenetic data for individualized patient dosage recommendations in an improved and optimized way and for better outcomes while reducing clinician burden and time for improved patient outcomes and effectiveness and efficiency in patient therapy and patient treatment and management outcomes and processes and strategies and techniques that optimize patient treatment and management processes and results and objectives and goals and approaches and strategies and techniques, CDSS. However, the successful implementation of all these CDSS, MTM, and precision dosing applications depends on four key pillars: robust governance and regulatory alignment; explainability and human-in-the-loop oversight to maintain clinician autonomy and trust in algorithms; rigorous external and prospective validation; and high-quality and interoperable data. Additionally, policymakers, systematic reviews, and implementation studies consistently highlight the need for pharmacist and clinician training [21]. Artificial intelligence has found widespread applications across multiple domains of pharmacy practice as shown in (Table 2).

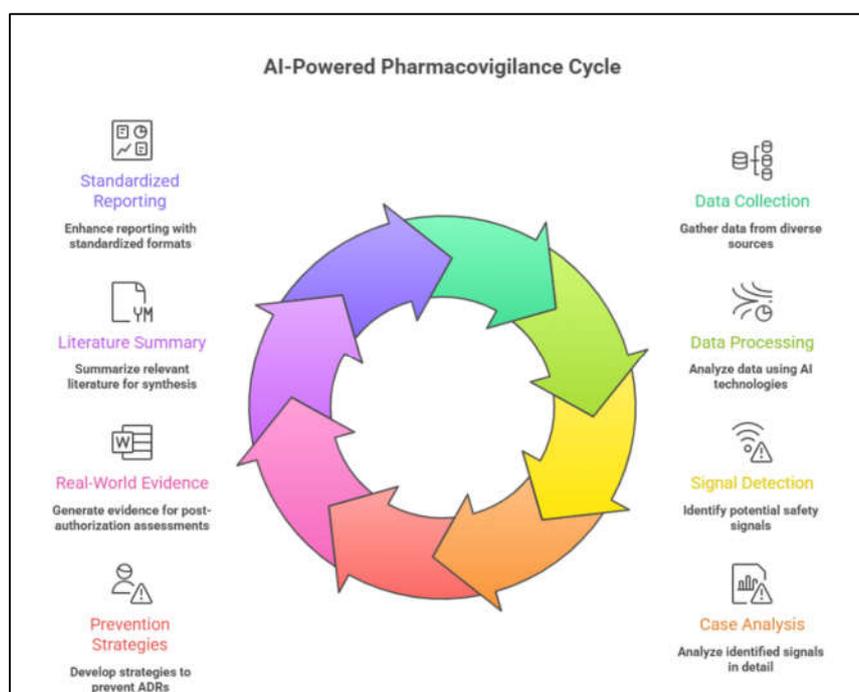
**TABLE 2: APPLICATIONS OF ARTIFICIAL INTELLIGENCE ACROSS DIFFERENT DOMAINS OF PHARMACY PRACTICE**

Pharmacy Domain	AI Application	Key Benefits
Drug Discovery	Virtual screening, target identification	Reduced time and cost of drug development
Clinical Pharmacy	Clinical decision support systems	Improved therapeutic outcomes and reduced medication errors
Pharmacovigilance	Automated ADR signal detection	Early identification of drug safety issues
Hospital Pharmacy	Inventory forecasting and workflow automation	Reduced drug shortages and operational errors
Community Pharmacy	Prescription validation and patient counselling tools	Enhanced dispensing accuracy and patient engagement

### 5. AI-Driven Pharmacovigilance and Drug Safety Monitoring:

AI-Powered PV uses machine learning, natural language processing, Bayesian analysis, and other revolutionary technologies of generative AI for intense automated analysis of very large and highly heterogeneous safety databases to speed up and perform precise detection, analysis, and prevention of ADRs. Thus, AI-Powered PV transforms PV from a post-hoc manual reporting system to a proactive near-real-time system of surveillance of ADRs [22]. Using information from spontaneous reporting systems (FAERS and Eudra Vigilance

Reports for instance), Electronic Health Records, claims databases, safety registries, literature searches, social media sites, and digital health wearables for instance, AI makes it possible for automated end-to-end processing of cases. Using NLP capabilities of AI for instance, there is accurate and automated recovery of structured safety information from unstructured text with standardized vocabularies such as MedDRAn and INN stems for instance<sup>[23]</sup>. The traditional disproportionality analysis algorithms ROR, PRR, BCPNN, and MGPS have been complemented by an ever-growing number of empirical Bayes, Bayesian, and ML algorithms for the detection of safety anomalies over time and in multiform safety distributions, as illustrated by the mining of the FAERS database for antibiotics and proteasome inhibitors in the detection of known and new safety signals<sup>[24]</sup>. Apart from the detection task, the application of AI builds the foundation for the provision of real-world evidence in the form of emulation exercises in post-authorisation safety assessments over populations and strata by enabling longitudinal assessments<sup>[25]</sup>. PV professionals also benefit from additional support from Generative AI with regard to 'literature summary'. This further assists with integrating evidence to perform synthesis; however this mandates care to prevent AI 'hallucinatory' error/misrepresentation. However, owing to several reasons such as Data Quality and Bias, Interoperability challenges, Explanation and Replicability, Privacy and Governance concerns, and requiring "Human-in-the-Loop" supervision, adoption of AI, to a wider extent, could not happen yet with PV (Photovoltaics) applications. Consequently, against this background, recently emerged data briefs also aid with regard to 'standardized reporting' (such as READUS-PV), to enhance, with regard to 'acceptability,' 'efficiency,' and 'adequacy,' applications of AI with PV. AI-enabled pharmacovigilance activities, including signal detection and real-world evidence generation, are illustrated in (Figure 2).



**FIGURE 2: AI-POWERED PHARMACOVIGILANCE CYCLE**

## 6. Artificial Intelligence in Hospital and Community Pharmacy Settings:

The hospital and retail pharmacy operations are also increasingly being influenced by AI technology in improving inventory management, prescription verification, and dispensing errors using data analytics and automation techniques. In inventory management, AI algorithms forecast SKU-level, formulation, and strength of pharmaceuticals over short to medium-term periods using historical demand data, seasonal patterns, supplier lead time, and other factors such as outbreak of influenza and other diseases influenced by weather patterns and public health notifications to minimize stock-outs and overstocks. Advanced machine learning algorithms such as XGBoost, tree ensembles, recurrent neural networks, transformers, and hybrid ARIMA-ML algorithms have also produced meaningful improvements in inventory forecast error in retail and logistics domains with similar improvements in inventory management applications in hospital and retail pharmacy operations in reducing inventory holding costs, number of stock-outs requiring urgent purchases, and avoidable wastage of expired stock<sup>[26]</sup>. Reinforcement learning also facilitates adaptive replenishment and multi-echelon optimization of inventory at hospital wards and community branches with real-time visibility that facilitates either centralized or hybrid replenishment. For prescription validation, AI assists rule-based decision support by pointing out potentially unsafe or erroneous prescriptions, including dosing errors, drug interactions, allergy checks, duplicate therapy, and route or frequency issues, based upon patient-specific parameters such as age, kidney function, lab values, and medication history. Natural language processing algorithms derive structured medication and intent concepts from free-text prescription fields and notes with supervised machine learning algorithms focusing upon high-risk medication, relieving cognitive burden on pharmacists, though explainability and generation of alert fatigue have been cited as significant challenges<sup>[27]</sup>. AI also improves the accuracy of drug dispensing by means of computer vision technologies that confirm tablets, bottles, labels, and barcodes with a combination of RFID, weight sensors, and anomaly detection algorithms that check for any discrepancies or pick errors in auto-dispensing and robotics platforms, thus leading to a measurable decrease in instances of erroneous drug or erroneous dosing for high-throughput applications<sup>[28]</sup>. Despite that, successful implementation of AI for various applications is contingent upon quality-driven and compliant inter operable data, integration with ERP/pharmacy management systems, explainable AI with audit trails, with a critical need for pharmacist-labelled loop-governance for ensuring safety, compliance, and ethical use of patient-level data, thus reaffirming that AI is a complementing agent rather than a substitute for experienced professional-level medical judgment.

## **7. AI Applications in Personalized and Precision Medicine:**

"Pharmacogenomics (PGx) and biomarker-guided therapy are one of the major cornerstones of precision medicine, emphasizing the contribution of genetic differences, molecular markers, and associated influences in understanding drug metabolism, drug efficacy, and drug toxicity, hence aiming at developing models that can specifically outline individuals who are most susceptible to benefits or harms of a drug<sup>[29]</sup>. Artificial Intelligence (AI) revolves largely in acting as an added significant tool in finding new PGx (Pharmacogenomics) markers by recognizing those complex associations between genotype, phenotype, polygenetic patterns, and multiomic markers, which are beyond human capacity in understanding, hence

improving predictive efficacy of drug response such as adverse drug reactions. Techniques such as supervised machine learning models, particularly those based on methods such as gradient boosting, Random Forest, deep learning, attention models, transformers, are empowered in predicting outcomes using genomic, transcriptomic, proteomic, metabolomic, along with those based upon clinical datasets, hence simultaneously emphasizing biological relevancy in biomarker discovery, in interaction with tools such as SHAP, attention maps [30]. "Further enhanced productivity can be achieved with the use of integrative, multi-omics AI models, in which genomics, metabolomics, and proteomics can be combined, exemplified in cancer and metabolic disease research, in which the use of composite biomarkers has been shown to improve the prediction of treatment response and toxicity compared to single-omics biomarkers [31]. Simultaneously, AI-driven stratification of patients in clinical practice not only can solve the problem of disease heterogeneity but also provide solutions for the selection of targeted therapies, optimal dose regimen development, and enhanced enrichment of clinical trials, utilizing unsupervised machine learning, representation learning (autoencoder, variational autoencoder), and graph learning models, as well as multimodal fusion models, with successful clinical applications in cancer, dermatological, and metabolic disease research, in which AI-informed molecular endotypes were shown to predict differential treatment responses and prognosis. Despite such obvious advantages as a decrease in trial and error medication use, increased patient safety, and fast-track discovery of biomarkers, issues persist with data bias, diversity of genetically represented individuals, reproducibility of results from omics analysis, data privacy with concerns to genomic data, and ultimate government approval of AI-based clinical decision support systems. To effectively deploy precision therapies, therefore, and ensure that AI-based pharmacogenomics and patient stratification deliver patient-friendly and safe precision medicines, there is an urgent need to bring together multidisciplinary stakeholders and policymakers to ensure clinical AI interpretability and early government engagement [32].

## **8. Ethical, Legal, and Regulatory Considerations:**

The use of AI in precision medicine entails complex and closely intertwined issues of data privacy, security, bias, transparency, accountability, and, by implication, ethical and social responsibilities, inasmuch as genomic data, electronic health record data, image data, and multi-omics data are considered unique, sensitive, and identifiable information. Moreover, its complexities are amplified with familial associations, rare variants, and clinical context. Even ostensibly de-identified data sets can be re-identified when combined with publicly available information. This is a risk that is greatly amplified in high-dimensional AI training datasets that integrate genomics with long-term EHRs. Additionally, various cyber threats, including breaches, thefts, and model-based attacks like membership inference and model inversion, pose serious risks to patient confidentiality and public trust. These identified vulnerabilities are further widened by distributed data ecosystems, including wearables, IoT devices, organ-on-chip platforms, and infrastructures of federated learning. This requires the need for strong architectures of cybersecurity, secure aggregation, and risk management through the supply chain [33]. Concurrently, AI systems are also at risk of perpetuating disparities in healthcare owing to biases that arise from the lack of representation in their genomic datasets, clinical and socioeconomic biases in electronic health records, measurement effects in omics tools,

and the use of algorithms in AI tools that opt for accuracy rather than equity <sup>[34]</sup>. Transparency and explainability, therefore, assume the imperative in gaining clinician trust, regulatory adoption, and ethical compliance in AI tools <sup>[35]</sup>. A growing number of regulatory texts, like GDPR, HIPAA, and developing FDA and EMA directives, classifies high-risk AI applications with regards to software and medical device combinations (Software as a Medical Device, or SaMD), underlining the concepts of risk management, validation, traceability, and clinician override <sup>[36]</sup>. In this respect, some best practices for successful mitigation techniques have emerged through literature to comprise: practices related to Privacy by Design concepts (differential Privacy, Federated Learning, and Encryption. Apart from applying these measures to ensure AI privacy in precision medicine practice, some overlapping ethical principles such as equity in precision medicine, return of genomic results to individuals and communities, informed consent in genetic research, public engagement in precision medicine research and adaptive regulation of precision medicine research strategies are essential for responsible practices in precision medicine.

### **9. Challenges and Limitations of AI in Pharmacy Practice:**

"The optimal utilization of Artificial Intelligence (AI) in pharmacy practice is impeded by a set of interconnected challenges, which are technological, infrastructural, human resource, and financial in nature, thereby inhibiting the safe incorporation of AI into everyday dispensing of medications. For highly accurate AI models, there is a need for highly accurate data, which comes from sources such as electronic medical records, pharmacy computer systems, or laboratories, but a lack of integration of data, inconsistent programming, data gaps, and a failure of various systems to interact with each other <sup>[37]</sup>. These are further exacerbated by the lack of standardization in IT infrastructure for most community pharmacies and facilities in resource-limited settings to ensure appropriate IT infrastructure and connectivity that enable the functions of AI-driven decision support systems. The lack of standardization in clinical processes for patient medication and laboratory tests adds to the list of technical factors affecting variability in model performance across facilities, aside from the added overhead of model management in ensuring cybersecurity and model drift performance. Apart from infrastructure requirements, acceptability by healthcare practitioners—pharmacists especially—is already demonstrated to be a key determiner for successful deployment. They emphasize challenges of autonomy, trust, accountability, disruption of work flows, and alert fatigue, as well as doubts raised by a lack of external verification and uncertain regulations for the use of AI for medication decisions <sup>[38]</sup>. These sociotechnical factors slow down implementation, limit partial and selective use, and prevent maximizing potential for enhancing medication safety, reconciliation, and therapy optimization using AI technology. Cost factors and worker preparedness are other limitations for scaling up, as AI system implementation involves heavy upfront costs for software and hardware implementation and subsequent costs for maintenance and security. In order to address these challenges, the need exists for staged and value-driven approaches to the implementation of strategies, investments in interoperability standards, and efforts in co-design with pharmacists, as well as investments in the development of the staff with the help of AI literacy training and the development of pharmacy positions related to informatics. Taken altogether, the literature highlights the challenges, implications, and importance of the

point that the integration of AI in pharmacy represents more than innovation; thus, its transformation involves the need to invest in the infrastructure. Despite its advantages, the adoption of AI in pharmacy practice is limited by several challenges as shown in Table 3.

**Table 3. Challenges and Limitations of Artificial Intelligence in Pharmacy Practice**

<b>Challenge</b>	<b>Description</b>
Data Privacy	Risk of misuse or breach of sensitive patient data
Ethical Issues	Bias, transparency, and accountability of AI algorithms
Regulatory Barriers	Lack of clear AI-specific healthcare regulations
Cost Factors	High implementation and maintenance expenses
Skill Gap	Need for specialized training among pharmacists

## 10. Future Perspectives and Emerging Trends:

The fusion of artificial intelligence in telepharmacy, telemonitoring, and digital therapy is thus transforming the practice of pharmacy because of its capacity for scalable, evidence-based, and data-intensive management of patients' medications, especially in the context of rural settings where such services are most required. Telepharmacy systems augmented by artificial intelligence capabilities can facilitate distant patient review and consultation through patient inquiry triaging, distilling patient data from the electronic healthcare record, routine assessment for potential drug interactions, adherence, and safety, and the formulation of targeted, evidence-based suggestions for pharmacists within the context of telepharmacology, thus making the service more efficient and extensive, yet within the purview of expert care [39]. The combination of wearable sensors, telemedicine apps, and artificial intelligence analysis can, therefore, facilitate monitoring for patient adherence, drug reaction, and early signs of deterioration in real time, through the distribution of alerts directly to the pharmacists' attention, thus being consistent with the maturity models of digital healthcare, where the key priorities include the establishment of infrastructural interpretability, among others, for effective embedding within the healthcare ecosystem [40]. AI and Machine Learning (ML) technologies that have ingested multi-source datasets during transitions of care, such as hospital discharge summaries, outpatient medication prescriptions, and lab results, have the ability to flag and prioritize at-risk patients for telepharmacy interventions, thus decreasing adverse drug events and readmissions when co-developed with clinicians and patients. In this rapidly changing environment, the pharmacist assumes a leadership role in the application of medication-focused AI, utilizing their pharmacotherapeutic knowledge to develop and test the application of the model, as well as to develop pathways and monitor outcomes, which have been recognized as more important in the trend analyses of managed care and hospital

pharmacy<sup>[41]</sup>. Techno pharmacists and other new roles, informatics pharmacists, digital health experts, and telepharmacy care coordinators, are being developed and expanded as a new interface is created between medical practice and the science of data analysis and computation for overseeing AI applications and the management of medications at a population level<sup>[42]</sup>. Expectations for future development, as has been expressed through horizon scanning literature, suggest a prominent and widespread use of AI-assisted clinical decision support systems as part of pharmacy information technology for optimized dosing, pharmacovigilance and therapeutic drug monitoring, and pharmacogenomics. However, achieving these will require the readiness of the healthcare system in terms of interoperability, governance, co-design, and equal access to digital health, as readiness will help in preventing disparities in healthcare in the event of overdependence on the imperfect nature of AI, support by pharmacists being essential. In light of the current evidence, the integration of digital health in the realm of pharmacy places the innovative technological advancements in the domain of pharmacists to not only implement the advancement in the context of healthcare delivery, but also to manage the advancement for the better in terms of transparency and quality regarding medication safety, access, as well as quality.

## 11. Conclusion

AI is currently emerging as a shift in power within the pharmacy sector, creating innovative means to address the increasingly complex health care delivery and managing medications. Its implementation ranges from the entire life cycle of medication products, accelerating research and development processes to optimize health care decision making, pharmacovigilance, and personalized health care support. Its use enables the pharmacist to make informed decisions to optimize therapy and medication processes to achieve positive outcomes for patients. With great potential, AI's integration into pharmacy practice would need much deliberation on critical ethical, legal, and regulatory challenges, especially on data privacy, transparency, and accountability issues. Furthermore, appropriate training and skill development remain compulsory for pharmacists to use AI systems as an aid rather than a replacement for them. In future healthcare systems, the pharmacist shall assume the role of a leader and expert professional, advising and contributing to responsible and productive application of AI technologies. Thus, artificial intelligence needs to be considered an enabler that helps enhance, and not substitute, the judgment of experts in the practice of pharmacy. By being properly situated within the context of education, cooperation, and good governance, great contributions can be made by the use of AI to ensure safe consumption of medicines and an effective healthcare system.

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